ایک قوم
ایک نصاب
ONE NATION, ONE CURRICULUM

Single National Curriculum 2022

MATHEMATICS

Mathematics 1-8

Introduction

OVERVIEW and INTRODUCTION:

Mathematics plays an essential role in every aspect of our daily life, in hidden ways and in everyday usage all around us: whether it is time tracking, driving, cooking, computers, airplanes, body scanners, software, coding or jobs such as accounting, finance, banking, engineering, and software. These functions require a strong mathematical background. It is excellent for our brains and develops neural pathways that not only deepens knowledge of the field but improves the brain power as well. While solving mathematical problems, data are collected, disassembled, and then interconnected to solve them. This develops analytical and problem solving skills for a child which he/she then transfers to resolve any issues in their daily lives.

Mathematics is the "universal language" as it is universally understood across cultures, countries and languages. The simple arithmetic equation of 2+2=4 is understood all across the world and remains the same all around the world. It would not be incorrect to say that mathematics is the pillar of organised life for the present day. Without numbers and mathematical evidence, we cannot resolve any issues in our daily lives.

The Single National Mathematics Curriculum 2020 has been designed from the perspective of modern trends in Mathematics and emerging requirements of society in terms of National Integrity and Social Cohesion. The Single National Curriculum (SNC) of Mathematics for grade I-VIII aims to ensure that learners become proficient in doing Mathematics, develop mathematical literacy, induce logical thinking and are able to apply mathematical reasoning in real life and problem-solving.

This document helps teachers to design, implement, and analyze instructions, and assessment methods to accomplish the overall goal of the curriculum. The entire curriculum is divided into four strands, Numbers and Operations, Algebra, Geometry and Measurements and Statistics and Probability, all underpinned in Reasoning and Logical thinking which serves as a cross-cutting strand.

This Curriculum comprises standards, curriculum templates and a progression grid to show the progression of Mathematical concepts across the grades. The curriculum templates identify the student learning outcomes given in the progression grid into two essential aspects: knowledge and skill for the teacher. It also provides a sample of activities that match the Student learning outcomes and the content. Another essential feature of the curriculum template is the sample assessment questions and means for both formative and summative measures.

The learning outcomes emphasize the development of knowledge and conceptual understanding through application and reasoning skills. This curriculum emphasizes values to promote students' spiritual, moral, social, and cultural development through mathematics.

The learning approach that is encouraged for the teaching of mathematics throughout this curriculum is the Concrete-Pictorial- Abstract (i.e. CPA) approach. The Concrete-Pictorial-Abstract (CPA) approach is an

approach in learning Mathematics which is done in stages. Each stage is built on the previous stage and must therefore be taught sequentially. The CPA approach consists of three stages of learning namely learning through physical manipulation of concrete objects, followed by learning through pictorial representations of manipulation of concrete objects, and ends with solving problems using abstract notation (Witzell, 2005). Several research support the effectiveness of this approach, including enhancement of problem solving skills, analytical, reasoning skills, fewer procedural errors incur by students using this approach in algebraic variables compared to students learning through conventional learning. As students manipulate objects, visualize, create or design objects, and find solutions to a mathematical problem by imagining objects or their numbers proportionally, it develops their spatial sense abilities, problem solving abilities.

AIMS OF MATHEMATICS CURRICULUM

The basic aims of the mathematics curriculum from grade I-V are as follow:

- instill Mathematical skills for everyday use.
- strengthen basic mathematical skills to set the foundation for higher-level mathematics.
- develop the ability to think logically to analyze diverse situations.
- develop a sense of appreciation and enjoyment while learning mathematics.
- develop a deep and sustainable understanding through the Concrete, Pictorial and Abstract (CPA) approach by Jerome Bruner.
- Engage in investigations and inquiries to develop skills in mathematical reasoning, processing information, making connections to real-life situations and making judgments.

The SNC Mathematics is based on standards that provide a set of progressive and detailed learning outcomes for each topic and grade. The grade-wise learning development is shown through a progression grid/matrix.

The Student's Learning Outcomes (SLOs) for each grade are further categorized as knowledge and skill, which will help teachers to plan their lessons and administrators to monitor the effective learning process. This curriculum document includes details of pedagogical approaches designed to help mathematics teachers achieve the overall aims of this curriculum. For example, among others, real life situations are used to achieve this curriculum's aims. It helps engage students in analyzing situations and applying mathematical knowledge to solve related real-life situations. Moreover, students get opportunities to construct similar situations to engage intellectually with mathematical content.

Mental Mathematics and the inquiry approach, equally important strategies are also used especially for developing number sense, forming predictions, justifying arguments with evidence and drawing conclusions. Thus, this curriculum focuses on principles, patterns and systems so that students can apply their growing mathematical knowledge and develop a holistic understanding of the subject.

This document also includes assessment guidelines to ensure meaningful relationship and alignment between curriculum learning outcomes, instructional design and assessment methods. Specific formative assessment strategies are suggested that lead to improvement of students learning. An effective learning-outcomes-oriented quality assurance system, which is based on constant monitoring and an effective feedback loop, is recommended.

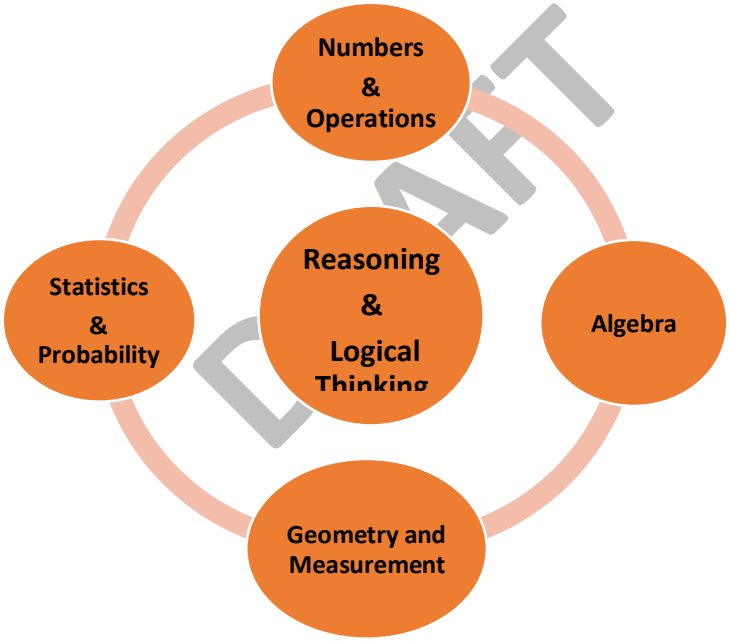
Mathematics teachers are therefore expected to:

- Shift from dispensing information to plan investigative tasks.
- Encourage mastery of concepts instead of accelerating learning to complete syllabus.
- Encourage students to realise the inter concept and intra concept connections.
- Create a cooperative and collaborative learning environment.
- Design assessment tasks.
- Draw valid inferences about students.
- Use this information to improve their teaching practices

MATHEMATICS CURRICULUM CONTENT STRANDS AND STANDARDS

The curriculum for Mathematics is comprised of the following five strands. The strands are intentionally kept broad to allow flexibility to the teachers to adapt their teaching styles by their students. These strands include Numbers and Operations, Algebra, Geometry and Measurement, Statistics & Probability.

All of this content is underpinned by reasoning and logical thinking. All standards and students' learning outcomes are built around these strands.



ASSESSMENTS:

Assessment is a mandatory part of the teaching and learning process. It cannot be treated isolated from the teaching and learning process. It helps both teachers and learners to judge and evaluate their efforts and pace of learning.
In mathematics it becomes more essential, as mathematical concepts are linked with each other. Concepts grasped during one teaching session serve as a basis for the learning of upcoming concepts. Teachers use assessments for a number of purposes such as pre-assessing the learners' need, providing relevant instruction, assessing the intended learning outcomes, placement of the learners in different

groups, diagnosis of weaknesses and strengths of the learners, adjustment of teaching strategies / techniques and promotion of the learners to the next grade. Major functions of the assessment are instructional planning, feedback, making decision, and selection of appropriate resources and strategies to move forward.

In short the prime purpose of any assessment is to improve students' learning. Assessment, classified according to its **purpose**, and can be thought of as assessment *for, as, and of* learning.

The main forms are noted as:

- *Assessment for learning (known as Formative assessment),*
- *Assessment as learning (known as Formative assessment).*
- *Assessment of learning (known as Summative assessment).*

Formative Assessments:

Assessment for learning:

In this type of assessment, the teacher provides students with descriptive feedback and coaching for improvement. The purpose for ***teachers*** is to:

- gather evidence of student achievement consistently, fairly and conscientiously over short periods of learning time, optimally through informal methods;
- monitor students' progress towards the defined learning goals;
- provide descriptive, detailed, clear and specific feedback and coaching to students to improve their learning;
- define teaching adjustments and next steps for teaching to help students reach their potential.

Note: The teacher would not use this data as assessment data for the evaluation of student learning.

The most common forms of ***assessment for learning*** **(formative assessment)** are:

Checklists, anecdotal notes, field notes, rubrics, exemplars/benchmarks, continuums, portfolios/ reflective journals, learning stories, reading running records, observation diaries, inquiry charts, CATs, observations of students non-verbal feedback, homework exercises, questioning (open and closed), quiz, projects, selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc), open-ended tasks, reflections, KWL, KWHL, performance assessments, process-focused assessments, conferences between student and the instructor, answering specific questions, students reflections, students feedback collected periodically self-assessments, portfolio, etc.

Assessment as Learning

The main purpose of assessment as learning is to provide evidence to the students of their learning. The purpose for ***students*** is to:

- Develop their ability to continuously and consistently self-assess themselves and know where they are in their learning and what they can do.
- Become independent and autonomous learners who are able to:
    - set learning goals for themselves;
    - monitor their own progress towards these learning goals;
    - make adjustments in their learning approaches by determining and deciding next steps for developing their learning;
    - reflect on their thinking and learning;
    - guide and provide feedback to their peers to help improve their learning and achieve their learning goals.

Note: The teacher would not use this data as assessment data for the evaluation of student learning.

The most commonly used forms of **assessment as learning (formative assessment)** are:
In-class activities where students present their findings informally and provide feedback on peer assessments.

Summative Assessments

Assessment of Learning (Summative)

This assessment leads to the evaluation of student learning. It accurately summarizes and communicates to parents, individual students, teachers, other teachers, school leaders and policymakers what students know and can do concerning the overall curriculum expectations.
The teacher assesses a student's summative work at the end of a learning period, to determine to what degree (at what level) the student has achieved the learning goal.
The purpose for ***teachers*** is to:

- Provide evidence of students' achievement at strategic times during a specific class and often at the end of a learning unit.
- Summarize learning achieved by students at a given time, after a unit of learning;
- Provide assessment data for evaluation;
- Make judgments about the quality of students learning on the established curriculum expectations;
- Provide a value (pass/fail) to that quality of learning achieved by the students.
- Record and report student's achievements to all stakeholders including parents, teachers, school and senior management as well as students themselves.

Note: The teacher would use this data as assessment data for the evaluation of student learning.

Commonly forms of **assessment of learning (summative assessment)** are:
class tests, end of unit tests, mid-year examinations, monthly tests, progress tests, standardized tests, unseen test/examination in controlled conditions, MCQs in controlled conditions, open book or take-away exam, Essay or Report in controlled conditions, portfolio, presentations (peer - or tutor – assessed in controlled environments), performance (musical or dramatic), oral examination etc.

References:

Audsley, S.M. (2019) 6 reasons to study Mathematics. Retrieved from https://www.phdstudies.com/article/6-reasons-to-study-mathematics/

Growing Success- Assessment, Evaluation and Reporting in Ontario Schools (2013); and Assessment, Evaluation and Reporting Handbook (2013) retrieved from http://www.edu.gov.on.ca/eng/policyfunding/success.html]

Putri, H.E.; Rahayu, P.; Muqadas, I. and Wahyudy, M. A. (2019). The Effect of Concrete-Pictorial-Abstract (CPA) Approach on Improving Elementary School Students' Spatial Sense Ability. Retrieved from: https://files.eric.ed.gov/fulltext/EJ1264986.pdf

Quddusi, M.A. (2018) Retrieved from: The Scientific World (2022) What is the importance of Mathematics in our daily lives. https://www.scientificworldinfo.com/2018/11/what-is-importance-of-mathematics-in.html

ایک قوم
ایک نصاب
ONE NATION, ONE CURRICULUM

Single National Curriculum 2022

Required Standards and Student Learning Outcomes (SLOs)
for every child in Pakistan

ECE - 8

FOUR PARTS OF A CURRICULUM:

Math Progression Grid (1-8)

Note: *The progression grid identifies the core student learning outcomes.*
An asterisk (*) placed at the end of a student learning outcome indicates an advanced/additional skill for that specific learning outcome.
Please refer to the relevant 'Suggested Guidelines' document to be informed of more directions for advanced/additional complementary content and ideas.

Domain A: Numbers and Operations

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Benchmarks: Students will be able to demonstrate knowledge of place value (up to 4-digit numbers); represent whole numbers with words, diagrams, number lines, or symbols; order and compare numbers. They will add and subtract numbers up to 4-digit numbers; multiply (up to 3-digit numbers with 1-digit) and divide (3-digit by 1-digit number). Solve problems involving odd and even numbers, addition, subtraction, multiplication and division of numbers (involving missing numbers, money, quantities and measures), round numbers to nearest tens, hundreds and thousands and make estimates. Recognise fractions as parts of wholes or collections; represent fractions using words, numbers, equivalent fractions in simplest form; compare and order simple fractions; add and subtract simple like and unlike fractions, including those set in problem situations. Demonstrate knowledge of decimal place value to the tenth.			**Benchmarks:** Students will be able to demonstrate knowledge of place value (5-digit to 7-digit numbers); represent whole numbers with words, diagrams, number lines, or symbols; order and compare numbers. They will add and subtract numbers up to 6-digit numbers; multiply (up to 5-digit numbers with 3-digit) and divide (up to 5 digit up to 2 digit number) Solve problems involving odd and even numbers, addition, subtraction, multiplication and division of numbers (involving missing numbers, money, quantities and measures), round numbers to nearest tens, hundreds and thousands and make estimates. Recognise fractions as parts of wholes or		**Benchmarks:** Students will be able use language, notation and Venn diagrams to describe sets and their elements, operate with real numbers, their properties and identify absolute value of real numbers, apply commutative ,associative and distributive laws on real numbers , compare, arrange and round off real numbers to required degree of accuracy, calculate factors, multiples, HCF and LCM, square roots and cube roots, ratio, rate, proportion, percentages, profit, loss, discount, Zakat, Ushr, commission, Taxes, insurance, partnership and Inheritance and apply all of these concepts in real life contexts.	

			collections; represent fractions using words, numbers; compare and order simple fractions; add and subtract simple like, unlike fractions, including those set in problem situations. Demonstrate knowledge of decimal place value (up to three decimal place) compare, order, and round decimals (to the nearest whole number and up to two decimal place); add, subtract, multiply and divide decimals, including those set in real world problems (including money, quantities or measures).				
Student Learning Outcomes							
[SLO: M-01-A-01] Count objects and numbers to and across 99 (2-digit numbers) forwards and backwards, beginning from zero one, or from any given number.	[SLO: M-02-A-01] Count numbers up to and across 999 (3-digit numbers) forwards and backwards, beginning from zero or one, or from any given number.	[SLO: M-03-A-01] Count up to 9999 (4-digit numbers).	[SLO: M-04-A-01] Count up to 99,999 (5-digit numbers).	[SLO: M-05-A-01] Count up to 9,999,999 (7-digit numbers)	---	---	---
[SLO: M-01-A-02] Read and write numbers up to 99 (2-digit numbers) in	[SLO: M-02-A-02] Read and write numbers up to 999 in numerals and up to	[SLO: M-03-A-02] Read and write up to 999 in numerals and in words.	[SLO: M-04-A-02] Read and write up to 99,999 (5-digit numbers) in numerals	[SLO: M-05-A-02] Read and write up to 9,999,999 (6 and 7 digit numbers) in	---	---	---

numerals and in words.	99 in words.		and in words.	numerals and in words.			
[SLO: M-01-A-03] Recognise the place value of each digit in 2-digit numbers (tens, ones/units).	[SLO: M-02-A-03] Recognise the place value of each digit in 3-digit numbers (hundreds, tens, ones/units).	[SLO: M-03-A-03] Recognise the place value of each digit in 4-digit numbers.	[SLO: M-04-A-03] Recognise the place value of each digit in 5-digit numbers.	[SLO: M-05-A-03] Recognise the place value of each digit in 6 and 7 digit numbers.	---	[SLO: M-07-A-01] With increasing degree of challenge, use the concept of place value for whole numbers, integers, rational numbers and decimal numbers.	---
[SLO: M-01-A-04] Compare and order numbers up to 99 using appropriate language (for instance: more and less, greater, smaller, equal to, same as, increasing, decreasing, smallest to largest and vice versa etc.) [SLO: M-01-A-05] Identify numbers	[SLO: M-02-A-04] Compare and order numbers up to 999 using appropriate language and <, > and = signs.	[SLO: M-03-A-04] Compare numbers using symbols and arrange numbers up to 9999 using appropriate language	[SLO: M-04-A-04] Compare numbers using symbols and arrange numbers up to 99,999	---	---	---	---

before, after and between two numbers.							
---	[SLO: M-02-A-05] Round numbers to the nearest tens using different concrete objects and pictorial representations.	[SLO: M-03-A-05] Round numbers to the nearest tens, hundreds and thousands using different concrete and pictorial representations.	[SLO: M-04-A-05] Reinforce/recall round off numbers to the nearest tens, hundreds, thousands. [SLO: M-04-A-06] Round numbers to the nearest ten thousands.	---	---	[SLO: M-07-A-02] Round off whole numbers, integers, rational numbers and decimal numbers to a required degree of accuracy, significance or decimal places (up to 3 decimal places).	[SLO: M-08-A-01] Round off numbers up to 5 significant figures.
[SLO: M-01-A-06] Recognise the position of objects and write it using ordinal numbers up	[SLO: M-02-A-06] Recognise the position of objects and write it using ordinal numbers up to	---	---	---	---	---	---

to 10.	20.						
---	[SLO: M-02-A-07] Read and write Roman numbers up to 12.	[SLO: M-03-A-06] Read and write Roman numbers up to 20.	[SLO: M-04-A-07] Read and write Roman numbers up to 100.	---	---	---	---
[SLO: M-01-A-07] Find, recall and use addition and subtraction facts to 20.	[SLO: M-02-A-08] Find, recall and use addition and subtraction facts to 100.	---	---	---	---	---	---
[SLO: M-01-A-08] Compare numbers to find how many more and how many less [SLO: M-01-A-09] Add and subtract numbers mentally and in written form including: ● up to three 1-digit numbers ● 2-digit numbers and tens. [SLO: M-01-A-10] Add and subtract numbers mentally and in written form	[SLO: M-02-A-09] Add and subtract numbers mentally and in formal written form (with and without regrouping) including: ● 3-digit number and a 1- digit number. ● 3-digit number and tens. ● 3-digit number and a 2-digit number. ● Two 3-digit numbers.	[SLO: M-03-A-07] Add and subtract numbers mentally and in written form (with and without regrouping) including: ● 4-digit numbers with 1-, 2-, 3- and 4-digit numbers.	[SLO: M-04-A-08] Add and subtract up to 5-digit numbers mentally and in written form (with and without regrouping) including: ● 5-digit numbers with 1-digit, 2-digit, 3-digit, 4-digit and 5-digit numbers.	[SLO: M-05-A-04] Add and subtract up to 6-digit numbers mentally and in written form (with and without regrouping) including: ● 6-digit numbers with 1-digit, 2-digit, 3-digit, 4-digit, 5-digit and 6-digit numbers.	---	---	---

including: ● 2-digit numbers and 1-digit numbers (without regrouping) ● Two 2-digit numbers (without regrouping)							
[SLO: M-01-A-11] Solve real-world word problems with addition and subtraction using concrete objects and pictorial representations (involving missing numbers, money, quantities and measures)	[SLO: M-02-A-10] Solve real-world word problems with addition and subtraction (involving missing numbers, money, quantities and measures)	[SLO: M-03-A-08] Solve real-world word problems (including missing numbers and money) involving addition and subtraction.	[SLO: M-04-A-08] Solve real-world word problems (including multi step) involving addition and subtraction.	[SLO: M-05-A-05] Solve real-world word problems (including multi step) involving addition and subtraction.	---	---	---

---	[SLO: M-02-A-11] Estimate the answer to an addition and subtraction question. (using various approaches)	[SLO: M-03-A-09] Estimate the answer to an addition and subtraction question. (using various approaches)	[SLO: M-04-A-09] Estimate the answer to an addition and subtraction question. (using various approaches)	[SLO: M-05-A-06] Estimate the answer to an addition and subtraction question. (using various approaches)	---	[SLO: M-07-A-03] Use knowledge of rounding off to give an estimate to a calculation; to check the reasonableness of the solution.	[SLO: M-08-A-02] Analyze approximation error when numbers are rounded off. [SLO: M-08-A-03] Solve real-world word problems involving approximation
---	[SLO: M-02-A-12] Recognise even and odd numbers.	[SLO: M-03-A-10] Recognise and differentiate between even and odd numbers.	---	---	---	---	---
[SLO: M-01-A-12] Identify Pakistani coins (Rs. 1, 2, 5 and 10) and notes (Rs. 10, 20, 50, 100, and 500 [SLO: M-01-A-13] Solve money problems involving addition and subtraction of	[SLO: M-02-A-13] Identify international currency and denominations (for instance dollars.) [SLO: M-02-A-14] Solve money problems involving addition and subtraction of Pakistani money and	---	---	---	---	---	[SLO: M-08-A-04] Convert Pakistani currency to well-known international currencies and vice versa.

Pakistani money.	a few selected international currency notes. (for instance dollar)						
[SLO: M-01-A-14] Count and write in 2's, 5s and 10s using concrete objects (such as counters, pebbles, popsicle sticks etc) and pictorial representations (such as number line, hundred square grid) [SLO: M-01-A-15] Recognise counting in 2s, 5s and 10s as multiplication tables of two, five and ten. [SLO: M-01-A-16] Recognise multiplication as repeated addition using concrete objects and pictorial representations (for instance materials, groups and arrays)	[SLO: M-02-A-15] Count and write in 3s, 4s, 5s, 10s and 100s. [SLO: M-02-A-16] Recognise counting in 3s, 4s as multiplication tables of three and four. [SLO: M-02-A-17] Recognise multiplication as repeated addition and develop multiplication tables (times tables) for 2, 3, 4, 5 and 10.	[SLO: M-03-A-11] Count and write in multiple steps. Develop times tables for 6, 7, 8, and 9 and write multiplication sentences using concrete and pictorial representations.	---	---	---	---	---

	[SLO: M-02-A-18] Write multiplication statements (i.e., sentences) using concrete and pictorial representations.						
[SLO: M-01-A-17] Recognise using concrete objects and pictorial representations that the multiplication of any two numbers can be done in any order.	[SLO: M-02-A-19] Recognise using concrete and pictorial representations that the multiplication of any two numbers can be done in any order.	[SLO: M-03-A-12] Reinforce through concrete and pictorial representations that the multiplication of any two numbers can be done in any order.	---	---	---	---	---
---	[SLO: M-02-A-20] Multiply mentally and in written form using the multiplication tables that they know: ● 1 digit number by another 1 digit number. [SLO: M-02-A-21] Multiply mentally and in written form using the multiplication tables	[SLO: M-03-A-13] Multiply mentally and in written form: ● 2 digit numbers by 1 digit numbers. ● 3 digit numbers by 1-digit numbers.	[SLO: M-04-A-10] Multiply up to 4-digit numbers with 1-digit and 2-digit numbers mentally and in written form.	[SLO: M-05-A-07] Multiply upto 5-digit numbers with 1-digit, 2-digit and 3-digit numbers in written form.	---	---	---

	that they know: • 2-digit number by a 1-digit number using a multiplication grid. [SLO: M-02-A-22] Multiply a number with 0 and 1.						
---	[SLO: M-02-A-23] Solve real-world word problems involving multiplication.	[SLO: M-03-A-14] Solve real-world word problems involving multiplication.	[SLO: M-04-A-11] Solve real-world word problems involving multiplication.	[SLO: M-05-A-08] Solve real-world word problems involving multiplication.	---	---	---
[SLO: M-01-A-18] Recognise division as repeated subtraction using concrete objects and pictorial representation. (groups, arrays and sharing)	[SLO: M-02-A-24] Recognise division as repeated subtraction through concrete and pictorial representation. [SLO: M-02-A-25] Write division statements (i.e., sentences) using concrete and pictorial representations.	---	---	---	---	---	---

[SLO: M-01-A-19] Recognise using concrete objects and pictorial representation that the division of one number by another number cannot be done in any order.	[SLO: M-02-A-26] Recognise using concrete and pictorial representation that the division of one number by another cannot be done in any order.	[SLO: M-03-A-15] Reinforce through concrete and pictorial representation that the division of any two numbers cannot be done in any order (Commutative).	---	---	---	---	---
---	[SLO: M-02-A-27] Divide mentally and in written form: ● 1-digit number by another 1-digit number (without remainder) ● 2-digit number by a 1-digit number (without remainder)	[SLO: M-03-A-16] Divide mentally and in written form: ● 2-digit numbers by 1 digit number (with and without remainder) ● 3-digit numbers with 1-digit numbers (with and without remainder) [SLO: M-03-A-17] Divide a number by 1 and itself.	[SLO: M-04-A-12] Divide up to 4-digit numbers by 1-digit and 2-digit numbers in written form.	[SLO: M-05-A-09] Divide up to 5-digit numbers by 1-digit and 2-digit numbers in written form.	---	---	---
[SLO: M-01-A-20] Solve simple real world problems involving multiplication and	[SLO: M-02-A-28] Solve real-world word problems involving multiplication and	[SLO: M-03-A-18] Solve real-world word problems involving division.	[SLO: M-04-A-13] Solve real-world word problems involving division.	[SLO: M-05-A-10] Solve real-world word problems involving division.	---	---	---

division using any method (for instance materials, repeated addition, groups and arrays, mental methods, and known multiplication tables).	division using any method (for instance materials, repeated addition/subtraction, groups, arrays, mental and or written methods).						
---	[SLO: M-02-A-29] Solve real-world word problems (including Pakistani currency) involving addition, subtraction, multiplication and division.	[SLO: M-03-A-19] Solve real-world word problems involving addition, subtraction, multiplication and division.	[SLO: M-04-A-14] Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.	[SLO: M-05-A-11] Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.	---	----	---
---	---	---	[SLO: M-04-A-15] Identify divisibility rules for 2, 3, 5 and 10 and use them on up to 4-digit numbers.	[SLO: M-05-A-12] Identify divisibility rules for 7 and 11 and use them on up to 5-digit numbers.	---	---	---
---	---	---	[SLO: M-04-A-16] Identify and differentiate between multiples and factors and find: ● all factor pairs of a number	---	[SLO: M-06-A-01] Identify: ● Factors of up to 3-digit numbers ● Multiples of up to 2-digit	---	---

			• common factors of two numbers [SLO: M-04-A-17] Identify and differentiate between multiples and factors and find: • common multiples of two or more than 2-digit numbers.		numbers • Prime factors of up to 4-digit numbers and express in index notation		
---	---	---	---	---	[SLO: M-06-A-02] Identify base and exponent and express numbers given in expanded form in index notation and vice versa.	---	---
---	----	----	[SLO: M-04-A-18] Identify and differentiate between 2-digit prime and composite numbers up to 50.	[SLO: M-05-A-13] Identify and differentiate between 2-digit prime and composite numbers up to 100.	---	---	---
---	---	---	---	[SLO: M-05-A-14] Find H.C.F and	[SLO: M-06-A-03]	[SLO: M-07-A-04]	---

				L.C.M of two numbers (up to 2-digits) using various methods. (For instance prime factorization, division method etc.)	Find H.C.F and L.C.M of two or three numbers (up to 3-digits) using various methods (for instance prime factorization and division method).	Recall H.C.F and L.C.M.	
---	---	---	---	[SLO: M-05-A-15] Solve real-world word problems involving H.C.F and L.C.M.	[SLO: M-06-A-04] Solve real-world word problems involving H.C.F and L.C.M.	---	---
---	---	---	---	---	[SLO: M-06-A-05] Recognise, identify and represent integers (positive, negative and neutral integers) and their absolute or numerical value.	[SLO: M-07-A-05] Recall - Recognise, identify and represent integers (positive, negative and neutral integers) and their absolute or numerical value.	---
---	---	---	---	---	[SLO: M-06-A-	---	---

					06] Arrange a given list of integers and their absolute value in ascending and descending order.		
---	---	---	---	---	[SLO: M-06-A-07] Add and subtract upto-2-digit like and unlike integers and verify commutative and associative laws (where applicable).	---	---
---	---	---	---	---	[SLO: M-06-A-08] Multiply up to 2-digit like and unlike integers and verify commutative, associative and distributive laws. [SLO: M-06-A-09]	---	---

					Divide like and unlike integers.		
[SLO: M-01-A-21] Recognise, find, name and write fractions: - half (½) - quarter (¼) - two-quarters (2/4) - three-quarters (¾) of a length, shape, set of objects or quantity using pictorial representations.	[SLO: M-02-A-30] Identify, name and write; -unit fractions -non-unit fractions -like fractions -unlike fractions of a discrete set of objects using pictorial representations.	[SLO: M-03-A-20] Recognise among: -proper fractions -improper fractions. -mixed numbers	[SLO: M-04-A-19] Differentiate among: -proper fractions -improper fractions -mixed numbers.	---	---	[SLO: M-07-A-06] Identify and represent (on a number line) rational numbers. [SLO: M-07-A-07] Represent whole numbers, integers and decimal numbers on a number line.	[SLO: M-08-A-05] Differentiate between rational and irrational numbers. [SLO: M-08-A-06] Represent real numbers on a number line and Recognise the absolute value of a real number.
---	---	[SLO: M-03-A-21] Identify equivalent fractions and show families of equivalent fractions. [SLO: M-03-A-22] Simplify fractions to the lowest term.	[SLO: M-04-A-20] Convert improper fractions to mixed numbers and vice versa.	---	---	[SLO: M-07-A-08] Identify and convert between various types of fractions.	---
---	[SLO: M-02-A-31] Compare and order	[SLO: M-03-A-23] Compare and order like	[SLO: M-04-A-21] Compare and order	[SLO: M-05-A-16] Compare and order	---	[SLO: M-07-A-09]	[SLO: M-08-A-07]

	unit fractions and like fractions (with denominators up to 10) using <, > and = sign.	fractions using symbols <, > and =.	unlike fractions.	whole numbers, proper, improper fractions and mixed numbers in ascending and descending order.		Compare (using symbols <, >, =, ≤ and ≥) and arrange (in ascending or descending order) whole numbers, integers, rational numbers and decimal numbers.	Demonstrate the ordering properties of real numbers.
---	[SLO: M-02-A-32] Add and subtract like fractions within one whole (e.g., ¼ + ¾ = 4/4).	[SLO: M-03-A-24] Add and subtract like and unlike fractions (with denominators that are multiples of the same number).	[SLO: M-04-A-22] Add and subtract like and unlike fractions (with denominators that are multiples of the same number) and write the answer in mixed numbers (if applicable).	[SLO: M-05-A-17] Add and subtract; two or three unlike fractions and mixed numbers.	---	[SLO: M-07-A-10] Verify associative and commutative properties of rational numbers.	---
---	---	---	[SLO: M-04-A-23] Multiply and divide proper, improper fractions and mixed numbers by a whole number. [SLO: M-04-A-24] Multiply two fractions	[SLO: M-05-A-18] Multiply and divide proper, improper fractions and mixed numbers and express the answer in its simplest form (if applicable).	---	[SLO: M-07-A-11] Verify associative, commutative and distributive properties of rational numbers.	[SLO: M-08-A-08] Demonstrate the following properties: -closure property -associative property - existence of

			and/or mixed numbers.				identity element -existence of inverses - commutative property - distributive property
---	---	---	[SLO: M-04-A-25] Solve real-world word problems involving fractions by identifying appropriate operations.	[SLO: M-05-A-19] Solve real-world word problems involving fractions.	---	[SLO: M-07-A-12] Solve real-world word problems involving operations on rational numbers.	[SLO: M-08-A-09] Solve real-world word problems involving calculation with decimals and fractions.
---	[SLO: M-02-A-33] Know and recognise that tenths arise by dividing an object into ten equal parts and in dividing single digit numbers and quantities by ten (using concrete and pictorial representations).	[SLO: M-03-A-25] Know and recognise that hundredths arise by dividing an object, single digit numbers and quantities into hundred equal parts.	[SLO: M-04-A-26] Recognise, read, write decimal numbers and identify the place value of decimal numbers with up to three decimal places.	---	---	---	[SLO: M-08-A-10] Identify and differentiate between decimal numbers as terminating (non-recurring) and non-terminating (recurring).
---	---	*[SLO: M-03-A-ADD] Identify that tenths arise by dividing an*	[SLO: M-04-A-27] Recognise the result of dividing 1 or 2-	---	---	---	---

		*object, single digit number and quantities into ten equal parts (e.g., 2/10 = 0.2)**	digit number by 10 and 100 and identifying the value of digits in the answer as ones, tenths and hundredths (e.g., 24/100 = 0.24)				
---	---	---	[SLO: M-04-A-28] Express -a decimal number (up to three decimal places) as a fraction whose denominator is 10, 100 and 1000. -a given fraction in its decimal equivalent (tenths, hundredths or thousandths) when the; (i) denominator of the fraction is 10, 100 or 1000. (ii) denominator of a fraction is not 10, 100, or 1000 but can be converted to 10, 100 or a 1000. [SLO: M-04-A-29] Recognise and write a quarter, a half and	[SLO: M-05-A-20] Convert fractions to decimals and vice versa.	---	---	---

			three quarters (i.e., ½, ¼, ¾. to its decimal equivalents.				
---	---		[SLO: M-04-A-30] Compare and order decimal numbers with up to two decimal places.	[SLO: M-05-A-21] Compare and order numbers up to three decimal places using signs >, < and = sign and in ascending and descending order.	---	---	---
---	---		[SLO: M-04-A-31] Round decimal numbers (with up to three decimal places) to the nearest whole number and to one and two decimal places.	[SLO: M-05-A-22] Reinforce rounding decimal numbers (with up to three decimal places) to the nearest whole number and to tenth and hundredth.	---	---	---
---	---	---	[SLO: M-04-A-32] Add and subtract 3-digit numbers with up to two decimal places.	[SLO: M-05-A-23] Add and subtract numbers up to three decimal places.	---	---	---
---	---	---	[SLO: M-04-A-33] Multiply and divide a 2-digit number with one decimal place by:	[SLO: M-05-A-24] Multiply numbers up to two decimal places by:	---	---	---

			• a 1-digit number. • a 2- digit number	•up to 2-digit whole numbers •3-digit numbers with up to two decimal places. [SLO: M-05-A-25] Divide numbers up to two decimal places by • up to 2-digit whole numbers • 2-digit numbers with one decimal place.			
---	---	---	[SLO: M-04-A-34] Multiply and divide a 2-digit number with one decimal place by 10 and 100.	[SLO: M-05-A-26] Multiply and divide a number up to two decimal places by 10, 100 and 1000.	---	---	---
---	---	---	[SLO: M-04-A-35] Use appropriate operations to solve real-world word problems including 2-digit numbers with one decimal place (including money,	[SLO: M-05-A-27] Use appropriate operations to solve real-world word problems including numbers up to two decimal places (including money,	---	---	---

			quantities and measures).	quantities and measures).			
---	---	---	[SLO: M-04-A-36] Recognise the order of operations and use it to solve mathematical expressions involving whole numbers, decimals and fractions.	[SLO: M-05-A-28] Recognise the order of operations and use it to solve mathematical expressions involving whole numbers, decimals and fractions.	[SLO: M-06-A-10] Recognise the order of operations and use it to solve mathematical expressions involving whole numbers, decimals, fractions and integers.	[SLO: M-07-A-13] Recognise the order of operations and use it to solve mathematical expressions involving whole numbers, decimals, fractions and integers.	---
---	---	---	[SLO: M-04-A-37] Recognise the percent symbol (%) and understand that percent is the 'number of parts per hundred'.		---	---	---
---	---	---	---	[SLO: M-05-A-29]	[SLO: M-06-A-11] Express one	---	---

				Express percentages as a fraction with denominator 100 and as a decimal number. [SLO: M-05-A-30] Use equivalences between simple fractions, decimals and percentages in real world contexts.	quantity as a percentage of another, compare two quantities by percentage and increase or decrease a quantity by a given percentage.		
---	---	---	---	[SLO: M-05-A-31] Solve real-world word problems involving conversion of percentage, fraction and decimal numbers. [SLO: M-05-A-32] Solve problems which require knowing percentage and decimal equivalents of ½, ¼, 1/5, 2/5, 4/5 and those fractions	[SLO: M-06-A-12] Solve real-world word problems involving percentage.	---	---

				with a denominator of a multiple of ten or 25.			
---	---	---	---	[SLO: M-05-A-33] Use unitary method to calculate; the value of many objects of the same kind when the value of one is given, the value of one object when value of many is given and value of many objects when value of some is given (including related real-world problems).	[SLO: M-06-A-13] Explain rate as a comparison of two quantities where one quantity is 1.	[SLO: M-07-A-14] Calculate rate and average rate of quantities.	---
---	---	---	---	---	[SLO: M-06-A-14] Calculate ratio of two numbers (up to 3-digit) and simplify ratios.	[SLO: M-07-A-15] Calculate increase and decrease in a ratio based on change in quantities.	---
---	---	---	---	---	[SLO: M-06-A-15]	---	---

					Explain and calculate continued ratio.		
---	---	---	---	---	[SLO: M-06-A-16] Solve real-world word problems involving ratio and rate.	---	---
---	---	---	---	---	---	[SLO: M-07-A-16] Explain and calculate direct and inverse proportion and solve real-world word problems related to direct and inverse proportion.	[SLO: M-08-A-11] Calculate direct and inverse and compound proportion and solve real-world word problems related to direct, inverse and compound proportion. (using table, equation and graph)
---	---	---	---	---	---	[SLO: M-07-A-17] Identify and differentiate between selling	[SLO: M-08-A-12] Explain and calculate profit percentage, loss

						price, cost price, loss, discount, profit percentage and loss percentage.	percentage and discount.
---	---	---	---	---	---	[SLO: M-07-A-18] Explain income tax, property tax, general sales tax, value-added tax, zakat and ushr.	[SLO: M-08-A-13] Explain and calculate profit/markup, principal amount and markup rate.
---	---	---	---	---	---	---	[SLO: M-08-A-14] Explain insurance, partnership and inheritance.
---	---	---	---	---	---	[SLO: M-07-A-19] Solve real world word problems involving profit, loss, discount, commission, tax, zakat and ushr.	[SLO: M-08-A-15] Solve real world word problems involving profit %, loss %, discount, profit, markup, insurance, partnership and inheritance.

---	---	---	---	[SLO: M-05-A-34] Recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3})	[SLO: M-06-A-17] Recognise and calculate squares of up to 2-digit numbers.	[SLO: M-07-A-20] Recognise and calculate squares of numbers up to 3-digits.	---
---	---	---	---	---	---	[SLO: M-07-A-21] Find the square roots of perfect squares of (up to 3-digit) natural numbers, fractions and decimals.	[SLO: M-08-A-16] Find the square root of natural numbers, common fractions and decimal numbers (up to 6-digit).
---	---	---	---	---	---	[SLO: M-07-A-22] Solve real-world word problems involving squares and square roots.	[SLO: M-08-A-17] Solve real-world word problems involving squares and square roots.
---	---	---	---	---	--	---	[SLO: M-08-A-18] Recognise perfect cubes

							and find: -cubes of up to 2-digit numbers - cube roots of up to 5-digit numbers which are perfect cubes
---	---	---	----	---	---	---	[SLO: M-08-A-19] Solve real-world word problems involving cubes and cube roots.
---	---	---	---	---	[SLO: M-06-A-18] Use language, notation and Venn Diagrams to represent different types of sets and their elements. (finite, infinite, empty, singleton and universal set)	[SLO: M-07-A-23] Use language, notation and Venn Diagrams to represent different sets and their elements. (natural numbers, whole numbers, integers, even numbers, odd numbers, prime numbers)	[SLO: M-08-A-20] Describe sets using language (tabular, descriptive and set-builder notation) and Venn diagrams
---	---	---	---	---	---	[SLO: M-07-A-24]	[SLO: M-08-A-21]

						Identify and differentiate between: ● subset and superset ● proper and improper ● equal and equivalent ● disjoint and overlapping.	Find the power set (P) of set A where A has up to four elements.
---	---	---	---	---	---	[SLO: M-07-A-25] Describe and perform operations on sets (union, intersection, difference and complement). [SLO: M-07-A-26] Verify the following: A ∩ Ac = ∅ A ∪ Ac = U ($A \cup B$)c= $Ac \cap Bc$ ($A \cap B$)c=	[SLO: M-08-A-22] Describe operations on sets and verify commutative, associative, distributive laws with respect to union and intersection.

						$Ac \cup Bc$.	
---	---	---	---		---	---	[SLO: M-08-A-23] Verify De Morgan's laws and represent through Venn Diagram.
---	---	---	---	---	---	---	[SLO: M-08-A-24] Apply sets in real-life word problems.

Domain B: Algebra

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Benchmarks: Students will be able to analyse and complete geometrical and number patterns; find the missing number or operation in a number sentence.			**Benchmarks:** Students will be able to analyse and complete number patterns; find the missing number or operation in a number sentence.		**Benchmarks:** Students will be able to recognise and manipulate number patterns, use letters to represent numbers, expand, simplify, factorise, evaluate and manipulate algebraic expressions, use algebraic identities, interpret and plot graphs of linear equations, solve linear and simultaneous linear equations and linear inequalities and apply all of these concepts in real life context.		

Student Learning Outcomes							
[SLO: M-01-B-01] Identify and extend the next shape in patterns with 2 or 3 orientations.	[SLO: M-02-B-01] Complete geometrical patterns (e.g., on a square grid) according to one or two of the following orientations: Shape, size or colour.	---	---	---	---	---	---
[SLO: M-01-B-02] Identify and extend patterns using 2-D and 3-D shapes as well as through pictorial illustrations.	[SLO: M-02-B-02] Explore patterns in a variety of ways using 2-D and 3-D shapes.	---	---	---	---	---	---
---	[SLO: M-02-B-03] Identify and extend repeating, increasing and decreasing number patterns. (for e.g., on a number line or on a hundreds chart)	[SLO: M-03-B-01] Recognise and extend a given number pattern in increasing and decreasing order.	[SLO: M-04-B-01] Using a pattern rule, describe the pattern found in a given table or chart.	[SLO: M-05-B-01] Using a pattern rule, describe the pattern found in a given table or chart.	[SLO: M-06-B-01] Recognise simple patterns from various number sequences.	[SLO: M-07-B-01] Recall recognizing simple patterns from various number sequences.	[SLO: M-08-B-01] Differentiate between an arithmetic sequence and a geometric sequence.
---	---	---	[SLO: M-04-B-02] Complete the given	[SLO: M-05-B-02] Identify and apply	[SLO: M-06-B-02]	[SLO: M-07-B-02]	[SLO: M-08-B-02]

			increasing and decreasing number patterns.	the pattern rule of a given increasing and decreasing pattern to: -extend the pattern for the next three terms -determine missing elements in a given pattern.	Continue a given number sequence and find: -term to term rule -position to term rule	Recall how to continue a given number sequence and find: -term to term rule -position to term rule	Find terms of an arithmetic sequence using: -term to term rule -position to term rule
---	---	---	---	---	---	[SLO: M-07-B-03] Find terms of a sequence when the general term (nth term) is given.	[SLO: M-08-B-03] Construct the formula for the general term (nth term) of an arithmetic sequence.
---	---	---	---	---	[SLO: M-06-B-03] Solve real life problems involving number sequences and patterns.	[SLO: M-07-B-04] Solve real life problems involving number sequences and patterns.	[SLO: M-08-B-04] Solve real life problems involving number sequences and patterns.
---	---	[SLO: M-03-B-02] Find the missing number or operation in	[SLO: M-04-B-03] Identify and write expressions or	---	---	---	---

		a number sentence (e.g., 20 + w = 100).	number sentences to represent problems that may involve unknowns.				
---	---	---	[SLO: M-04-B-04] Identify and use relationships in a well-defined pattern (e.g.,, describe the relationship between adjacent terms and generate pairs of whole numbers given a rule).	---	---	---	---
---	---	---	---	---	[SLO: M-06-B-04] Explain the term algebra as an extension of arithmetic, where letters, numbers and symbols are used to construct algebraic expressions.	[SLO: M-07-B-05] Students will know Muhammad bin Musa Al-Khwarizmi as the founding father of Algebra. [SLO: M-07-B-06] Recall variables as a quantity	[SLO: M-08-B-05] Recall the difference between: ➔ open and close sentences ➔ expression and equation ➔ equation and

						which can take various numerical values. [SLO: M-07-B-07] Recognise open and close sentences, like and unlike terms, variable, constant, expression, equation and inequality. [SLO: M-07-B-08] Recognise polynomials as algebraic expressions in which the powers of variables are whole numbers.	inequality
---	---	---	---	---	---	[SLO: M-07-B-09] Identify a	---

						monomial, a binomial and a trinomial as a polynomial.	
---	---	---	---	---	[SLO: M-06-B-05] Evaluate algebraic expressions by substitution of variables with numerical values.	[SLO: M-07-B-10] Add and subtract two or more polynomials.	[SLO: M-08-B-06] Recall the addition and subtraction of polynomials.
---	---	---	---	---	[SLO: M-06-B-06] Manipulate simple algebraic expressions using addition and subtraction.	[SLO: M-07-B-11] Find the product of: - monomial with monomial - monomial with binomial/trinomial - binomials with binomial/trinomial	[SLO: M-08-B-07] Recall the multiplication of polynomials.
---	---	---	---	---	---	---	[SLO: M-08-B-08]

							Divide a polynomial of degree up to 3 by -a monomial -a binomial
---	---	---	---	---	[SLO: M-06-B-07] Simplify algebraic expressions.	[SLO: M-07-B-12] Simplify algebraic expressions (by expanding products of algebraic expressions by a number, a variable or an algebraic expression) involving addition, subtraction, and multiplication division.	[SLO: M-08-B-09] Simplify algebraic expressions involving addition, subtraction, multiplication and division.
---	---	---	---	---	---	[SLO: M-07-B-13] Explore the following algebraic identities and	[SLO: M-08-B-10] Recognise the following algebraic identities and

						use them to expand expressions: $(a+b)^2$ $= a^2 + b^2 + 2ab$ $(a-b)^2$ $= a^2 + b^2 - 2ab$ $(a+b)(a-b)$ $= a^2 - b^2$	use them to expand expressions: $(a+b)^2$ $= a^2 + b^2 + 2ab$ $(a-b)^2$ $= a^2 + b^2 - 2ab$ $(a+b)(a-b) = a^2 - b^2$.
---	---	---	---	---	---	---	[SLO: M-08-B-11] Apply algebraic identities to solve problems like $(103)^2$, $(1.03)^2$, $(99)^2$, 101×99.
---	---	---	---	---	---	[SLO: M-07-B-14] Factorize algebraic expressions (by taking out common terms and by regrouping) [SLO: M-07-B-	[SLO: M-08-B-12] Factorize the following types of expressions: ● ka + kb + kc ● ac + ad + bc + bd ● $a^2 \pm 2ab + b^2$ ● $a^2 - b^2$

						15] Factorize quadratic expressions (by middle term breaking method).	• $a^2 \pm 2ab + b^2 - c^2$
---	---	---	---	---	---	---	[SLO: M-08-B-13] Manipulation of algebraic expressions $(a + b)^3 = a^3 + 3a^2 b + 3ab^2 + b^3$ $(a - b)^3 = a^3 - 3a^2 b + 3ab^2 - b^3$
---	---	---	---	---	[SLO: M-06-B-08] Recognise and construct linear equations in one variable.	[SLO: M-07-B-16] Construct linear equations in two variables such as; $ax + by = c$, where a and b are not	[SLO: M-08-B-14] Construct simultaneous linear equations in two variables.

						zero.	
---	---	---	---	---	[SLO: M-06-B-09] Solve linear equations involving integers, fractions and decimal coefficients.	[SLO: M-07-B-17] Recall solving linear equations in one variable.	[SLO: M-08-B-15] Solve simultaneous linear equations in two variables using: - elimination method - substitution method - graphical method division and factorisation method
---	---	---	---	---	[SLO: M-06-B-10] Solve real-world problems involving linear equations.		[SLO: M-08-B-16] Solve real-world word problems involving two simultaneous linear equations in two variables.
---	---	---	---	---	---	---	[SLO: M-08-B-17]

							Identify base, index/ exponent and its value.
---	---	---	---	---	---	---	[SLO: M-08-B-18] Deduce and apply the following laws of Exponents/ Indices: -Product Law -Quotient Law -Power Law
---	---	---	---	---	---	---	[SLO: M-08-B-19] Solve simple linear inequalities i.e.,, ax > b or cx < d ax + b < c ax + b>c [SLO: M-08-B-20] Represent the solution of linear inequality on the number line.
---	---	---	---	---	---	[SLO: M-	---

						07-B-18] Introduction to Cartesian coordinate system.	
---	---	---	---	---	---	[SLO: M-07-B-19] Plot the graph of the linear equation ax + b=0 where a ≠ 0 and of linear equations in two variables.	---
---	---	---	---	---	---	[SLO: M-07-B-20] Recognise and state the equation of a horizontal line and a vertical line.	[SLO: M-08-B-21] Recognise the gradient of a straight line. Recall the equation of horizontal and vertical lines i.e.,,

							$y = c \ and \ x = a$
---	---	---	---	---	---	[SLO: M-07-B-21] Find values of 'x' and 'y' from the graph.	[SLO: M-08-B-22] Find the value of 'y' when 'x' is given from the equation and vice versa.
---	---	---	---	---	---	---	[SLO: M-08-B-23] Plot graphs of linear equations in two variables i.e.,, $y = mx$ and $y = mx + c$
---	---	---	---	---	---	---	[SLO: M-08-B-24] Interpret the gradient/ slope of the straight line.
---	---	---	---	---	---	---	[SLO: M-08-B-25] Determine the y-intercept of a

							straight line.

Domain C: Measurement

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Benchmarks: Students will be able to measure, compare and order lengths (Kilometres/metres/ centimetres), mass (kilograms/grams/milligrams), and capacity (litres/ millilitres); read, write and compare time (hours and minutes); measure area and perimeter using square grids. They would also solve problems involving mass, length, weight/mass, capacity, and time (including addition and subtraction).			**Benchmarks:** Students will be able to measure, compare and convert lengths, mass, capacity and time from one standard unit to another; read, write and convert time in 24 hour and 12 hour notation. They would also solve problems involving length, mass/weight, capacity and time; solve problems involving perimeter and area of parallelogram, triangle, square, rectangle and rectilinear shapes.		**Benchmarks:** Students will be able to convert between different units of measure, solve problems involving speed, distance, time, area and perimeter of 2D shapes, surface area and volume of 3D shapes and apply the Pythagorean Theorem.		
Student Learning Outcomes							
[SLO: M-01-C-01] Use mathematical language to compare the height/length of two or more objects. [SLO: M-01-C-02]	[SLO: M-02-C-01] Compare the lengths of different objects using standard units of length (metre and centimetre) using <, >, and = signs.	---	---	---	---	---	---

Measure and compare the length of objects using non-standard units.							
---	[SLO: M-02-C-02] Recognise and use the standard units of length (metre and centimetre) to measure and record the length of different objects.	[SLO: M-03-C-01] Recognise and use the standard units of length (kilometre, metre, centimetre and millimetre) to measure and record the length of different objects.	---	---	---	---	---
---	---	---	[SLO: M-04-C-01] Convert units of length from larger to smaller units (Kilometre, metre, centimetre and millimetre).	[SLO: M-05-C-01] Convert units of length from larger to smaller and vice versa.	---	[SLO: M-07-C-01] Convert different units of distance.	---
---	[SLO: M-02-C-03] Add and subtract lengths, given in the same units to solve real-world word problems.	[SLO: M-03-C-02] Add and subtract lengths, given in the same units to solve real-world word problems.	[SLO: M-04-C-02] Convert, add and subtract lengths, to solve real-world word problems.	[SLO: M-05-C-02] Convert, add and subtract lengths, to solve real-world word problems.	---	---	---
[SLO: M-01-C-03] Use mathematical language to compare	[SLO: M-02-C-04] Compare the mass of different objects using	---	---	---	---	---	---

the mass of two or more objects. [SLO: M-01-C-04] Measure and compare the mass of objects using non-standard units.	standard units of mass (kilogram and gram) using <, >, and = signs.						
---	[SLO: M-02-C-05] Recognise and use the standard units of mass (Kilograms and grams) to measure and record the mass of different objects.	[SLO: M-03-C-03] Recognise and use the standard units of mass (Kilograms, grams and milligrams) to measure and record the mass of different objects.	---	---	---	---	---
---	---	---	[SLO: M-04-C-03] Convert units of mass from larger to smaller units (kilogram and gram).	[SLO: M-05-C-03] Convert units of mass from larger to smaller and vice versa.	---	---	---
---	[SLO: M-02-C-06] Add and subtract mass, given in the same units to solve real-world word problems.	[SLO: M-03-C-04] Add and subtract mass, given in the same units to solve real-world word problems.	[SLO: M-04-C-04] Convert, add and subtract mass to solve real-world word problems.	[SLO: M-05-C-04] Convert, add and subtract mass to solve real-world word problems.	---	---	---
[SLO: M-01-C-05] Use mathematical	[SLO: M-02-C-07] Compare the capacity	---	----	---	---	---	---

language to compare the capacity of two or more objects.	of different objects using standard units of capacity (litre and millilitre) using <, >, and = signs.						
[SLO: M-01-C-06] Measure and compare the capacity of objects using non-standard units	[SLO: M-02-C-08] Recognise and use the standard units of capacity (litre and millilitre) to measure and record the capacity of different objects.	[SLO: M-03-C-05] Recognise and use the standard units of capacity (litre and millilitre) to measure and record the capacity of different objects.	[SLO: M-04-C-05] Convert units of capacity from larger to smaller units (litre and millilitre).	[SLO: M-05-C-05] Convert units of capacity from larger to smaller and vice versa.	---	---	---
[SLO: M-01-C-07] Read and write temperature to the nearest appropriate unit i.e., (℃) using pictorial representations and relating temperature scale to number line.	[SLO: M-02-C-09] Read and write temperature to the nearest appropriate unit i.e., (℃) using pictorial representations and relating temperature scale to number line. [SLO: M-02-C-10] Compare and order temperature using <, >, and = signs.	[SLO: M-03-C-06] Read and write temperature to the nearest appropriate unit i.e., (℃) using pictorial representations and relating temperature scale to number line. [SLO: M-03-C-07] Compare and order temperature using <, >, and = signs.	[SLO: M-04-C-06] Recognise the other temperature measuring scales; Kelvin, Celsius and Fahrenheit		---	---	---
---	[SLO: M-02-C-11]	[SLO: M-03-C-08]	[SLO: M-04-C-07]	[SLO: M-05-C-06]	---	----	----

	Add and subtract capacities given in the same units to solve real-life word problems.	Add and subtract capacities given in the same units to solve real-life word problems.	Convert, add and subtract capacities to solve real-life word problems.	Convert, add and subtract capacities to solve real-life word problems.			
[SLO: M-01-C-08] Read and write time in hours (o'clock) from analogue clock and digital clock. [SLO: M-01-C-09] Show time in an hour on an analogue clock.	[SLO: M-02-C-12] Read and write time in hours and minutes (with five minute intervals, half past, quarter past and quarter to) from analogue and digital clocks. [SLO: M-02-C-13] Show time in hours and minutes on an analogue clock.	[SLO: M-03-C-09] Read and write time in hours and minutes from analogue and digital clocks.	[SLO: M-04-C-08] Read and write time from digital and analog clocks in 12-hour and 24-hour format.	---	---	---	---
---	---	[SLO: M-03-C-10] Recognise and use a.m. and p.m.	---	---	---	---	---

---	[SLO: M-02-C-14] Recognise intervals of time (for instance · to estimate/give a rough calculation of the time taken by particular events or tasks)	---	[SLO: M-04-C-09] Convert larger units to smaller units of time (hours, minutes, seconds, years, months, weeks and days). [SLO: M-04-C-10] Calculate duration of different events using start time and end time.	[SLO: M-05-C-06] Convert larger units to smaller units of time and vice versa.	---	[SLO: M-07-C-02] Convert 12 hour clock to 24 hour clock and vice versa. [SLO: M-07-C-03] Convert between different units of time and speed.	----
---	---	[SLO: M-03-C-11] Add and subtract measures of time given in the same units to solve real-life word problems.	[SLO: M-04-C-11] Add, subtract and convert measures of time to solve real-life word problems.	[SLO: M-05-C-07] Add, subtract and convert measures and intervals of time to solve real-life word problems.	---	[SLO: M-07-C-04] Calculate arrival time, departure time and journey time in a given situation (on the previous day and the next day).	---
---	---	---	---	---	---	[SLO: M-07-C-05] Solve real-world word problems	---

						involving distance, time and average speed. [SLO: M-07-C-06] Differentiate between uniform and average speeds.	
[SLO: M-01-C-10] Name days of the week and months of the Solar and Islamic year.	[SLO: M-02-C-15] Use Solar and Islamic Calendar to find a particular day/date in real-life situations.	[SLO: M-03-C-12] Read and write days and dates from the Solar Calendar.	---	---	---	---	---
---	[SLO: M-02-C-16] Recognise perimeter and area.	[SLO: M-03-C-13] Recognise and identify the units of measurement of area and perimeter and find the perimeter and area of 2-D figures (Squares and rectangles) and irregular figures (figures covers either ½ or 1 square unit only) on a square grid.	[SLO: M-04-C-12] Identify the units of measurement for perimeter and area, [SLO: M-04-C-13] Differentiate between the perimeter and area of a square, rectangular and rectilinear shapes. [SLO: M-04-C-14] Apply formulas to find the perimeter and	[SLO: M-05-C-08] Recognise that the shapes with the same area can have different perimeters and vice versa. [SLO: M-05-C-09] Calculate the area of parallelograms and triangles.	[SLO: M-06-C-01] Calculate the area of; a path (inside or outside) a rectangle or square, parallelogram, triangle and trapezium.	[SLO: M-07-C-07] Calculate the area and perimeter of the shaded/unshaded region in composite shapes. [SLO: M-07-C-08] Calculate the circumference	[SLO: M-08-C-01] State the Pythagoras theorem and use it to solve right angled triangles. [SLO: M-08-C-02] Calculate the arc length and the area of the sector of a

			area of squares, rectangles and rectilinear shapes.			and area of a circle.	circle.
---	---	---	---	[SLO: M-05-C-10] Solve real life word problems involving perimeter and area of square and rectangular regions.	[SLO: M-06-C-02] Solve real life word problems involving perimeter and area.	---	[SLO: M-08-C-03] Solve real life word problems using Pythagoras theorem.
---	---	---	---	---	[SLO: M-06-C-03] Calculate the surface area and volume of cube and cuboids.	[SLO: M-07-C-09] Calculate the surface area and volume of any simple 3-D shape including right prisms and cylinders.	[SLO: M-08-C-04] Calculate the surface area and volume of the pyramid, sphere, hemisphere and cone.

---	---	---	---	---	---	[SLO: M-07-C-10] Convert between standard units of area (m2, cm2, mm2 and vice versa) and volume (m3, cm3 and mm3 and vice versa)	---
---	---	---	---	---	[SLO: M-06-C-04] Solve real life word problems involving the surface area and volume of cubes and cuboids.	[SLO: M-07-C-11] Solve real life word problems involving the surface area and volume of right prisms and cylinders.	[SLO: M-08-C-05] Solve real life word problems involving the surface area and volume pyramid, sphere, hemisphere and cone.

Domain D: Geometry

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Benchmarks:			**Benchmarks:**		**Benchmarks:**		

Students will be able to use properties to describe and compare three-dimensional shapes (cube, cuboid, cone, cylinder, sphere, prism and pyramids) and relate those with two dimensional shapes; differentiate and classify polygons. Identify parallel and perpendicular lines; reflective symmetry, right angles and angles smaller and larger than a right angle; positions, directions and movements, centre, radius, and diameter of a circle**.**			Students will be able to use properties to describe and compare quadrilaterals; identify three dimensional shapes and relate three dimensional shapes with their two dimensional representations. They will also identify and draw types of angles up to 180 degrees and lines of symmetry in 2-D shapes; compare and order angles by size; identify circumference of a circle.		Students will be able to construct lines, angles of different measure, bisectors of angles, line segments, triangles and quadrilaterals ,use the properties of triangles ,quadrilaterals, polygons and circles to calculate unknown angles and lengths, apply facts of congruence and similarity and analyse and apply concepts of symmetry and transformations from two and three-dimensional perspectives.		
Student Learning Outcomes							
[SLO: M-01-D-01] Recognise and identify 2-D shapes (Rectangle, square, circle and triangle) with respect to their characteristics (i.e., sides and corners).	[SLO: M-02-D-01] Recognise, identify and draw 2-D shapes (Rectangle, square, circle, triangle, semi-circle and quarter-circle) with respect to their characteristics. [SLO: M-02-D-02] Identify pairs of perpendicular and parallel lines.	[SLO: M-03-D-01] Differentiate and classify polygons with respect to their attributes (pentagon, hexagon, octagon and decagon).	---	[SLO: M-05-D-01] Recognise, compare and classify types of quadrilaterals and their characteristics (parallel sides, equal sides, equal angles, right angles, lines of symmetry etc). (Square, rectangle, parallelogram, rhombus, trapezium and kite).	---	[SLO: M-07-D-01] Recognise quadrilaterals and their characteristics (parallel sides, equal sides, equal angles, right angles, lines of symmetry etc). (Square, rectangle, parallelogram, rhombus,	---

						trapezium and kite) [SLO: M-07-D-02] Differentiate between convex and concave polygons.	
[SLO: M-01-D-02] Recognise and identify 3-D Shapes (cube, cuboid, cone, cylinder and sphere) with respect to their characteristics.	[SLO: M-02-D-03] Recognise, identify 3-D shapes in different orientations. [SLO: M-02-D-04] Make 3-D Shapes using varied modelling materials (cube, cuboid, cone, cylinder, sphere,) with respect to their characteristics.	[SLO: M-03-D-02] Identify and differentiate between prisms and pyramids with respect to their attributes.	---	[SLO: M-05-D-02] Recognise and draw nets of prisms and pyramids.	[SLO: M-06-D-01] Recognise and identify 3-D shapes (i.e., cube, cuboid, cone, cylinder, sphere, hemisphere and cone) with respect to their characteristics.	---	---
[SLO: M-01-D-03] Describe the position, movement and direction of an object including moving in a straight line using positional	[SLO: M-02-D-05] Describe the position, direction and movement of an object including moving clockwise, anti-clockwise,	[SLO: M-03-D-03] Describe the movement of objects (i.e., slide and rotation).	---	---	[SLO: M-06-D-02] Reflect an object using grid paper and compass and find the line of reflection by	[SLO: M-07-D-03] Translate an object and give precise description of transformation	[SLO: M-08-D-01] Rotate an object and find the centre of rotation by

language (for instance: inside, outside, above, below, over, under, far, near, before, after, straight, backward, right and left).	quarter, half and three quarters turns using appropriate positional language (for instance: inside, outside, above, below, over, under, far, near, before, after, beside, between, left, right and in front of, quarter turn, half turn, three quarter turns, clockwise, anti- clockwise, behind etc). [SLO: M-02-D-06] Recognise turn as a rotation.				construction.		construction. [SLO: M-08-D-02] Enlarge a figure (with the given scale factor) and find the centre and scale factor of enlargement.
---	[SLO: M-02-D-07] Identify and differentiate between a straight and curved line. [SLO: M-02-D-08] Identify horizontal and vertical lines.	[SLO: M-03-D-04] Recognise point, line, ray and line segment; and draw and measure line segments.	[SLO: M-04-D-01] Recognise and identify parallel and non-parallel lines.	---	[SLO: M-06-D-03] Identify and differentiate between parallel lines, perpendicular lines and transversal.	[SLO: M-07-D-04] Know that the perpendicular distance from a point to a line is the shortest distance to the line.	---

---	---	[SLO: M-03-D-05] Identify the centre, radius and diameter of a circle.	[SLO: M-04-D-02] Describe the radius, diameter and circumference of a circle.	---	---	[SLO: M-07-D-05] Describe the properties of a circle; centre, radius, diameter, chord, arcs, major and minor arc, semi-circle and segment of a circle.	[SLO: M-08-D-03] Describe chord, arcs, major and minor arc, semi-circle, segment of a circle, sector, central angle, secant, tangent and concentric circles.
---	[SLO: M-02-D-09] Identify quarter turns.	[SLO: M-03-D-06] Recognise and Identify quarter turns and identify quarter turns as right angles (and vice versa). [SLO: M-03-D-07] Identify half and 3-quarter turns (clockwise and anti-clockwise) as two and three right angles respectively.	[SLO: M-04-D-03] Recognise and identify acute, right and obtuse angles. [SLO: M-04-D-04] Compare and order angles up to 180 degrees by size. [SLO: M-04-D-05] Measure and draw angles (using a protractor) within 180 degrees.	[SLO: M-05-D-03] Identify - angles at a point on a straight line and half a turn (180 degrees). - angles at a point and 1 whole turn (360 degrees). [SLO: M-05-D-04] Describe and calculate complementary and supplementary angles.	[SLO: M-06-D-04] Identify adjacent angles and find unknown angles related to parallel lines and transversals. (corresponding, alternate and vertically opposite angles)	[SLO: M-07-D-06] Calculate unknown angles in quadrilaterals using the properties of quadrilaterals. (square, rectangle, parallelogram, rhombus, trapezium and kite).	---
---	---	---	---	---	---	[SLO: M-07-	---

						D-07] Understand the relationship between interior and exterior angles of polygons and between opposite interior and exterior angles in a triangle. [SLO: M-07-D-08] Calculate the interior and exterior angles of a polygon and the sum of interior angles of a polygon.	
---	---	[SLO: M-03-D-08] Identify reflective symmetry in 2-D shapes.	[SLO: M-04-D-06] Recognise and draw lines of symmetry in 2-D shapes and complete symmetrical figures with respect to a given line of symmetry.	[SLO: M-05-D-05] Explore, identify and draw lines of symmetry in 2-D shapes and complete symmetrical figures with respect to a given line of symmetry.	[SLO: M-06-D-05] Recognise rotational symmetry, find the point of rotation and order of rotational symmetry.	[SLO: M-07-D-09] Recognise identity and draw lines of symmetry in 2-D shapes and rotate objects using rotational	---

						symmetry; and find the order of rotational symmetry.	
---	---	---	---	[SLO: M-05-D-06] Identify and describe different types of triangles; with respect to sides and angles. Calculate and measure unknown angles in a triangle.	---	[SLO: M-07-D-10] Calculate unknown angles in a triangle**.**	---
---	---	---	---	---	[SLO: M-06-D-06] Construct angles of specific measures (30, 45, 60, 75, 90, 105 and 120) and bisect angles using a compass. [SLO: M-06-D-07] Construct a perpendicular (from a point on the line and outside the line) and a	[SLO: M-07-D-11] Construct different types of triangles. (equilateral, isosceles, scalene, acute-angled, right-angled and obtuse-angled)	[SLO: M-08-D-04] Construct a triangle when: -three sides (SSS) -two sides and included angle (SAS) -two angles and included side - a right-angled triangle when hypotenuse and one side (HS)

					perpendicular bisector.		are given. [SLO: M-08-D-05] Construct different types of quadrilaterals (square, rectangle, parallelogram, trapezium, rhombus and kite). [SLO: M-08-D-06] Draw angle and line bisectors to divide angles and sides of triangles and quadrilaterals.
---	---	---	---	---	---	---	[SLO: M-08-D-07] Identify congruent and similar figures (in your

							surroundings), apply properties of two figures to be congruent or similar and apply postulates for congruence between triangles.

Domain E: Statistics and Probability

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
Benchmarks: Read and interpret data from pictographs, bar graphs, tally charts, block graphs and Carroll diagrams. Organise and represent data using pictographs, bar graphs, tally charts, block graphs and Carroll diagrams to answer questions. Describe the probability of an event.			**Benchmarks:** Read and interpret data from tables, pictographs, bar graphs, tally charts, block graphs, line graphs, pie charts and Carroll diagrams. Organise and represent data using tables, pictographs, bar graphs, tally charts, block graphs, line graphs, pie charts and Carroll diagrams to answer questions. Solve problems in context in relation to		**Benchmarks:** Students will be able to collect, classify and tabulate statistical data, interpret, construct and use statistical graphs, calculate and interpret measures of central tendency and solve problems using various concepts pertaining to Experimental and Theoretical Probability.		

	averages of quantities, measures and numbers. Describe the probability of an event; represent the probability of an event including real world problems.	
Student Learning Outcomes		

[SLO: M-01-E-01] Read and interpret data using pictographs, block graphs and tally charts. (including real-world problems)	[SLO: M-02-E-01] Read and interpret data using pictographs, bar graphs and tally charts and; represent data using tally charts. (including real-world problems)	[SLO: M-03-E-01] Represent data; read and interpret data using Carroll Diagrams. (including real-world problems)	[SLO: M-04-E-01] Draw, read and interpret horizontal and vertical single and double bar graphs. (including real-world problems)	[SLO: M-05-E-01] Draw, read and interpret bar and line graphs. Interpret pie charts. (including real-world problems)	[SLO: M-06-E-01] Draw, read and interpret horizontal and vertical multiple bar graphs and pie charts. (including real-world problems)	[SLO: M-07-E-01] -Recognise drawing and interpreting of bar graphs, line graphs and pie charts. -Differentiate between a histogram and a bar graph. -Construct and compare histograms for both discrete and continuous data with equal interval range. -Select and justify the most appropriate graph(s) for a given data set and draw simple conclusions based on the shape of the graph.	[SLO: M-08-E-01] Select and justify the most appropriate graph(s) for a given data set and draw simple conclusions based on the shape of the graph.

---	---	---	---	---	[SLO: M-06-E-02] Identify and organize different types of data (i.e., discrete, continuous, grouped and ungrouped).	[SLO: M-07-E-02] Recognise the difference between discrete, continuous, grouped and ungrouped data.	[SLO: M-08-E-02] Recognise the difference between discrete, continuous, grouped and ungrouped data.
---	---	---	---	[SLO: M-05-E-02] Find the average of given quantities, measures and numbers in a data. [SLO: M-05-E-03] Solve real world word problems related to averages involving quantities, measures and numbers.	[SLO: M-06-E-03] Calculate the mean, median and mode for ungrouped data and solve related real-world problems.	[SLO: M-07-E-03] Calculate the mean, median and mode for ungrouped data and the mean for grouped data and solve related real-world problems; Compare, choose and justify the appropriate measures of central tendency for a given set of data.	[SLO: M-08-E-03] Calculate range, variance and standard deviation for ungrouped data and solve related real-world problems.

---	---	---	---	---	---	[SLO: M-07-E-04] Construct frequency distribution tables for given data (i.e., frequency, lower class limit, upper class limit, class interval and mid-point) and solve related real-world problems.	[SLO: M-08-E-04] Construct frequency distribution tables, histograms (of equal widths) and frequency polygons and solve related real-world problems.
[SLO: M-01-E-02] Describe the likelihood that everyday events will occur, using mathematical language (i.e., impossible, less likely and more likely).	[SLO: M-02-E-02] Describe the likelihood that everyday events will occur, using mathematical language (i.e., impossible, less likely, more likely, unlikely and certain).	[SLO: M-03-E-02] Describe the likelihood that everyday events will occur, using mathematical language (i.e., impossible, possible, less likely, more likely, equally likely, unlikely and certain).	M-04-E-02] Describe the outcome of a simple probability experiment (spinner and dice), using mathematical language (i.e., impossible, less likely, more likely, equally likely, unlikely and certain).	[SLO: M-05-E-04] Explain experiments and outcomes; and represent the probability (using a fraction) that an event will occur, in simple games and probability experiments (including real-world word problems).	[SLO: M-06-E-04] Explain experiments, outcomes, sample space, events, equally likely events and probability of a single event. Differentiate the outcomes that are equally likely and not equally likely	[SLO: M-07-E-05] \Explain and compute the probability of; certain events, impossible events and complement of an event. (including real-world word problems).	[SLO: M-08-E-05] Explain and compute the probability of; mutually exclusive, independent, simple combined and equally likely events. (including real-world

					to occur. (including real-world word problems).		word problems). [SLO: M-08-E-06] Perform probability experiments (for example tossing a coin, rolling a die, spinning a spinner etc. for certain number of times) to estimate probability of a simple event [SLO: M-08-E-07] Compare experimental and theoretical probability in simple events.

ایک قوم
ایک نصاب
ONE NATION, ONE CURRICULUM

Single National Curriculum 2022

Curriculum Guidelines

ECE - 8

FOUR PARTS OF A CURRICULUM:

DRAFT

Mathematics - Class I
Suggested Guidelines

Domain: Number and Operations

STEP 1

Standard.: *Students will be able to count, read, write, compare, order, add, subtract, multiply and divide numbers. They will be able to recognize fractions as part of the whole, represent fractions, order and add and subtract fractions. They will be able to solve problems in contexts using appropriate number operations.*

Student Learning Outcomes:

Counting, place value, comparing, ordinal numbers, read and write numbers.

Students will be able to:

- *Count, read and write numbers 2-digit numbers up to 99;*
- *Recognize place value of 2-digit numbers;*
- *Compare and order 2-digit numbers using appropriate language;*
- *Identify numbers before, after and in between two numbers.*
- *Read and write numbers up to 99 (2-digit numbers)*

Addition and subtraction:

Students will be able to:

- *Find, recall and use addition and subtraction facts (number stories) to 20.*
- *Compare numbers to find how many more and how many less.*
- *Add and subtract numbers including:*
  - *3 single digit numbers*
  - *2 digit number with a single digit (without regrouping).*
  - *2 digit number and tens.*
  - *Two 2-digit numbers (without regrouping).*
- *Solve real-world word problems with addition and subtraction using concrete objects and pictorial representations (involving missing numbers, money, quantities and measures).*

Money:

Students will be able to:

- *Identify Pakistani coins (Rs. 1, 2, 5 and 10) and notes (Rs. 10, 20, 50, 100, 500, 1000 and 5000)*
- Solve problems involving addition and subtraction of Pakistani currency.

Multiplication and Division:

Students will be able to:

- *Count and write in 2's, 5s and 10s using concrete objects (such as counters, pebbles, popsicle sticks etc) and pictorial representations (such as number line, hundred square grid)*
- *Recognise counting in 2s, 5s and 10s as multiplication tables of two, five and ten.*
- *Recognize multiplication as repeated addition through concrete objects and pictorial representations (for instance, using groups and arrays)*
- *Recognize through concrete objects and pictorial representations that the multiplication of any two numbers can be done in any order.*
- *Recognize division as repeated subtraction using concrete objects and pictorial representation, (groups, arrays and sharing).*
- *Recognize, using concrete objects and pictorial representation ,that the division of one number by another number cannot be done in any order.*
- *Solve simple real world problems involving multiplication and division using any method, (for instance materials, repeated addition, groups and arrays, mental methods, and known multiplication tables).*

Fractions:

Students will be able to:

- Recognise, find, name and write fractions:
  - half ($\frac{1}{2}$)
  - quarter ($\frac{1}{4}$)
  - two-quarters ($\frac{2}{4}$)
  - three-quarters ($\frac{3}{4}$)

  of a length, shape, set of objects or quantity using pictorial representations.

Counting, place value, comparing, ordinal numbers, read and write numbers:

Knowledge:

Students will be able to:

- Count forward and backward from any given 2-digit number.
- Place value of 2-digit numbers (hundreds, tens, ones/units)
- Compare and order numbers using appropriate language.
- Recognize Ordinal numbers up to 10.
- Read and write numbers up to 99

Addition and Subtraction:

Knowledge:

Students will be able to do:

- Addition and subtraction of facts up to 20
- Addition and subtraction of:
  - 3 single digit numbers

Counting, place value, comparing, ordinal numbers, read and write numbers:

Skills:

Students will be able to:

- Count objects and numbers to and across 99 (2-digit numbers) forwards and backwards, beginning from zero or one, or from any given numbers (using objects such as counters, base ten material, pebbles and pictorial representations such as hundred square grid, number line etc).
- Recognize the place value of each digit in a 2-digit number (tens and ones/units).
- Compare and order numbers up to 99 using appropriate language (for instance: more and less, greater, smaller, equal to, same as, increasing, decreasing, smallest to largest and vice versa etc.)
- Identify numbers before, after and between the numbers.

- 2 digit number with a single digit number (without regrouping)
- 2 digit number with a tens
- Two 2-digit number without regrouping.

- Addition and subtraction of real life problems using concrete objects and pictorial representations (involving missing numbers, money, quantities and measures)

Advanced/Additional:

- *Addition and subtraction of:*
  - *3 single digit numbers*
  - *2 digit number with a single digit number (with or without regrouping)*
  - *2 digit number with a tens*
  - *Two 2-digit number (with or without regrouping).*

Money:

Students will be able to:

- Recognize Pakistani coins (Rs. 1, 2, 5 and 10) and notes (Rs. 10, 20, 50, 100, 500, 1000 and 5000)

Multiplication and Division:

Students will be able to:

- Know counting in 2s, 5s and 10s.
- Know multiplication tables of two, five and ten.
- Know multiplication as repeated addition.
- Know division as repeated subtraction.
- Know multiplication and division of real life problems using any method (for instance materials, repeated addition/subtraction, groups, arrays, sharing, mental methods, and known multiplication tables)

Fractions:

Students will be able to:

- Know fractions half ($\frac{1}{2}$), quarter ($\frac{1}{4}$), two-quarters ($\frac{2}{4}$), three-quarters ($\frac{3}{4}$) of a

- Recognize the position of objects and write it using ordinal numbers up to 10^{th}.
- Read numbers up to 99 in numerals and write numbers up to 10 in words

Advanced/Additional:

- *Compare and order numbers from zero up to 99 using <, >, and = signs.*
- *Read and write numbers up to 99 in numerals and in words (i.e. write numbers up to 99 in words)*

Addition and Subtraction:

Skills:

Students will be able to:

- Find, recall and use addition and subtraction facts to 20.
- Compare numbers to find how many more and how many less.
- Add and subtract:
  - Up to 3 single digit numbers (i.e. up to three 1-digit numbers)
  - 2 digit number with a single digit number (without regrouping)
  - 2 digit number with a tens
  - Two 2-digit number without regrouping.
- Solve real-world word problems with addition and subtraction using concrete objects and pictorial representations. (involving missing numbers, money, quantities and measures)

Advanced/Additional

- *Recognise and use the inverse relationship between addition and subtraction to check calculations.*
- *Recognise that the addition of two numbers can be done in any order (commutative) while subtraction of one number from another cannot.*
- *Add and subtract:*
  - *3 single digit numbers*
  - *2 digit number with a single digit number (with or without regrouping)*
  - *2 digit number with a tens*
  - *Two 2-digit number (with or without regrouping).*

Money:

Students will be able to:

length, shape, set of objects, or quantity using pictorial representations.	• Identify Pakistani coins (Rs. 1, 2, 5 and 10) and notes (Rs. 10, 20, 50, 100, 500, 1000 and 5000) • Solve problems involving addition and subtraction of Pakistani currency. *Advanced/Additional:* • *Identify international currency and its denominations such as dollar, pound, cents, pence (as per needs of the students)* • *Solve problems involving addition and subtraction of Pakistani currency and a few selected international currency.* **Multiplication and Division:** Students will be able to: • Count and write in 2's, 5s and 10s using concrete objects (such as counters, pebbles, popsicle sticks etc.) and pictorial representations (such as number line, hundred square grid) • Recognize counting in 2s, 5s and 10s as multiplication tables of two, five and ten. • Recognize multiplication as repeated addition using concrete objects and pictorial representations (for instance materials, groups and arrays) • Recognize through concrete objects and pictorial representations that the multiplication of any two numbers can be done in any order. • Recognize division as repeated subtraction using concrete objects and pictorial representation. (for instance groups, arrays and sharing) • Recognize using concrete objects and pictorial representation that the division of one number by another cannot be done in any order. • Solve simple real life problems involving multiplication and division using any method (for instance materials, repeated addition/subtraction, groups, arrays, sharing, mental methods, and known multiplication tables). **Fractions:** Students will be able to: • Recognize, find, name and write fractions: - half ($\frac{1}{2}$) - quarter ($\frac{1}{4}$)

	- two-quarters ($\frac{2}{4}$) - three-quarters ($\frac{3}{4}$) of a length, shape, set of objects or quantity, using pictorial representations.

STEP 2

Assessments

Formative Assessments

Some types of formative assessments the teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some forms of summative assessment are:

- End of Unit Test
- Class test
- Periodic/Monthly tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some sample questions that can be used as part of summative assessment are:

1. Choose the correct answers.

i. I have 2 tens. What number is it?

a) 2 b) 20 c) 12 d) 02

ii. How many tens are there in number 14?

a) 1 b) 10 c) 4 d) 14

iii. 28 is same as:

a) 0 tens 8 ones b) 2 tens 8 ones

c) 8 tens 2 ones d) 1 tens 0 ones

iv. 29 – 17 =

a) 12 b) 2 c) 22 d) 46

v. Which one of these numbers is greater than 5 but smaller than 9?

a) 6 b) 10 c) 4 d) 11

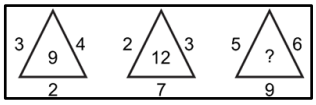
vi. Farah has 2 fewer buttons than Aira.

How many buttons does Farah have?

a) 7 b) 9 c) 11 d) 13

2. Answer these.

i. What is the missing number in the ∆?



ii. 2 tens + 18 = _____

iii. 6 + 8 + 9 = _____ tens _____ ones

iv. 4 tens – 7 = _____

v. 25 – 20 = _____ tens _____ ones

3. Fill each box with "+" or "-" to make the equations equal.

20		**4**	=	**10**		**6**

STEP 3

Learning Activities

Counting, place value, comparing, ordinal numbers, reading and writing numbers:

Students will be able to:

- *Count, read and write 2-digit numbers;*
- *Recognize place value of 2-digit numbers;*
- *Compare and order 2-digit numbers using appropriate language;*
- *Identify numbers before, after and in between two numbers.*
- *Read and write numbers up to 99 (2-digit numbers)*

NOTE: For suggested activities and teacher exposition on place value, please refer to class 2 suggested guidelines.

Activity 1:

Greater Than or Less Than

With your students, go around your class and count different objects. For example, you might want to count the number of chairs in the office and then count the number of chairs in another room.

1. Then have your students say and write a "number" sentence comparing the number. They may want to draw pictures and use the greater than, less than, or equal to words.
2. Then ask your students to find objects that are greater than, less than, or equal to a number. For example, you might ask your student to find a group of something that is equal to the number of chairs in the kitchen or the total number of chairs in their home.
3. This would allow your students to practice adding skills as well as practice inequalities.

Activity 2:
To the Letter

1. Connect maths and spelling together. Together with your students, collect a group of spelling words in a list.
2. Ask: *How many letters does each word have? Which words have more letters? Which words have fewer letters? Which words have the greatest or least number of letters? Which words have the same number of letters?*
3. Then have your student write "number" sentences using the words and the appropriate inequality symbol.

Activity 3:
Rocking Out

1. Have your students collect small rocks from their homes or around the schoolyard. Then have students bring in their rocks and count them.
2. Then divide the class into small groups and have them make inequalities using their collections.
3. Have them write their number sentences in words using numbers and symbols.
4. As an extension you can ask them to figure out how many more or less rocks they have than another member of their group.

Activity 4:
Class Hundred Chart

1. Using hundred pieces of scrap paper, index cards, sticky notes, or chalk, have your whole class create a large "hundred" chart on the floor.
2. Then have a few student volunteers pick a number and stand on it.
3. Each student should call their number out.
4. Then give different directions, such as "Find a number that is greater than the number you are standing on" or "Find a number that is 10 less than the number you are standing on."
5. Take turns, so every student gets to stand and move on different numbers.

Addition and Subtraction:
SLOs:

- *Find, recall and use addition and subtraction facts (number stories) to 20.*
- *Compare numbers to find how many more and how many less.*
- *Add and subtract numbers including:*
  - *3 single digit numbers*
  - *2 digit number with a single digit (without regrouping).*

- *2 digit number and tens.*
- *Two 2-digit numbers (without regrouping).*

- *Solve real-world word problems with addition and subtraction using concrete objects and pictorial representations (involving missing numbers, money, quantities and measures)*

Activity 5:
Addition and Subtraction fact families:
Resources required: Video Addition and Subtraction fact families from the link https://youtu.be/ujuCuY7MPAU; internet, index cards (with one addition and subtraction sentence written on it)

1. Preview the movie 'Addition and Subtraction Fact Families' to plan for any adaptations
2. Write out sets of addition/subtraction fact families on index cards with one number sentence per card so there are enough for the whole class. For example, 2 + 4 = 6; 4 + 2 = 6; 6 - 4 = 2; 6 - 2 = 4
3. Write the following two number sentences on the board: 2 + 4 = 6; 4 + 2 = 6. Ask students what they notice. They should notice that both sentences include the same numbers. They may also observe that the order of the two numbers being added doesn't matter,as either way the sum is 6.
4. Now write these two sentences on the board along with the first two: 6 - 4 = 2; 6 - 2 = 4. Again, ask students what they notice. They should observe that both sentences include the same numbers and that both begin with 6.
5. Finally ask them to look at all four sentences together. What do they notice? Help them recognize that all four statements include just the numbers 2, 4, and 6. Explain that these are a fact family.
6. Tell students that today they will learn about fact families and then play a game where they reunite facts from the same family. Play the BrainPOP Jr. video 'Addition and Subtraction Fact Families' for the whole class.
7. Pause as needed to reinforce student understanding of key concepts and vocabulary.
8. After the movie, distribute a fact family index card (see Preparation) to each student. Tell students that they need to find the rest of their family for a family reunion! Allow students time to walk around the classroom finding the other three facts that make up their family.
9. Finally, invite each family to review their facts and then present themselves to the rest of the class. If time allows, challenge them to put the numbers that make up their fact family on a fact family triangle.
10. Conclude the lesson by challenging students to the Easy or Hard Quiz to assess their understanding.

Activity 6:
Fact Family Home
Invite students to draw a picture of a four-story home with three windows in every story. Put two minus signs between the first two windows on the bottom floors, and a plus sign between the first two windows on the top floors. Then put an equal sign between the last two windows on all four floors. Let the students fill the windows with fact family equations. You can also fill in the fourth floor with 3 + 4 = 7 and have your students complete the other equations.

Activity 7:
Basic addition and subtraction using variety of pictorial strategies.
Resources:

- Video 'Basic Addition' from the link https://youtu.be/cJ_boPjzKtI
- Video 'Basic Subtraction' from the link https://youtu.be/yTYVVV1_nJw.

- Video ‘Doubles’ from the link https://youtu.be/PGa0yVoOLVM.

1. Play the video ‘Basic Adding’ to help students know how addition can be done, as well as the vocabulary for addition and subtractions procedures.
2. Demonstrate a few addition questions.
3. Give a few questions to make students practice basic addition using any method that they prefer.
4. Now play the video ‘Basic subtraction’ to help students know various strategies to subtract.
5. Demonstrate a few subtraction questions.
6. Give a few questions to make students practice basic subtraction using any method that they prefer.
7. Show the video ‘Doubles’ to build student understanding of this mental math strategy.

Activity 8:
Using variety of strategies to add single digit numbers through an online game
Resources:

- Online game ‘Addition blocks’ from the link https://www.brainpop.com/games/additionblocks/.
- Video ‘Doubles’ from the link https://youtu.be/PGa0yVoOLVM.

1. This lesson plan uses a free online game called Addition Blocks. The game is useful for providing practice with addition facts, but does not explicitly teach addition, so make sure students have already had some practice with mental math strategies prior to playing the game.
2. Before introducing the game to your students, preview it yourself by diving right into game play, or click on "How to Play" for directions. You can easily differentiate the game for students by instructing them to click "Options" and then select a specific speed and level of difficulty. The following is recommended: **1st - 3rd grade** Speed: Slow; Difficulty: Easy.
3. Show the video ‘Doubles’ as well as ‘Basic Adding’ to build student understanding as well as recap this mental math strategy before playing the game.
4. Project the online game ‘Addition Blocks’ for the class to see. Show students how to set the speed and difficulty level by clicking on "Options," and then demonstrate game play.
5. Model how to play the game. Use think-aloud strategies to show students how you use mental math during game play. You might want to have a few student volunteers play and share their thinking as well.
6. Provide 10-15 minutes for students to explore the game on their own or with a partner.
7. Lead students in a whole-class discussion about the mental math strategies they used during game play. Was it easier to combine two numbers or more than two numbers to create the target number? Why? Which combinations were the easiest to add, and which were the hardest?
8. Explain that students will now practice mental math strategies for addition by creating and playing a hands-on game with a partner. Pass out 25-50 blank index cards to each pair of students, or give students construction paper and have them create cards by folding and cutting the paper into equal sized squares. Instruct students to write one digit numbers on the cards. Younger students may want to write only digits from 1-9.
9. Encourage students to work with their partner to create an addition game using their cards. They can spread their cards in an array like in the Addition Block game, then take turns selecting a target number for their partner to make with cards. Or, they can create their own original concept for a game. Provide at least 10 minutes for students to plan and practice playing their games,
10. Allow students to revisit the Addition Blocks game as well as their original games throughout the school year to build fluency with addition facts. You might also want to pair up students with different partners

and allow them to teach one another their games. Encourage students to talk about their mental math strategies together.

Activity 9:
Using a variety of strategies to add and subtract 2 digit numbers.
Strategy 1: Base-Ten Blocks
Resources for teacher support:

- Video 'Adding Using base ten blocks' from the link https://youtu.be/aQMjLFlbsDA
- Video 'Subtracting using base-ten blocks' from the link https://youtu.be/hkQhlXQjGT0.

1. View the two videos 'Adding using base ten blocks and subtracting using base ten blocks' to know how to add and subtract 2-digit numbers with a single digit, a ten or another 2 –digit number.
2. If you are short of resources, you could always create rods by gluing ten beans/buttons on a popsicle stick to represent rods and using individual beans/buttons would represent ones. You could always use pictorial representations such as sticks to represent tens, while circles or dots to represent ones.
3. You may search for other videos on Youtube to know how to use base ten blocks to add and subtract either through concrete experience or through pictorial representations.
4. Using base ten blocks to add and subtract two digit numbers is a very concrete model for students to use. It's very easy for them to visually see the process of putting together the tens and ones plus the act of regrouping is a lot easier to visually see here as well.
5. One way to have the students use base ten blocks is to do two things. The first would be to actually use base ten blocks as they're adding and subtracting for every single problem.
6. The next option would be to draw sticks and circles to represent tens and ones, if your classroom is limited, on base ten block materials.
7. If you give students a whiteboard, it would be very easy for them to map out every single problem that they can add or subtract without using base ten blocks, but ideally, they would learn better on those manipulatives to visually see their problems being solved.

Strategy 2: Break-apart (partitioning or expanding) strategy
Resources for teacher's support:

- Video 'Simple tricks to help with partitioning and addition' from the link https://youtu.be/1Cf08KP92zo.
- Website Addition with partitioning from the link https://www.mathswithmum.com/addition-by-partitioning/. (Interactive demonstration, video, worksheets and a lesson)
- Video 'Addition and subtraction: Mental calculations' from the link https://youtu.be/-18qLbg1Gmk.

1. View the 2 videos given above to know about the partitioning method to add numbers. You may search other videos and websites to learn more about this easy method to add numbers.
2. Strategy number 2 is all about the break-apart method which also could be known as the expanded form method. The reason it is called break apart just because the students are actually taking apart the two digit and splitting it into tens and ones.
3. Students will be able to add the tens from each number and the ones from each number and make their math a little bit easier. It does get a bit difficult when students have to do some regrouping on their addition or subtraction problem, so that is definitely a big step that you have to teach when using this strategy. However, without regrouping, it is quite an easy method to use.

4. You may scaffold children's learning of this method by providing blanks to help students develop a further understanding of how to break apart/partition numbers.

Strategy 3: Give and Take away (or Rounding and Adjusting):
Resources for Teachers support:

- Adding and subtracting using rounding and adjusting from the website link - https://classroom.thenational.academy/lessons/adding-and-subtracting-using-the-round-and-adjust-strategy-chk64e. (It includes a video, questions and other support material to help understand this method)
- Video 'Addition and subtraction: Mental calculations' from the link https://youtu.be/-18qLbg1Gmk.

1. Use the teachers resources provided to know in detail about this strategy. You may search more to gain further information about this strategy. The second resource gives a lot of strategies to add and subtract numbers (including partitioning, number line, bridging, rounding and adjusting etc.)
2. The third 2-digit addition and strategy would be the give-and-take method. The process of this method is different between the addition and subtraction problems. So it is important that you give the students a lot of practice here.
3. In an addition problem, if you take two from one number, you have to add two to the other number.
4. However, in a subtraction problem, if you take two from one number, you have to take two from the second number as well.
5. This strategy does require a lot of practice because the students really have to focus on which strategy fits with addition or subtraction, however, once given practice, it is the easiest to use. One suggestion is to give them lots of hands-on practice.
6. It's also very important to teach the strategy of finding the number that is closest to a 10 to make their problem as easy as they can.

Strategy 4: Open number line
Resources for teachers support:

- Video 'Adding and subtracting – using a number line' from the link https://youtu.be/ucDucqYbffs.
- Video 'Addition and subtraction: Mental calculations' from the link https://youtu.be/-18qLbg1Gmk.

1. Use the resources provided for teachers support to know about addition and subtraction with an open number line. You may browse for more videos as there are many supportive resources available on net.
2. Open number lines are the fourth strategy for 2-digit addition and subtraction problems. An open number line is where students have make jumps in order to represent adding or subtracting tens and ones.
3. On a subtraction problem the students will begin on the biggest number. Then, they will jump back the number that they are supposed to subtract.
4. When a student makes these jumps, they will represent the tens with a bigger jump and the ones, with smaller jumps.
5. It is important that the students label each of these jumps at the bottom (or top) of the number line. This will help them see the act of taking 10/1 or adding 10/1.

Strategy 5: Simple Algorithms

1. This 2-digit addition subtraction strategy is the standard algorithm.

2. The standard algorithm is lining up the addition or subtraction problem vertically where the tens and ones are stacked on top of each other.
3. This can be done with or without regrouping.
4. It is suggested to break up your lessons into first teaching the standard algorithm without regrouping. And then once your student has mastered that, then you can start teaching standard algorithm with regrouping.

Multiplication and Division:

Students will be able to:

- *Count and write in 2's, 5s and 10s using concrete objects (such as counters, pebbles, popsicle sticks etc) and pictorial representations (such as number line, hundred square grid)*
- *Recognise counting in 2s, 5s and 10s as multiplication tables of two, five and ten.*
- *Recognize multiplication as repeated addition through concrete objects and pictorial representations (for instance using groups and arrays)*
- *Recognize through concrete objects and pictorial representations that the multiplication of any two numbers can be done in any order.*
- *Recognize division as repeated subtraction using concrete objects and pictorial representation. (groups, arrays and sharing)*
- *Recognize using concrete objects and pictorial representation that the division of one number by another number cannot be done in any order.*
- *Solve simple real life problems involving multiplication and division using any method (for instance materials, repeated addition, groups and arrays, mental methods, and known multiplication tables.*

Activity 10:

Variety of strategies to teach skip counting in 2s, 5s and 10s

1. Bead the thread: Use beads and a thread to teach students skip counting. Ask them to bead the thread according to selected skip counting. Ask them to count the beads in skip counting.
2. Use the website https://www.weareteachers.com/skip-counting/ to explore, choose and use from amongst 21 skip counting activities. Another great website is https://earlyimpactlearning.com/19-counting-by-2s-activities-easy-medium-and-hard/ which though gives ideas on skip counting by 2s; however many of them could be adopted for skip counting in 5s and 10s.
3. Once you have given them ample practice of skip counting in twos, fives and tens, introduce these skip counts as multiplication tables.
4. Again make them skip count with different activities, but this time round, ask them to read them as times tables and write them as multiplication statements (such as 2 x 3 = 6 read as 2 three times is six etc.)

Activity 10:

Teaching multiplication through groups and arrays (Introduction and explaining Arrays to children):

NOTE: Multiplication and division need to be taught through concrete and pictorial representations at this early age. Therefore arrays are the suggested strategy for teaching multiplication and division.
Children may use objects such as beans/buttons/ rocks/ marbles to develop arrays (while providing concrete experience) or draw dots/ flowers/circles etc. to represent arrays (while working through pictorial representations.

A brief introduction to arrays as well as how to introduce arrays and groups to students in order to multiply is provided below for teachers new to concept.

The activity steps provided below and the videos shared would serve two purposes. One is to provide guidelines on introducing and using (or drawing) arrays and the second to introduce repeated addition (with or without arrays) to multiply and find answers.

1. Arrays can help your children develop concepts of multiplication and division. An array is a set of objects organized into equal groups. For example, 6 objects can be arranged into several different arrays: 1 group of 6 objects, 6 groups with 1 object in each group, 3 groups with 2 objects in each group, or 2 groups with 3 objects in each group.
2. An arrays is a set that shows equal groups arranged in rows and columns. Arrays are all around us: A pack of socks might have 3 pairs, a carton of eggs might have 2 rows of 6 eggs, a tray of muffins might have 3 rows of 2 muffins, etc. Together with your students, think of objects that are grouped in sets.
3. Watch the following videos to understand what arrays are and how do you make arrays from groups: you may show it to your students (if resources are available)
   - Arrays from the link https://youtu.be/DdVj0qhvtiU
   - Multiplication using Arrays from the link https://youtu.be/z8lcZUWbqT0
4. Familiarize your students and yourself with arrays by organizing objects in different ways during your demonstration. Give lots of practice of arrays by demonstrating through different examples, for instance 5 x 3; 4 x 4; 1 x 5 etc.
5. Use both concrete and pictorial representations during your demonstration so that students have ample visual practice of arrays. Explain purpose of arrays using beans/buttons /rocks /counters (or through drawing dots/circles/flowers to represent arrays).
6. Give practice questions and resources to students to solve multiplication sums by developing arrays. If resources are not available, you may ask students to draw arrays to find answers to your given questions.
7. Remind your students that when they multiply, they put equal groups together to find the total. Like addition and subtraction, multiplication is an operation, a way to manipulate numbers.
8. We use the symbol *x* to show multiplication. In the number sentence 3 x 2, you must add the number 3 two times in order to find the product, or answer. This is called repeated addition. You can also add the number 2 three times in order to find the answer.
9. Explain that Arrays can help people count more easily. Explain to your children that instead of counting objects one by one, they can organize the objects into equal groups and count the groups.
10. At this point show them the videos given below or see them yourself (before the lesson) to make notes for yourself on how to explain arrays and how to use them for multiplication (including explaining multiplication as repeated addition):
    - Making Equal groups from the link https://youtu.be/Gh5psiNzayk
    - Arrays and repeated addition from the link https://youtu.be/IXQO5jo2utg
    - Array multiplication from the link https://youtu.be/lRgKavUxvKY
    - Multiplication with arrays from the link https://youtu.be/sIIiROTvPKY
11. Remind children that the order in which numbers are multiplied does not affect the outcome: 3 x 2 will yield the same answer as 2 x 3.
12. Draw or model different arrays and have children write multiplication number sentences that describe them.
13. Introducing your children to arrays at an early age will help build a solid foundation for multiplication and division. Arrays can help your children visualize and understand more complicated math operations.

NOTE: The same notion of arrays would be used to explain both multiplication and division. Use the same videos given above (making equal groups) as well as the ones provided below in activity 13 to build your understanding

about arrays and division. Remember multiplication and division are opposites of one another.Making groups of equal size and finding the product in an array would yield multiplication while finding the share for each person or group in an array would yield division.

Activity 11:
An Array of Arrays

1. Give bags of counters, beans, coins, or other small objects to small groups or partners.
2. Have them arrange the objects into equal groups and discuss different ways to organize the same number of objects.
3. Remind students that the groups should have equal numbers of objects. Have students draw their different arrangements and practice counting the groups.
4. Help students write multiplication or addition number sentences to go with each arrangement to calculate the total.

Activity 12:
Egg Carton Counting:

1. Have students work in small groups and give each group a half-dozen egg cartons.
2. Have one student put beans or counters in each section of the carton.
3. Remind the student to put in the same number of beans or counters in each section.
4. Then have the other students in the group count to find the total number.
5. Have students discuss different strategies to count, such as counting on, skip-counting, or making an addition or multiplication sentence.
6. Have students write down and compare their answers. Allow each student in the group an opportunity to fill the egg carton.

Activity 13:
Division through arrays:

Activity 12 does give information on how to connect division as you teach for multiplication. However for further guidance, a few videos and websites are shared. Both activities involve a good comprehensive demonstration by teachers followed by practice questions by students regarding multiplication and division.
Therefore the focus of these activities is to help teachers develop their demonstration and exposition as they explain multiplication and division through arrays and not through the traditional methods.

1. Watch the following videos to make notes for demonstrating, (once again) how arrays can be used to divide.
   - Division array strategy from the link https://youtu.be/EAd8fOTC8Dk
   - Arrays division from the link https://youtu.be/RXdb9X2d-_k.
2. Visit the following websites to develop your understanding regarding arrays and how multiplication and division are interrelated. It also gives in-depth understanding for the teacher to ensure that students are able to know and understand that multiplication and division are opposite of each other and developing arrays would help solve not only multiplication but division problems as well.
   - Teaching relationship between multiplication and division using arrays from the link https://www.hmhco.com/blog/teaching-relationship-between-multiplication-division-using-arrays#
   - Arrays, multiplication and division from the link https://nrich.maths.org/8773
   - dividing with arrays through the link https://www.ixl.com/math/lessons/dividing-with-arrays.

3. Once you have developed a good understanding, demonstrate for students through simple examples such 15 ÷ 3; 24 ÷ 4 etc. and explain as you develop arrays using beans/buttons/rocks/counters.
4. Give practice questions and resources to students to solve division sums by developing arrays. If resources are not available, you may ask students to draw arrays to find answers to your given questions.

Activity 14:
Online division quiz through arrays.

1. Ask students to access the website https://www.khanacademy.org/math/cc-third-grade-math/intro-to-division/imp-division-intro/e/division-with-arrays.
2. A quiz is provided with arrays developed. They are required to identify the division sum that represent each of the array.
3. Have students complete the online quiz. (NOTE: where internet cannot be provided, you may copy the questions and use these questions to hold a quiz in your class or give it as an individual work).
4. Let students compare their scores and explain to one another the errors that they made.

Activity 15:
Division through Making Equal groups
Teachers/students resources:

- Video 'Making Equal groups' from the link https://youtu.be/Gh5psiNzayk.

1. There are many approaches to teaching division, and we recommend employing different strategies and providing plenty of examples to help children visualize and understand division.
2. Making equal groups and exploring different ways to share helps children understand the basic principles behind dividing.
3. You may use arrays as given in the activity – division through arrays, to help children understand the relationship between multiplication and division.
4. Explain to your children that when groups are equal, they each have the same number of items.
5. Division can be a difficult for some children to grasp, so it is important to use tangible materials to model real-life division situations.
6. Present your child with 6 counters (pennies, beans, buttons, etc.) and pretend they are cookies. Using cookies or another treat is always a good way to get kids engaged. As soon as you tell them that they will be working with cookies, their investment in making sure there are "fair" groups will go up and their math skills will suddenly improve!
7. Then ask your child to split them into two fair groups. He or she can dole them out one by one or draw pictures or make a tally chart to divide the counters equally to figure out there will be 2 groups with 3 pennies each.
8. Continue practicing with different numbers of counters and dividing them into different numbers of equal groups.
9. Then present your child with a story problem to model, such as "There are 12 cookies that must be divided among 4 friends. How many cookies does each friend get?"
10. Provide your child with 12 counters and have him or her divide them into 4 equal groups.
11. Your students can create an array to help divide them into equal groups. An array is a set of items that show equal groups in rows and columns. Your students can make an array to show 4 rows of 3 counters each. This means that each friend, as represented by the rows, get 3 cookies each. Pose different division problems and have your child use arrays to solve them.

12. Provide another problem for your child that requires him or her to make and count groups. For example, you can pose the following problem: "Aliya collects stickers in a sticker album. She has 15 stickers, and 3 stickers can fit on each page. How many pages can he fill?"
13. To solve this problem, your students can model using counters, drawing pictures, or making tallies.
    - He or she can also use a number line and skip count. Have your student start at 0 and skip-count by 3's to get to 15. Then your student can count the number of times he or she skip-counted to find the answer.
    - Your student can also start at 15 and subtract 3 as many times needed to get to 0: 15 – 3 = 12, 12 – 3 = 9, 9 – 3 = 6, 6 – 3 = 3, 3 – 3 = 0. Then count the number of times he or she subtracted.

    Have your child practice solving problems using different strategies, and then discuss which strategies work best for which type of problem.
14. You can use arrays and a number triangle to help your child see the connection. For example, the equations 3 x 2 = 6 and 2 x 3 = 6 are related to 6 ÷ 2 = 3 and 6 ÷ 3 = 2. Fact families use the same numbers and different operations, so 3, 2, and 6 are in the same fact family.
15. Division can be a tricky subject for children, but children can grasp concepts more easily by working through different examples and employing different strategies and visualization techniques.
16. We encourage children to use counters and model problems to help them understand basic operations and how they are connected.

Fractions:

Students will be able to:

- Recognise, find, name and write fractions:
  - half ($\frac{1}{2}$)
  - quarter ($\frac{1}{4}$)
  - two-quarters ($\frac{2}{4}$)
  - three-quarters ($\frac{3}{4}$)

  of a length, shape, set of objects or quantity using pictorial representations.

Activity 16:

Introduction to Fractions:

Teachers Support Resource/Students resources:

- Video 'Basic Parts of a Whole' from the link https://youtu.be/6UJLduCBjno.
- Video 'More Fractions' from the link https://youtu.be/5Eoo2RnGgAM.

1. It is highly recommended to review the video's 'Basic Parts of a Whole' and 'More Fractions' before explaining fractions to students.
2. The two videos introduce fractions and explore unit fractions, including one-half, one-third, and one-fourth. This movie will go beyond unit fractions and further investigate fractions of sets. We encourage children to work with counters, small objects, or even food to help them experiment with different parts of a whole or set.
3. Show the two videos to students.
4. Review with children that a fraction is a number that shows part of a whole.

5. You may wish to introduce a simple fraction such as one-half. You can take a piece of paper and cut it in half to show that there are two equal parts. Remind children that since there are two equal parts, two goes in the denominator, or the bottom of the fraction. Then take one half away. What fraction of the whole paper is left? Point out that there is only one of two parts remaining, so one goes in the numerator, or the top of the fraction. Thus, one-half of the paper is left.
6. You may wish to continue this activity with other unit fractions, (including one-third if you wish), one-fourth, three-fourths, two-fourths.
7. Help children move beyond unit fractions. You can divide a piece of paper into eighths and color two sections blue. Ask children to identify the fraction of the paper that is blue. Help them count the total number of sections (eight) and put that number in the denominator. Then count the total number of blue sections (two) and put that number in the numerator. Thus, two-eighths of the paper is blue (which is one-fourth actually).
8. Repeat the activity by having students identify the fraction of the paper that is *not* blue. Six-eighths of the paper is not blue.
9. Repeat the activity again to explore other fractions, such as three-fourths, (five-sixths, and eight-tenths provided your students are ready and interested to explore further).
10. You may wish to have students work in pairs and trade off coloring in squares and writing fractions that name the colored and plain parts.
11. Help children understand how fractions can name a whole. Divide a piece of paper into fourths and color all the sections blue. What fraction of the paper is blue? Guide children to understand that there are four equal parts, so four is the denominator. How many parts are blue? Guide children to count the blue sections and put four in the numerator. So four-fourths of the paper is blue. That means the whole paper is blue. Help children understand that four-fourths, five-fifths, eight-eighths and so on, all represent a whole.
12. Explain to children that fractions can also name no parts! Take a piece of white paper and divide it into sixths. Since there are six equal parts, six goes in the denominator. How many parts are blue? Since none of the parts are blue, you put zero in the numerator. Repeat this activity to represent other fractions.
13. Explore fractions of sets together. Show a collection of fruit, such as three apples and two bananas. What fraction of the pieces of fruit are apples? Guide children to count all the fruit and put that number (five) in the denominator. Then have them count the number of apples and put that number (three) in the numerator. Thus, three-fifths of the fruit are apples.
14. Then show the same collection and ask what fraction of the fruit are oranges. Help them understand that zero out of the five fruit are oranges!
15. You may want children to work in pairs and use counters or objects to create a set. Then have them challenge each other to name fractions that describe their sets, being sure to write their fractions down.
16. Fractions can be challenging for some children, but hands-on exploration can help young learners understand and practice the concepts so they can become experts!

Activity 17:

Ready, Sets, Go:

1. Have each student prepare a set of small objects. They can group together different colors of crayons, blocks, counters, shapes, beads, beans, or other small items. Encourage them to be creative!
2. Then have students get in small groups and ask questions about each other's sets. What fraction of the set is red? What fraction of the set is not red? Have students write down their fractions and check each other's work.

3. Then challenge each small group to use their combined objects to show another fraction. For example, you might ask them to create a set that is two-fourths red, one quarter (one-fourth) blue; three quarters yellow etc. Have students work together to put together a set that illustrates the fraction.

Activity 18:
Pretend Pizza Party

1. Host a pretend pizza party in your classroom!
2. Give students different blank circles, squares, or rectangles that are divided into halves, one-fourths, two-fourths, three quarters (three-fourths).
3. Then ask students to draw different toppings or glue shapes or small objects to their pizzas. Encourage them to be creative.
4. They may want to use paper clips as toppings, or even use grass, leaves, or shells.
5. Then have pairs write fractions that describe their pizza. What fraction of the pizza has paper clips?
6. Have them write out their fractions on the back of their pizzas.
7. Ask volunteers to share their pizzas with the class, or place the pizzas in a center or independent work station as a self-checking fraction practice activity.

Activity 19:
Interactive Online Fraction games:

1. A good way to learn about fractions is through drawing or playing an interactive online games.
2. Following are a few recommended interactive online games. Allow children to access them to develop an in-depth understanding of fractions. (NOTE: You may play them in the class and have whole class participate in responding)
   - Math games from https://www.mathgames.com/fractions. The site has many interactive games on fractions per level. Choose the one's suiting your students' needs.
   - Splash Learn from https://www.splashlearn.com/fraction-games. The site requires you to register as a teacher and have access to many interactive games/per level/per topic for free. Choose the one's suiting your students' needs.
   - Maths Playground from https://www.mathplayground.com/index_fractions.html. Choose the one's suiting your students' needs.
   - Top marks from https://www.topmarks.co.uk/maths-games/7-11-years/fractions-and-decimals. The site is a very renowned website for interactive games, however you will have to choose wisely for your students.

References:

BrainPop (2021) Retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Elementary Nest (2021) Retrieved from: https://elementarynest.com/teaching-strategies-for-2-digit-addition-and-subtraction/

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Algebra

STEP 1	
Standard.: *Students will be able to explore patterns in a variety of ways*	
Student Learning Outcomes: *Students will be able to:* ● *Identify and extend the next shape in patterns with 2 or 3 orientations.* ● *Identify and extend patterns using 2-D and 3-D shapes.*	
Knowledge: Students will be able to understand: ● *Patterns using 2- D and 3-D shapes as well as through pictorial illustrations.*	**Skills:** Students will be able to… ● Identify and extend the next shape in patterns with 2 or 3 orientations. ● Identify and extend patterns using 2-D and 3-D shapes as well as through pictorial illustrations. *Advanced/Additional:* *Students will be able to:* ● Explore simple tessellations.

STEP 2

Assessments

Formative Assessments

Some types of formative assessments the teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

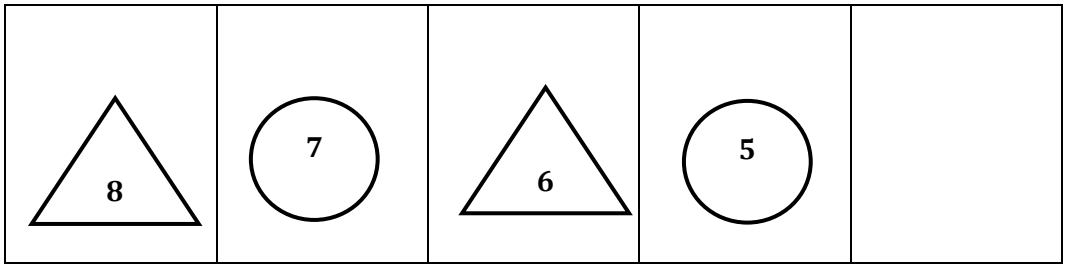
Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. Fill in the blanks.
   i. 8 + 6 = _____ + 9
   ii. 12 + _____ = 19
   iii. 11 – 5 = _____ + 3
   iv. _____ - 7 = 9 – 9
2. **Complete the pattern.**
   Draw the next shape and write the number in the shape.



STEP 3

Learning Activities

Students will be able to:

- *Identify and extend the next shape in patterns with 2 or 3 orientations.*
- *Identify and extend patterns using 2-D and 3-D shapes.*

Activity 1:

Patterns Introduction and exposition:

Teachers'/Students' resources:

- Video 'Patterns" from the link https://youtu.be/MBrdGGqUu1E.

There are many tasks provided within this activity 1. You may split it into number of lessons as per your need or follow the sequence and do all tasks of this activity (if you have sufficient time).

1. Patterns are great ways to introduce and develop algebraic thinking. Encourage your children to build patterns, and experiment in different ways by using shapes, colors, sounds, or movements.
2. Challenge your children to find patterns all around them, in their surroundings, in their clothes, or even in music. Help them to identify the unit that repeats in the pattern and predict what comes next.
3. **Review** with your children that a pattern is something that repeats over and over again. Patterns can use colors, shapes, sizes, sounds, and movements, as in dance routines.
4. Show different examples of patterns and encourage your children to find them on their own.
5. Show the video 'Pattern' to students to help explain patterns.
6. Then go through different patterns of movement, such as alternating jumping jacks with hopping once. You can also create sound patterns together by stomping, clapping, snapping, and tapping. If possible, play music for your children or bring in examples of music and have children identify the pattern.
7. **Encourage** your children to make their own patterns using two to four elements in a unit. They can use pattern blocks, different colored marbles or counters, or other small objects. They can also draw pictures or draw or paint stripes of different colors.
8. Instruct them to select two to four items or colors, and arrange them in a specific order. This is their unit of pattern. Then have them build the pattern by repeating the unit over and over again.
9. Have your children practice creating patterns using a variety of materials and challenge them to break the patterns into individual units.
10. Then, ask them to begin patterns for someone else to continue. Help your children to identify what type of pattern they have created: ABAB, ABC, ABB, or others.
11. **Present** a simple pattern to your children and have them figure out what comes next. Guide them to look for the individual unit first. Then follow the pattern with the unit in mind to figure out what comes next.
12. They may want to take notes, use words or sounds, or draw pictures to help them keep track of items in the pattern. For example, when using a sound pattern, such as clap, clap stomp, clap, clap, stomp, clap, clap, stomp, children can write down what happens in words, use abbreviations, or use colors or counters to represent each movement. Then help them read their symbols to figure out what comes next; a clap!
13. **Draw** or use shapes to create a pattern, but leave one shape out. Ask your children to find the missing shape. Guide them to find the unit and see where the missing shape falls in the sequence.
14. Invite children to create their own missing shape patterns and take turns guessing. This activity promotes algebraic thinking and problem solving skills.

15. Explain that patterns are everywhere. There are plenty of examples found in nature, such as stripes on a zebra or the arrangement of petals on a flower. Encourage your children to explore the world around them and see maths in unexpected places.

Activity 2:

1. Clap out a simple pattern and invite students to join in. Experiment with other basic patterns using clapping, foot stomping, and other movements. Invite children to describe and explain the patterns you created. Introduce the term pattern, which means "something that repeats over and over again."
2. Provide some experience with visual patterns. Read the pattern out loud together (e.g. "triangle, triangle, square") and help students decide what comes next.
3. Use the website https://www.topmarks.co.uk/Search.aspx?q=FINISH%20THE%20PATTERN to choose an interactive game for your students where they complete the patterns.
4. Allow children to explore patterns in small groups using manipulatives. They may want to make patterns with cars and trucks, different colored bears, etc. Other students may want to create patterns using art supplies.
5. Have volunteers share patterns they created. Encourage students to look for more patterns throughout the day.
6. You may want to line them up in a boy-girl pattern on the way to lunch and have them identify patterns in the school that they see on their walk.

Activity 3:

Clap and Tap

1. Clap and tap out a pattern for your students to follow, such as clap, clap, tap, clap, clap, tap, clap, clap, tap. Make sure you repeat the pattern at least three times to help students find the unit.
2. Stop the pattern and have students figure out what comes next, a clap or a tap. Then invite student volunteers to clap and tap their own patterns for other students to guess.

Activity 4:

AABB

1. Post a pattern for your students to follow, such as AABB, ABC, ABCD, etc.
2. Then have them use whatever items they wish to create the pattern. They may want to use beads, marbles, pattern blocks, connecting cubes, or draw pictures.
3. Have students check over each other's work. Then have student volunteers share their patterns with the class.

Activity 5:

Missing Link

1. Have small groups or pairs use pattern blocks or use small items to create a pattern.
2. Then have them remove one of the blocks or items to create a missing space.
3. Have other group members figure out the missing item.
4. Encourage your students to explore patterns that go beyond color or shape, such as texture and luster.

References:

BrainPop (2021) Retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Elementary Nest (2021) Retrieved from: https://elementarynest.com/teaching-strategies-for-2-digit-addition-and-subtraction/

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Measurement

STEP 1

Standard *1, 2, 3, etc.*: *Students will be able to measure, compare and order lengths mass, capacity and time using non-standard units and mathematical language. They will also be able to solve problems in context, involving lengths, mass/weight and capacity.*

Student Learning Outcomes: *Students will be able to:*

- *Measure, compare and order lengths, mass, capacity and time using non-standard units and mathematical language.*
- *Read and write time in hours (o'clock) from analogue clock and digital clock.*
- *Read and write temperature to the nearest appropriate unit i.e. (℃) using pictorial representations and relating temperature scale to number line.*
- *Show time in an hour on an analogue clock.*

- *Name days of the week and months of the Solar and Islamic year.*

Knowledge: Students will be able to understand: ● appropriate non-standard units that can be used to measure: - heights/ lengths of two or more objects in any direction. - mass of two or more objects. - capacity of two or more objects. ● mathematical vocabulary used to compare and order : - heights and lengths of two or more objects in any direction. - Mass/ weight of two or more objects - Capacity of two or more objects. ● the number of minutes in an hour and the number of hours in a day. ● Days of the week and months of both Solar and Islamic calendar year. *Advanced/Additional*: ● *appropriate standard unit and language to measure temperature (℃)*	**Skills:** Students will be able to: ● measure: - heights and lengths, using non-standard units (such as equal sized counters, blocks, popsicle sticks, etc.) - mass , using non-standard units (such as pebbles, blocks, counters etc.) - capacity ,using non-standard units (such as vessels, glasses, jars etc.) ● Compare and order heights and length of two or more objects in any direction by selecting and using appropriate mathematical vocabulary (such as, tall, taller, tallest; short, shorter, shortest; long, longer, longest; length, height) ● Compare and order mass/weight of two or more objects in any direction by selecting and using appropriate mathematical vocabulary (such as mass, weight, light, lighter, lightest, heavy, heavier, heaviest etc.) ● Compare and order capacity of two or more objects by selecting and using appropriate mathematical vocabulary (such as, filled, almost filled, more, less, equal to, full, half, empty, capacity, volume etc.) ● Read and write temperature to the nearest appropriate unit i.e. ℃) using pictorial representations and relating temperature scale to number line. ● Read and write time to the nearest hour using: - analogue clock and - digital clock. ● Draw the hands on a clock face to show time in an hour. ● Name days of the week and months of the: - Solar year - Islamic year ● Find a particular day and date from solar calendar and date from Islamic calendar. *Advanced/Additional:*

	● *Use appropriate mathematical vocabulary to compare temperature (such as hot, hottest, warm, warmer, cool, cooler, coolest, twice as, half as etc.)* ● *Read and write time to half past hour using:* - *analogue clock* - *digital clock.* ● *Draw the hands on a clock face to show half past time.*

STEP 2

Assessments

Formative Assessments

Some types of formative assessments the teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

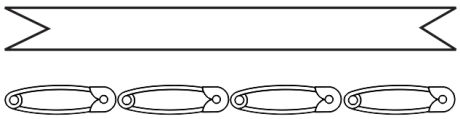
Some forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests.
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

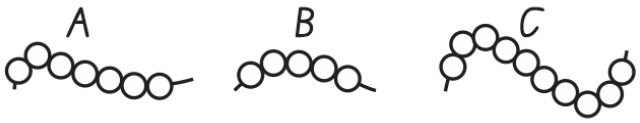
1. Draw a **longer** nail.

2. Measure the length of the ribbon.



The ribbon is about _____  long.

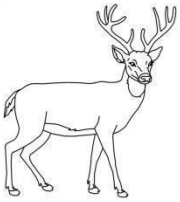
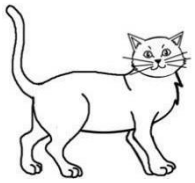
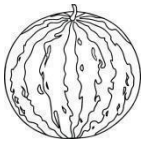
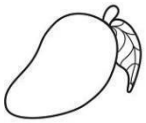
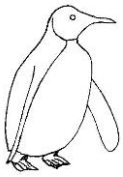
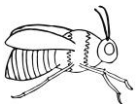
3. Arrange these beaded wires from the shortest to the longest.



_____ _____ _____

shortest longest

4. Arrange the objects from the lightest to the heaviest by using numbers 1, 2, 3.

a)	 _____	 _____	 _____
b)	 _____	 _____	 _____
c)	 _____	 _____	 _____

STEP 3

Learning Activities

Students will be able to:

- *Measure, compare and order lengths, mass, capacity and time using non-standard units and mathematical language.*

Resources:

Activity 1: Internet access/lap top to play the Video Non-standard measurement (if possible) from the link https://youtu.be/JCmqVAYujv4 ; non-standard units such as pencils, cubes etc.

Activity 1:

1. Before the activity, determine the distances you want students to measure, such as whiteboard/blackboard to window; window to door; teacher's desk to flag; etc. Write them on chart paper or on the whiteboard for all students to see.
2. Point to a large object, such as a window in the classroom, and ask students how they would measure the window. Allow time for them to answer. The most likely response would be," with standard measuring tools, such as a ruler". Ask the same about a small object, like a pencil.
3. Now ask how they would measure if they didn't have a ruler or other measuring tool. Some may come up with the idea of measuring with objects. If they don't, give an example, such as, measuring the window with sheets of paper. Ask if they could use sheets of paper to measure the pencil and why or why not. Then ask how they could measure the pencil without a ruler or tape measure.
4. Play the video – Non-standard Units. Explain that today they would join the characters, Moby and Annie, to discover how to measure length, width, and height without a ruler. Then play the movie, pausing at various points to reinforce student understanding of key concepts. NOTE: If the video cannot be played, then view the video on your own and use its contents to demonstrate how to measure using non-standard units.
5. After the movie (or demonstration), draw students' attention to the chart you created with different distances to measure (see Preparation). Ask students how they think they might be able to measure these distances without a ruler by using footsteps.
6. Challenge students to measure each of the distances on the chart in footsteps, and write their results in a notebook. Model how to measure by taking steps heel to toe with no spaces in between. Explain that it is important not to have any space between footsteps for accuracy in measurement. Before they begin measuring, have students practice stepping heel to toe with no spaces in between.
7. Ask students to predict whether all their measurements will be the same. Then, give them time to measure and record each distance.
8. After everyone has measured, bring the class together and ask students to share their results with each other. Ask these follow-up questions:
    a. Was your prediction correct? Why or why not?
    b. Why do you think your answers differ?
    c. Which requires more steps, larger or smaller feet? Explain.
    d. Why is it important to use the same-sized feet (or other object) when measuring?
9. Now share other non-standard units such as cubes, pencils, paper, buttons, counters etc. and ask them to measure their books, copies, even pencils, with them. (Determine smaller things that you want them to measure before this instruction).

10. **Note**: You could use this activity as another lesson on the same non-standard unit for length. Working in pairs, have one student select an object in the classroom to measure and have the other partner measure it using nonstandard units. Pairs should discuss the best nonstandard unit to use and record their measurements in their notebooks. Allow partners to take turns in selecting and measuring. As a class, discuss what each pair measured and the nonstandard unit they used to measure it. Which measurements were more difficult to make? Why?
11. **Note:** Use similar plan (step 1-10) to help student's measure liquids and weights/mass using non-standard units.
12. **Note:** Starting from here on, this could be a separate lesson or you may continue with this same lesson to help students compare and order objects using the mathematical vocabulary. Refer to objects they have measured and ask which was the longest and which was the shortest. Write the relevant mathematical vocabulary used for length on the board and ask students to order the things they have measured using the relevant vocabulary (given above).
13. **Note:** You may use similar discussion cues as mentioned in step 12 to make students compare and order capacity and mass using the relevant mathematical vocabulary.

Activity 2:
Measurement I Spy

1. Play an I Spy game with your students where they have to guess an object based on a clue about how you would measure it. For example, if the object is small, such as a cup, your clue might say that you can measure its height with paper clips. If the object is big, like a table, you might say that you can measure it with books.

Activity 3:
Which Way to Measure?

2. As you take a walk around the school, invite your students to think of nonstandard units they might use to measure the length, width, or height of what they see. For example, a building, a bicycle, or a bird, in the park. Which unit is most appropriate for each thing they see?
3. As an extension, ask children about standard units to measure length. Which would be best to measure, the bird or the bicycle?

Activity 4:
A Tale of Two Spoons

1. Instruct your students to put ten spoonfuls of water into a measuring cup.
2. Give your students a soup spoon or tablespoon to use. How much water is in the measuring cup? Record the answer.
3. Then give your students a serving spoon to use. How much water is in the measuring cup? Record the answer and compare it with the first measurement your students took.
4. Discuss with your students why using the same unit of measure consistently is essential when measuring something.

Student Learning Outcome:
Students will be able to:

- *Use relevant mathematical vocabulary to compare and order measures.*

Activity 5:

Long, longer, longest

1. Pass around baskets of ribbons of assorted lengths for children to choose and compare. Ensure they match up one end of the ribbons so that they are accurately comparing length. Invite them to share what they noticed and write any length words for children to see. Invite a child who describes his ribbon as long to come to the front and compare with other children until a longer ribbon is found.
2. Repeat to find an even longer one i.e. the longest. Find short, shorter and shortest ribbons in the same way.
3. Show how to measure length using cubes. Confirm that the cubes are all the same size, so that if something is 14 cubes long, you know it is longer than something 7 cubes long. Explain that you can use anything to measure with, but it is better if it is always the same size.

Activity 6:

Tall, taller, tallest

1. Explain that we can measure height in the same way. Use three objects of the same type, but different heights. Ask children to order the objects from tall to tallest. Measure the height of the shortest object using cubes. Ask them to estimate the heights of the taller and tallest objects.
2. Confirm with cubes. How close were their estimates?

Activity 7:

Short, shorter, shortest

1. Explain that you have seen many taller examples of the object you used to model tall, taller and tallest, so you are going to rename the tallest one 'short'. Ask what you can now say about the height of the other two objects. Re-order them to show short, shorter and shortest.

Activity 8:

Light and heavy

1. To ensure children do not think that big means heavy and light means small, prepare three identical boxes containing different amounts of rice or similar. Make sure the difference in mass is big enough for children to feel.
2. Start with two of the boxes. Invite children to pick them up and compare them by holding one in each hand. Show what happens when you use a set of balance scales to compare the two boxes.
3. Introduce the third box. Ask children to compare the masses of all three boxes and to order them from lightest to heaviest without using the scales. Move on to using the scales. Finally, find out how many identical interlocking cubes each box weighs. Start with the lightest so children can see that the next box needs more cubes to balance it and the third one, even more.

Activity 9:

Full and empty

1. Sand and water play is essential preparation for comparing the capacity of containers. Children do not attach any formal measurements to capacity,but just make direct comparisons.
2. Show children how to tip the contents from one container into another to compare. They need to see the excess spill over the edges to understand that there is not enough room for everything in the second

container. It holds less so it must be smaller. They also need to see the opposite, that if the second container has room for more, it must be bigger.

3. Once these ideas are secure, move on to finding out how many times children will need to tip the contents of a smaller container into a larger container until it is full. Use the vocabulary for capacity: full, empty, half full (even if not used exactly), more than and less than.

Student Learning outcome:

Students will be able to:

- *Read and write time in hours (o'clock) from analogue clock and digital clock.*

Activity 10:

- Video 'Time to the hour' from the link https://youtu.be/0TDtQMW4ZGo.
- Video 'Parts of a clock' from the link https://youtu.be/PJ7LBQo_t58.

1. Explain the notion of time to students. Tell them that time is how we divide the day into units. Learning to tell time will help them schedule their day and gain greater control of their surroundings.
2. Explain that although many clocks that they see are digital, learning to tell time from an analog clock is a necessary skill.
3. For a quick and fun review, show the video "Parts of a Clock". This video covers the basics of the clock—its parts, how the hands move, and how we use time to plan our day. You may wish to do some of the activities or assign the quizzes to ensure that your children have a firm grasp on the parts of a clock. They will then be ready to tell time to the hour.
4. Now show the video 'Time to the hour'.
5. Revise that on a clock, the hour hand, or short little hand, points to the hours while the minute hand, or the big long hand, points to the minutes.
6. Explain that when we say the time, we tell the hours first, followed by the minutes. For example, when the hour hand is on 10 and the minute hand is on 12, we say the time is ten o'clock.
7. Emphasise that the term "o'clock" means "of the clock" or "according to the clock." This phrase is used only with times that are exactly on the hour. Ten o'clock can be written in two other ways: 10 o'clock and 10:00. When we write the time using only numbers, we use a colon to separate the hours from the minutes. Furthermore, we always write the minutes to two places (10:00, 10:01, 10:02, and so on).
8. Explain that as time passes, the hands move. When the minute hand moves all the way around the clock, the hour hand moves from one number to the next. This is an hour.
9. Prompt your children to observe that the minute hand moves faster than the hour hand. Since there are twenty-four hours in a day, but only twelve numbers on a clock, the hour hand must go around the entire clock twice. This is why we have a six o'clock in the morning and a six o'clock in the evening.
10. Explain that twelve o'clock during the day, when the sun is high in the sky, is commonly known as *noon*. Twelve o'clock when the moon is high in the sky is known as *midnight* because it is the middle of the night.
11. The hands on a clock only move in one direction—toward the right, or clockwise. The opposite direction is called counterclockwise. Though the hands never move that way, the term is important to learn.
12. The best way to learn how to tell time is to practice. Use a demonstration clock or any analog clock and present different times on the hour for your child to read. This will help them prepare to learn time to the quarter-hour, half-hour, and minute in the future.

Activity 11:
On Schedule

1. Have your students keep an appointment book to schedule what they do at specific hours during the day. For example, a student may want to record the time he or she wakes up, eats lunch, and returns home from school.
2. Then make an analog clock by using paper plates, construction paper, crayons, and a brass brad to attach the hands.
3. Set this clock to remind the students about a specific activity. For example, you or a student can set the clock to 7:00 as a reminder that this is the time to wake up.
4. If possible, display different handmade clocks around the classroom and change them to suit you and your students' needs.

Activity 12:
Story Time:

1. Together with your students, make up stories that use time and have them note down the times .
2. They could draw pictures of an analog clock to show the time, or move the hour and minute hands of an analog clock to show the time. For example, you can tell a story about a rooster that cock-a-doodle-doos at six o'clock in the morning and then at twelve o'clock in the afternoon and then again at seven o'clock in the evening.
3. Your student can show the times and then make up stories of his or her own.

Activity 13:
Daytime, Night Time:

1. Have your child write about activities that he or she does during the day. What time does your child go to school? What time does your child have recess? What time does your child have lunch?
2. Then have your child note the times and think about what he does at the same time at night. For example, if your child goes to school at 8:00 in the morning, what does he do at 8:00 at night?
3. Have your child write a chart describing daytime and nighttime events. He or she can decorate the chart with illustrations.

Activity 14:

1. Ask children to watch the sand running through a one minute timer to get an idea of how long one minute is. Explain that the best way to get to know how long a minute is, is to do something in that minute, such as hopping or clapping. Do an activity while children count how many times you do it. Ask if they think you would do the activity more or less times if you did it faster. Repeat the same activity faster to show that you do more. Give children lots of opportunities to time themselves for a minute.
2. Explore the concept of slowness. Explain that when you do something slower, you take more time to do it so you can do less of it in a particular length of time. It takes more time to do the same thing when you do it slower.

Activity 15:
Earlier, later

1. Talk about how we use our senses to tell us that time is passing, e.g. we feel hungry because it is a long time since we last ate.
2. Explain that clocks and calendars help us to think about time passing. Show children an analogue clock and talk through what each hand does. Starting with both hands pointing to 12 o'clock, show how to move the minute hand all the way round the clock, so one hour has passed; the hour hand must now move on to the 1 to show 1 o'clock, an hour later. Explain that you are just showing how the clock hands work and that over an hour, the hands move so slowly that we don't notice them moving.
3. Once children are familiar with setting the clock to a particular hour, explore one hour later (one more hour) and one hour earlier (one less hour), being careful not to cross 12 o'clock at this stage.

References:
BrainPop (2021) retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Geometry:

STEP 2

Standard: *Students will be able to use properties to describe two dimensional and three dimensional shapes and describe positions, movement, directions and turns using appropriate vocabulary.*

Student Learning Outcomes: *Students will be able to:*

- *Recognize and identify 2-D shapes (rectangle, square, circle and triangle) and 3-D shapes (cube, cuboid, cone, cylinder and sphere) with respect to their characteristics (i.e. sides and corners for 2-D)*
- *Describe the position of an object including, moving in a straight line using positional language (for instance: inside, outside, above, below, over, under, far, near, before, after, right and left).*

Knowledge:
Students will be able to understand:

- 2- D shapes (rectangle, square, triangle, circle) and their properties.
- 3-D shapes (cube, cuboid, cone, cylinder, sphere).
- Position, direction and movement, using positional words.

Skills:
Students will be able to…

- Recognize and identify 2-D shapes (rectangle, square, circle and triangle).
- Describe the characteristics/properties of the 2-D shapes including the number of sides and corners.
- Recognise ad identify 3-D shapes ((cube, cuboid, cone, cylinder and sphere) with respect to their characteristics.

	● Identify 2-D shapes on the surfaces of 3-D shapes (e.g. a circle on a cylinder/base of a bottle; a rectangle on a tissue box etc.) ● Use mathematical vocabulary (positional words) to describe position, direction and movement, including movement in a straight line. (for instance inside, outside, above, below, over, under, far, near, before, after, right, left, straight, backward etc.) *Advanced/Additional:* ● *Describe the properties of 3-D shapes including the number of sides, corners and edges.*

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

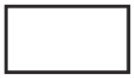
Some forms of summative assessment are:

- End of Unit test
- Class tests
- Periodic/Monthly tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

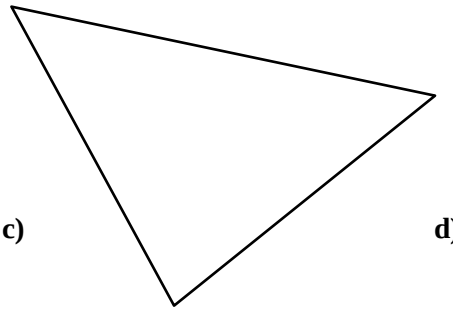
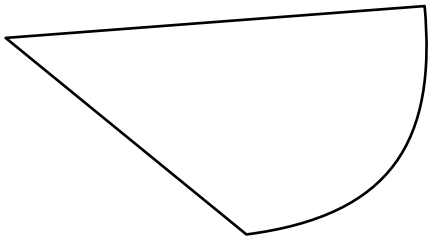
Some of the sample questions that can be used as part of summative assessment are:

1. **Choose the correct answers.**

i. Which shape has a **curved side?**

a)  **b)**  **c)**  **d)** 

ii. Which of the given shapes is not a triangle?

a)  **b)**  **c)**  **d)** 

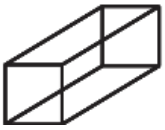
iii. The missing shape in the given pattern is:

a)  **b)**  **c)**  **d)** 

iv. I have 4 sides. All sides are equal. What am I?

a) circle **b)** square **c)** triangle **d)** rectangle

v. I am a solid. I have one curved and one flat face. What am I?

a)  **b)**  **c)**  **d)** 

2. Write the number of straight sides and corners in the graph given below.

Shape	Straight Sides	Corners

Square		
Circle		

STEP 3

Learning Activities:

Students will be able to:

- *Recognize and identify 2-D shapes (Rectangle, square, circle and triangle) with respect to their characteristics (number of sides and corners)*
- *Recognize and identify 3-D shapes (cube, cuboid, cone, cylinder and sphere) with respect to their characteristics (i.e. sides and corners for 2-D)*
- *Identify 2-D shapes on the surfaces of 3-D shapes (e.g. a circle on a cylinder/base of a bottle; a rectangle on a tissue box etc.)*

Activity 1:

Plane Shapes and Solid Shapes

Teachers /students resources:

- Video 'Plane Shapes' from the link https://youtu.be/sp_r5zC2g_E.
- Solid resources that have a circle, a rectangle, a square, a triangle and an oval as one of its face.
- Video 'Solid shapes' from the link https://youtu.be/KSPG24GMufo.

1. Show the video 'Plane shapes'.
2. After the video, draw the plane shapes on board and explain each one by one.
3. Explain that a circle is a round shape with no corners or sides. The distance from the center to any point on its line (circumference) is equal. A wheel, analog school clock, and coin are all usually circles.
4. An oval is shaped like an egg—an oblong circle.

5. A square is a shape with four corners and four sides. The length of each side is equal. A sandwich, window, and a tile can be squares.
6. A rectangle is a shape with four corners and four sides. Each pair of opposite sides has the same length. Most refrigerators, computer screens, and bookcases are rectangles.
7. A triangle is a shape with three corners and three sides. The sides do not have to be the same length, nor do all of the angles need to be the same. A slice of pizza, a sail in a sailboat, and a yield sign are all triangles.
8. Explain that shapes are everywhere—in the items we use every day and in the things we see all around us.
9. Encourage your children to look for shapes in their surroundings. How are shapes useful? When would using a square shape be more useful than using a round shape?
10. Show the video 'Solid shapes'.
11. Now show the objects that you have brought again. Build on their knowledge about solid figures, which are three-dimensional shapes such as cubes, rectangular prisms, pyramids, cylinders, cones, and spheres.
12. Make children identify basic plane shapes on the faces of these objects.
    Encourage your children to find basic solid shapes all around them.
13. Most children are familiar with cubes. Give examples that number cubes or dice, ice cubes, and some boxes are shaped like cubes.
14. Introduce fundamental concepts and vocabulary in Geometry, such as vertex/vertices, edges, faces, and bases as you display a cube and explain the characteristics of a cube.
15. Explain that a cube has six flat surfaces, or faces. Each face is shaped like a square with equal lengths of sides. A cube also has twelve edges and eight vertices.
16. Remind your children that a vertex is a corner of a shape. The plural form of the word *vertex* is *vertices*.
17. Present different examples of cubes to your children and help them identify the faces, edges, and vertices.
18. Pick up a cuboid (such as a rectangular tissue box) and explain that a cuboid is a solid figure that has the same number of faces, edges, and vertices as a cube. The faces of a cuboid are shaped like rectangles. Some cuboids have faces that are shaped like rectangles and squares.
19. Explain to your children that a cube is a special kind of a cuboid. Encourage your children to find examples of a cuboid and point out the different faces. Bulletin boards, cereal boxes, shoeboxes, and books are all cuboids.
20. Next pick up an object which is a cylinder. Explain that a cylinder is a solid shape that has two circular faces, no edges, and no vertices. A cylinder has a curved surface and is able to roll. Tuna cans, soup cans, poles, and pipes are all examples of cylinders.
21. You may wish to show how a cylinder can be created by rolling up a rectangle into a tube and attaching two circles to the ends. Conversely, you can take a toilet paper tube and cut it down lengthwise to show that it can turn into a rectangle.
22. Help your children understand that plane shapes can be manipulated to form solid shapes.
    Pick up an object which is a cone. A cone is a solid shape that has one curved surface, no edges, and one vertex. Traffic cones, funnels, and ice cream cones are all examples of cones. You may want to draw different examples of cones so students can see how they can vary in dimensions.
23. Lastly, show a sphere (such as a ball) and explain that a sphere is a solid figure familiar to all children. Balls, marbles, and oranges are all spheres. A sphere has no face, no edge, and no vertex. Spheres have a curved surface and are able to roll.
24. Studying shapes, both two-dimensional and three-dimensional, are fun ways for your children to explore the world around them. Ask: *How do we use cubes every day? What kind of shape do we drink out of?*

25. Encourage your children to find examples of solid shapes all around them and ask questions about how they use them. Would they rather play soccer using a ball or a box? Why?

Activity 2:
Sorting Shapes

1. Have students gather objects around the room that are circles, squares, rectangles, and triangles.
2. Have students identify each item and its shape.
3. Then have them sort the objects into different piles. Which shape is the most common? Which shape is the least common? Why?

Activity 3:
Mosaic Mural

1. Make a class mosaic. Have students cut out different shapes and color them.
2. The shapes can be of different sizes and orientations.
3. Then, tell the students to glue them together to make a large class mosaic.
4. Discuss different patterns students can make with the shapes.

Activity 4:
Scavenger Hunt

1. Have students go on a scavenger hunt for shapes in the school or classroom.
2. Divide the students into small groups and give each group a list of different-shaped items to find.
3. You can use clues to point them to the right item. For example, students can find something round that ticks or something rectangular like pages.
4. Groups can write where they found each item, or if possible, bring the item along.

Activity 5:
Getting into Shapes

1. Have your children put together different shapes to create a new shape. If you do not have building blocks at school, you can use household items such as cans, boxes, balls, and dice.
2. Have your students put different objects or shapes together and then discuss the new shape. What happens if you put two cubes together? What shape does it become?
3. Allow your students to stack and attach different shapes together to create a shape sculpture.

Activity 6
Organizing the Pantry

1. The kitchen or pantry is a great place to find different solid shapes.
2. Ask your students to collect different items and sort them by shape. This will enable them to see how the dimensions of cuboid, cylinders, and other solid shapes can be drastically different. For instance, a tuna can is a cylinder that is short and squat, but a glass can be a cylinder that's tall and skinny.
3. Encourage your student to describe how the shapes are alike and different.

Activity 7:
Cuboids and cubes

- Give children a cube and cuboid. Ask: *What is similar? What is different?* The cube looks the same; however, it is turned because every face is a square. Cuboids can be laid down or stood up on the longer

or shorter faces. Collect examples of cuboids, e.g. a box of biscuits, shoebox and examples of cubes e.g. a dice, sugar cube.

- Look with children at the drawings of 3-D shapes. Explain that it is difficult to show how the shapes take up space on paper. Demonstrate how they are drawn, using dotted lines for the unseen edges. Give children a cube or cuboid to hold and feel the faces and edges that they cannot see if they hold the shape without turning it.

Activity 8:
More 3-D shapes

- Give children a sphere, cone and a cylinder. Again, ask them what is similar and what is different about the shapes. They all have a curved surface. The sphere has only a single curved surface and looks the same however you turn it. Same is for the cone. Establish that the cylinder has two ends that are circles joined by a curved surface.
- Look with children at the drawings of 3-D shapes in the textbook. Demonstrate how they are drawn. Draw a cuboid with dotted lines for the unseen edges and ask children to explain why some lines are dotted.
- Many children have difficulty saying the word 'sphere'. Practice pronouncing it as a class and individually.

Activity 9:
2-D faces on 3-D shapes

1. Using the images in various Textbooks, explain that the flat faces on 3-D shapes are called 2-D shapes and that 2-D shapes have no depth.
2. Show children models of a selection of 2-D shapes.
3. Explain that representations of 2-D shapes necessarily have some thickness. Stress that they are models of 2-D shapes.

Activity 10:
2-D shapes

1. Show each 2-D shape model in turn, asking children to describe it in their own words. Introduce new vocabulary that may be needed.
2. Encourage children to hold each shape and run a finger along the outer edge, counting the sides and then the vertices. Name each shape and compare their properties. Examine similar shapes in various orientations. Ensure that children recognize that the properties do not change and therefore its name is the same.
3. Set up a group sorting activity, asking children to sort out models of 2-D shapes in various ways. Sort different colours and sizes of similar shapes by the shape name, before moving on to children's own ideas. Explain that the correct definitions and names of 2-D shapes are important, as they will be used throughout their school and everyday life.
4. Place a shape in a feely bag or envelope. Gradually reveal part of the shape, asking children what the shape could be. Ask how they decided their answer. Ensure that children focus on the properties of the shape rather than simply guessing its name.
5. Now ask them to draw 2-D shapes on a piece of paper.

*Students will be able to:***:**

- *Use mathematical vocabulary (positional words) to describe position, direction and movement, including movement in a straight line. (For instance inside, outside, above, below, over, under, far, near, before, after, right, left, straight, backward etc.)*

Activity 11:
Talking about position

1. Play games with children to secure the meaning of position words. In the playground, give instructions, e.g. *Move forwards five paces, turn left.* On the carpet, ask children to stand up, sit down, face the inside/outside of the circle. Sitting in class, invite them to put their hand behind their back, on top of their head, etc.
2. Most of these position words, e.g. top, middle and bottom, are quite easy words for children to learn and use. Create similar scenarios in the classroom and practice the words using real objects.
3. Determining left and right, as suggested in the misconception cartoon, is more challenging for children. Most children *write* with their *right* hand. Ask children to show you the hand they write with. Establish that is their *right* hand. Discuss with left-handed children that it is more unusual to write with the left hand and explain to them individually that they need to think to themselves that the hand they write with is not their right hand.
4. Show children that another way to find your left hand is to hold up both hands with the palms away from you and the thumbs at right angles. The forefinger and thumb of left hand makes an L shape, L for left. This is something that you can encourage them to use for checking.

Activity 12:
Moving objects:

1. In this section the moving words are left and right, up and down and forwards and backwards. These commands, along with turning, are the ones that children will use with programmable floor robots and other programmable toys, and can all be practised through play, e.g. games like 'Simon says'.
2. Ask children to write instructions to get from their classroom to somewhere else in the school, for instance, the Principal's room, library etc. Ask them to check the number of steps and use position and movement words to write the route.
3. The activity above could be extended by giving clues to a more complicated route. Clues could be given to work out the position of each object. For instance, ask them to use the clues to work out the order of the colored teddy bears:
   - The blue teddy is next to the orange teddy.
   - The yellow teddy is on the right of the blue teddy.
   - The middle teddy is blue.
   - The green teddy is the last teddy on the right.
   - The purple teddy is on the left of the orange teddy.

   Explain to the children that the best strategy would be to draw five blank teddy bears. Read all the clues and gradually add facts that are certain, e.g. the blue teddy is in the middle. In this way, complete the activity with children.

References:

BrainPop (2021) retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Statistics and Probability:

STEP 1

Standard.: *Students will be able to read and interpret data using a variety of data management techniques. They would also be able to explore probability to find likelihood of an event occurrence.*

Student Learning Outcomes: *Students will be able to:*

- *Read and interpret data using pictographs, block graphs and tally charts (including real-world problems).*
- *Describe the likelihood of an event occurring using mathematical language.*

Knowledge:
Students will be able to understand:

- Simple pictographs, block graphs and tally charts.
- Probability of the likelihood of an event occurring.

Skills:
Students will be able to:

- Read and interpret data using pictographs, block graphs and tally charts (including real-world problems).
- Describe the likelihood of occurrence of everyday events, using mathematical language (i.e. impossible, less likely and more likely).

Advanced/Additional:

- *Construct simple pictographs, blocks graphs, bar graphs and tally charts (including real-world problems).*

STEP 2

Assessments

Formative Assessments

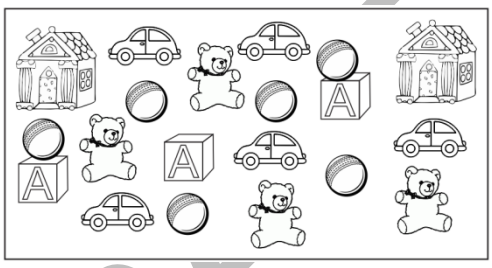
Some types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks

- Projects
- Selected responses (may include MCQs, true/ false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer.
- Periodic/Monthly tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. Look at the picture. Some toys are given in the box.



Count the toys in the box. Draw **circles** in the graph to show the counted number.

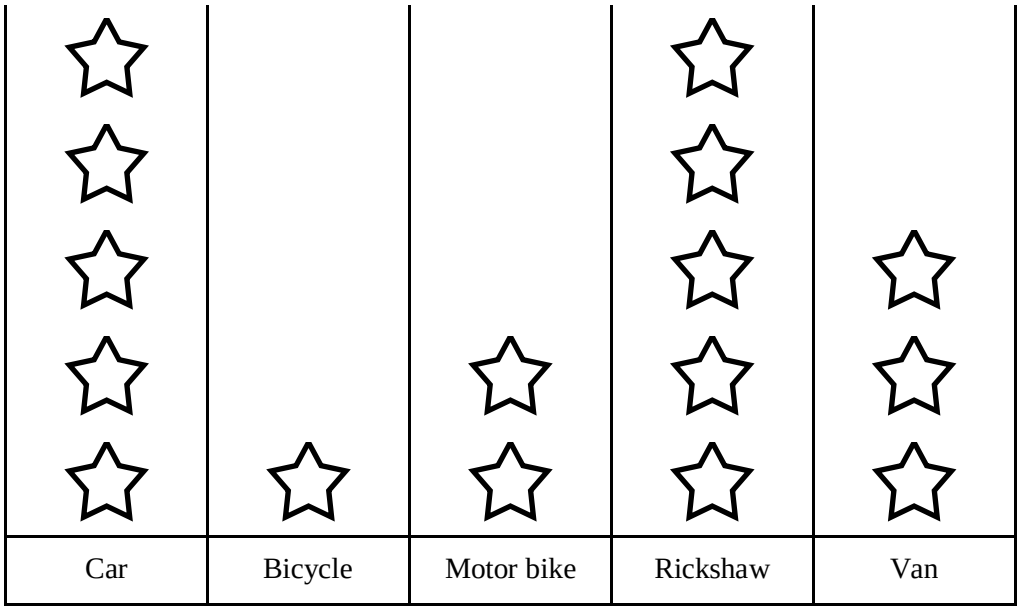
One circle (○) stands for 1 toy.

Toys				
Teddy bears	Balls	Doll houses	Blocks	Cars

2. The graph shows the vehicles that Simi saw on the road.

Each (☆) stands for 1 unit.

			☆	



i. How many **cars did** Simi see on the road? _____
ii. Which vehicle did Simi see the **most?** _____
iii. Which vehicle did Simi see the **least?** _____
iv. How many types of **vehicles** were there? _____

STEP 3

Learning Activities
Student Learning Outcome:
Students will be able to:

- *Read and interpret data using pictographs, block graphs and tally charts (including real-world problems).*

Activity 1:
Favorite Fruit (plan for either pictograph/bar graph or block graph)

1. Create a survey together about students' favorite fruit. Come up with a question together and have students take the survey.
2. Record their answers on the board using a tally chart. You may want students to come up to the board and record their choice on the tally chart themselves. Be sure to instruct them to mark every fifth tally mark across the other four.
3. Then use the data in the tally chart to create a pictograph. To challenge students, have each symbol in the graph stand for more than one vote, such as two or three.
4. Display the pictograph in the classroom. If possible, serve the fruit that gets the most votes.

Activity 2:
Data Miners

1. Have students bring in a pictograph, bar graph, or other graph to class. Children may want to clip graphs from magazines or newspapers, or find them online and print them out.
2. Then choose a few graphs to discuss and analyze together.

3. Challenge students to take the same information in the graph and display it using another kind of graph.

Activity 3:
Vote for a Sport (plan for either pictograph/bar graph or block graph)

1. Be active with your students! Create a survey about favorite sports, such as swimming, soccer, basketball, or baseball.
2. Then have your students do a survey of their friends about their favorite sport.
3. You may want to review how to record votes using a tally chart, and then create a pictograph to display the information.
4. Afterwards, gather the friends together to play the sport that got the most votes.

Activity 4:
Take a Walk (plan for either pictograph/bar graph or block graph)

1. Plan a hike or walk with your students. Before your trip, make predictions about what interesting things you might see and create a tally chart to organize the possibilities.
2. Bring the tally chart along on your walk and have your students record what they see.
3. Afterwards, analyze the data together. How many birds did you see? How many dogs? How many more squirrels did you see than people? What did you see the most, or the least?
4. Have your students turn the tally chart information into a pictograph and share it with the rest of the class.

Student Learning outcome:
Students will be able to:

- *Describe the likelihood of an event occurring using mathematical language.*

Activity 5:
Weather Forecast

1. Ask students to make a prediction about the weather. Together as a class, review different weather forecasts.
2. Use different forecasts from the internet, newspaper, radio, and news programs on television.
3. You may want to research the weather on the same date in previous years.
4. Then, test the students' predictions.
5. Have students measure the temperature every day and record their observations of the weather.
6. You can make a rain or snow gauge by placing a plastic ruler in a clear cup and leaving it in an open space.
7. Discuss how accurate the forecasts were.

Activity 6:
Toss a Coin

1. Remind your classroom that it is equally likely for a coin to land on head or tail.
2. Have small groups or pairs toss a coin one hundred times.
3. Have them make a tally chart to record their results.
4. After the tenth, fiftieth, and seventy-fifth tosses, have your students assess how the results have changed. Did their coin land on head or tail the same number of times? Why might tossing the coin over a thousand times get a more accurate result?

Activity 7:
Certain vs. Impossible

1. Discuss what is certain and impossible with your students.
2. Then make a list of goals that you and your students will be certain to accomplish. Goals might include reading every day, learning a new word each day, or learning a new skill.
3. Post the goals in your classroom and refer to them when needed.

Activity 8:
Spinning Spinner

1. Find a board game that uses a spinner.
2. Together with your students, make your own spinner for the game.
3. Model the same spinner after changing a few elements; such as, colors or sizes of the sections on the spinner. You can use a pin or a brad to fasten an arrow that spins.
4. Then play the game together using the new spinner. How did the game change? Was it fair or unfair? Why?

References:

BrainPop (2021) Retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Elementary Nest (2021) Retrieved from: https://elementarynest.com/teaching-strategies-for-2-digit-addition-and-subtraction/

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Growing Success- Assessment, Evaluation and Reporting in Ontario Schools (2013); and Assessment, Evaluation and Reporting Handbook (2013) retrieved from http://www.edu.gov.on.ca/eng/policyfunding/success.html

DRAFT

Mathematics - Class 2
Suggested Guidelines

Domain: Number and Operations

STEP 1
Standard.: *Students will be able to count, read, write, compare, order, round and make estimate to the nearest tens, add, subtract, multiply and divide numbers. They will be able to recognize fractions as part of the whole, represent fractions, order and add and subtract fractions. They will be able to solve problems in contexts using appropriate number operations.*
Student Learning Outcomes: **Counting, place value, compare and order, rounding numbers, ordinal numbers, roman numbers and reading and writing numbers.** *Students will be able to:* ● *Count, read and write 3-digit numbers up to 999.* ● *Recognize the place value of each digit in 3-digit numbers (hundreds, tens, ones/units).* ● *Compare and order numbers up to 999 using appropriate language and <, > and = signs.* ● *Round numbers to the nearest tens using concrete objects and pictorial representations.* ● *Recognize the position of objects and write it using ordinal numbers up to 20.* ● *Read and write Roman numbers up to 12.* ● *Read and write numbers up to 999 in numerals and up to 99 in words.* ***Addition and Subtraction:*** *Students will be able to:* ● *Find, recall and use addition and subtraction facts to 100.* ● *Add and subtract numbers mentally and in formal written form (with and without regrouping) including:* - *3-digit number and a 1-digit number.* - *3-digit number and tens.* - *3-digit number and a 2-digit number.* - *Two 3-digit numbers.* ● *Estimate the answer to an addition and subtraction question (using various approaches).* ● *Identify international currency and denominations (for instance, dollar).* ● *Solve real-world word problems with addition and subtraction (involving missing numbers, money, quantities and measures).*

Money:

Students will be able to:

- *Identify international currency and denominations (for instance, dollar).*
- *Solve money problems involving addition and subtraction of Pakistani money and a few selected international currency notes, (for instance, dollar).*

Multiplication and Division:

Students will be able to:

- *Recognize even and odd numbers.*
- *Count and write in 3s, 4s, 5s, 10s and 100s.*
- *Recognize counting in 3s, 4s as multiplication tables of three and four.*
- *Recognize multiplication as repeated addition and develop multiplication tables (times tables) for 2, 3, 4, 5 and 10.*
- *Write multiplication statements (i.e. sentences) using concrete and pictorial representations.*
- *Recognize using concrete and pictorial representations that the multiplication of any two numbers can be done in any order.*
- *Multiply mentally and in written form using the tables that they know:*
  - *1 digit number by another 1 digit number.*
  - *2-digit number by a 1-digit number using the multiplication grid.*
- *Multiply a number with 0 and 1.*
- *Recognize division as repeated subtraction through concrete and pictorial representation.*
- *Write division statements (i.e. sentences) using concrete and pictorial representations.*
- *Recognize using concrete and pictorial representation that the division of one number by another cannot be done in any order.*
- *Divide mentally and in written form:*
  - *1-digit number by another 1-digit number (without remainder).*
  - *2-digit number by a 1-digit number (without remainder).*
- *Solve real-world word problems involving multiplication and division using any method (for instance materials, repeated addition/subtraction, groups, arrays, mental and or written methods).*
- *Solve real-world word problems (including Pakistani currency) involving addition, subtraction, multiplication and division.*

Fractions:

Students will be able to:

- *Identify, name and write:*
  - *Unit fractions*
  - *Non-unit fractions*
  - *Like fractions*
  - *Unlike fractions*

  of a discrete set of objects using pictorial representations.

- *Compare and order unit fractions and like fractions (with denominators up to 10) using <, > and = sign.*
- *Add and subtract like fractions within one whole (e.g. $\frac{1}{4} + \frac{3}{4} = \frac{4}{4}$).*
- *Know and recognise that tenths arise by dividing an object into ten equal parts and in dividing single digit numbers and quantities by ten (using concrete and pictorial representations).*

Counting, place value, compare and order, rounding numbers, ordinal numbers, roman numbers and read and write numbers.
Knowledge:
Students will be able to:

- Know counting forward and backward from any given 3-digit number.
- Know place value of 3-digit numbers (hundreds, tens, ones/units).
- Compare numbers up to 999.
- Round numbers to the nearest tens.
- Know ordinal numbers from 1 to 20.
- Know Roman numbers up to 12.
- Read and write numbers to 999 in numerals and 99 in words.

Addition and Subtraction:
Students will be to:

- Know addition and subtraction facts up to 100.
- Addition and subtraction of numbers mentally and in formal written form (with and without regrouping) including:
  - 3-digit number and a 1-digit number.
  - 3-digit number and tens.
  - 3-digit number and a 2-digit number.
  - Two 3-digit numbers.
- Know estimation as an approach to find answers to a variety of situations.
- Addition and subtraction of real world problems (involving missing numbers, money, quantities and measures).

Money:
Students will be able to:

- Know international currency and its denominations (for instance, dollar).

Counting, place value, compare and order, rounding numbers, ordinal numbers and read and write numbers.
Skills:
Students will be able to:

- Count numbers up to and across 999 (3-digit numbers) forwards and backwards, beginning from zero or one, or from any given number using concrete objects (such as counters, pebbles, base ten material, popsicle sticks etc.) and pictorial representations (such as thousand square grid, number line etc.).
- Recognize the place value of each digit in 3-digit numbers (hundreds, tens, ones/units).
- Compare and order numbers up to 999 using appropriate language and <, > and = signs.
- Round numbers to the nearest tens using different concrete objects and pictorial representations.
- Recognize the position of objects and write it using ordinal numbers up to 20.
- Read and write Roman numbers up to 12.
- Read and write numbers up to 999 in numerals and in words.

Advanced/Additional:

- *Read and write Roman numbers up to 20.*

Addition and Subtraction:
Students will be able to:

- Find, recall and use addition and subtraction facts to 100.
- Reinforce addition and subtraction of:

- Know addition and subtraction of Pakistani and a few selected international currency (for instance, dollar).

Multiplication and Division:
Students will be able to:

- Know even and odd numbers.
- Know count in 3s, 4s and 100s.
- Know multiplication tables of three and four.
- Know multiplication as repeated addition.
- Write multiplication statements (i.e. sentences)
- Know multiplication of:
  - 1 digit number by another 1 digit number.
  - 2-digit number by a 1-digit number using the multiplication grid.
  - 0 and 1.
- Know division as repeated subtraction.
- Write division statements (i.e. sentences).
- Divide mentally and in written form:
  - 1-digit number by another 1-digit number (without remainder).
  - 2-digit number by a 1-digit number (without remainder).
- Know multiplication and division of real-world word problems.
- Know which operation to use to find answer to a given real world problem (addition, subtraction, multiplication or division).

Fractions:
Students will be able to:

- Know:
  - Unit fractions
  - Non-unit fractions
  - Like fractions
  - Unlike fractions
  - 2 digit number and a 1 – digit number.
  - Two 2-digit numbers.
- Add and subtract numbers mentally and in formal written form (with and without regrouping) including:
  - 3-digit number and a 1-digit number.
  - 3-digit number and tens.
  - 3-digit number and a 2-digit number.
  - Two 3-digit numbers.
- Estimate the answer to an addition and subtraction question. (using various approaches)
- Solve real-world word problems with addition and subtraction (involving missing numbers, money, quantities and measures).

Advanced/Additional:

- *Recognize and use the inverse relationship between addition and subtraction to check calculations.*
- *Recognize that the addition of two numbers can be done in any order (commutative) while subtraction of one number from another cannot.*

Money:
Students will be able to:

- Identify international currency and denominations (for instance, dollar).
- Solve money problems involving addition and subtraction of Pakistani money and a few selected international currency notes, (for instance, dollar).

Advanced/Additional:

- *Solve money problems involving addition and subtraction of Pakistani money and a few selected international currency notes. (for instance dollar, pound, riyal, dirham etc. as per the need/interest of the students).*

of a discrete set of objects using pictorial representations. ● Compare and order unit fractions and like fractions (with denominators up to 10) using <, > and = sign. ● Know addition and subtraction of like fractions within one whole *(e.g.* $\frac{1}{4} + \frac{3}{4} = \frac{4}{4}$ *)*. ● Know tenths of an object, single digit numbers and quantities.	**Multiplication and Division:** Students will be able to: ● Recognize even and odd numbers. ● Count and write in 3s, 4s, 5s, 10s and 100s. ● Recognize counting in 3s, 4s as multiplication tables of three and four. ● Recognize multiplication as repeated addition and develop multiplication tables (times tables) for 2, 3, 4, 5 and 10. ● Write multiplication statements (i.e. sentences) using concrete and pictorial representations. ● Recognize using concrete and pictorial representations that the multiplication of any two numbers can be done in any order. ● Multiply mentally and in written form using the tables that they know: - 1 digit number by another 1 digit number. - 2-digit number by a 1-digit number using the multiplication grid. ● Multiply a number with 0 and 1. ● Recognize division as repeated subtraction through concrete and pictorial representation. ● Write division statements (i.e. sentences) using concrete and pictorial representations. ● Recognize using concrete and pictorial representation that the division of one number by another cannot be done in any order. ● Divide mentally and in written form: - 1-digit number by another 1-digit number (without remainder). - 2-digit number by a 1-digit number (without remainder). ● Solve real-world word problems involving multiplication and division using any method (for instance materials,

repeated addition/subtraction, groups, arrays, mental and or written methods).

- Solve real-world word problems (including Pakistani currency) involving addition, subtraction, multiplication and division.

Advanced/Additional:
Students will be able to

- *Multiply mentally and in written form using the tables that they know:*
  - *1 digit number by another 1 digit number.*
  - *2-digit number by a 1-digit number with or without the multiplication grid.*

Fractions:
Students will be able to:

- Identify, name and write:
  - Unit fractions
  - Non-unit fractions
  - Like fractions
  - Unlike fractions

  of a discrete set of objects using pictorial representations.
- Compare and order unit fractions and like fractions (with denominators up to 10) using <, > and = sign.
- Add and subtract like fractions within one whole (e.g. ¼ + ¾ = 4/4).
- Know and recognize that tenths arise by dividing an object into ten equal parts and in dividing single digit numbers and quantities by ten (using concrete and pictorial representations).

Advanced/Additional:
Students will be able to:

- *Identify, name and write:*
  - *Unit fractions*
  - *Non-unit fractions*
  - *Like fractions*
  - *Unlike fractions*

	- *Equivalent fractions.* *of a discrete set of objects using pictorial representations.*

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.).
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. Encircle the correct answers.
   - **i.** Which is **not** equal to 3+3+3+3?
     a) 6×2 **b)** 4×3 **c)** 3×4 **d)** 5×3
   - **ii.** Which is the **same** as 4 groups of 5?
     a) 4+5 **b)** 4×5 **c)** 4+4+4+4 **d)** 5+5+5+5+5

iii. Which has the **same** answer as 9×2?

a) 6×3 **b)** 2×5 **c)** 3×3 **d)** 4×5

iv. ☐× ☐= 100

What number does ☐stand for?

a) 5 **b)** 10 **c)** 20 **d)** 50

v. 2×5 = _____ ten

a) 1 **b)** 10 **c)** 7 **d)** 5

vi. Which of the following is **not** correct?

a) 1×2 = 1+2

b) 2×10 = 10+10

c) 3×5 = 3+3+3+3+3

d) 4 groups of 2 = 2 groups of 4

2. Read the given clues and find the numbers. Then write the numbers in words.

i. The number is a 3-digit number.
It is the biggest 3-digit number.
What is the number?
Number: _____
Words: _____

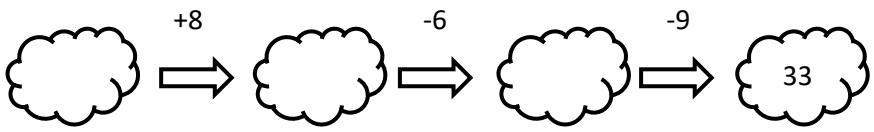
ii. The number is between 450 and 460.
The sum of its all digits is 15.
Number: _____
Words: _____

3. Fill in the missing numbers.

	2	
-	1	2
	1	5

	8	1
-	6	
	1	6

4. Find the missing numbers.



STEP 3

Learning Activities

Students will be able to:

1. *Count, read and write 3-digit numbers up to 999.*
2. *Recognize the place value of each digit in 3-digit numbers (hundreds, tens, ones/units).*
3. *Compare and order numbers up to 999 using appropriate language and <, > and = signs.*
4. *Round numbers to the nearest tens using concrete objects and pictorial representations.*

5. *Recognize the position of objects and write it using ordinal numbers up to 20.*
6. *Read and write Roman numbers up to 12.*
7. *Read and write numbers up to 999 in numerals and up to 99 in words.*

Activity 1:
Place Value:
Teachers /students resource:

- Video 'Place value' from the link https://youtu.be/np-0GyOqHRc.

1. View the video to make notes for yourself regarding the topic. You may also use it to show your students during the lesson.
2. Help your students understand the relationship between numbers and place value. Explain that place value is the value of a digit depending on its position in the number, such as ones, tens, hundreds, and thousands places.
3. Remind your students that a number is made up of digits or numerals. For example, the number 3 has one digit, while the number 987 has three digits, 9, 8, and 7.
4. Discuss numbers with your students. What is the biggest number they can find in the room? What is the biggest number they can think of?
5. Help students understand that numbers can be infinitely big or small. Each digit in a number stands for a group, called a place value. Our system of number or writing numbers is called a base-ten system because it is based on groupings of 10.
6. Show the numbers 1 through 9 to your students and name them out loud. You may also want to count different groups of items up to 9 and write the number on the board. We recommend demonstrating with base-ten blocks or connecting cubes. Numbers with one digit have only one place value, the ones place.
7. Remind your students that when you combine 10 ones, you get a group of ten. Write the number 10 on the board. The digit 1 shows that there is 1 one group of ten and 0 ones.
8. Then show a two-digit number such as 36. The digit farthest to the right is the ones place. That number tells you how many ones are in the number. The digit to its left is the tens place. It tells you how many tens are in the number.
9. Any number can be broken down by its place value. For example, 32 can been broken down into 32 ones or 3 groups of ten and 2 ones. Number 56 can be shown with 56 ones or 5 tens and 3 ones.
10. Use base-ten blocks or connecting cubes to show that 56 can be shown with 56 ones or with 5 groups of ten and 6 ones.
11. We recommend giving your students plenty of manipulatives to explore and represent a variety of numbers. For instance, begin with representing/showing a two digit number, another way, other than connecting cubes and easier to obtain is the counters/buttons etc.). You can give them 2 coloured counters such as red and green. Explain that red counters represent tens while green represent ones.
12. Show them how these counters would represent the number 32. I.e. you will pick 3 red counters and 2 green counters to represent the number 32.

13. Now hand over coloured counters to students and call out different 2 digit numbers and ask them to use counters to represent the numbers you call out.
14. When you are sure your students thoroughly understand tens and ones, explain that when you combine 100 ones, you get a group of one hundred. When you combine 10 tens, you get a group of one hundred.
15. You can demonstrate different groupings using connecting cubes or base-ten blocks. The third digit from the right shows how many hundreds are in the number. So the number 954 has 9 hundreds, 5 tens, and 4 ones. The number 520 has 5 hundreds, 2 tens, and no ones.
16. You may want to explore using the blocks and writing out the numbers in expanded form: 954 = 900 + 50 +4 and 520 = 500 + 20 + 0.
17. Remind your students that when they read a three-digit number, they must read the first digit, then say "hundred," and then say the rest of the number, as in nine hundred fifty-four and five hundred twenty.
18. Reading numbers with zeros or ones in the middle can be challenging for some students because they must remember to hold the place of the digit without saying its exact name.
19. Demonstrate how to read numbers like three hundred eight, four thousand twenty one, six hundred twelve, or five thousand four hundred nineteen. It's helpful to remind students to read the final two numerals together as a simple two-digit number.
20. Expose your students to a wide variety of numbers in different contexts, such as in books or on flyers and signs.
21. Have them read different numbers out loud and explore how they can be divided into their place values.
22. We recommend using number lines, connecting cubes, base-ten blocks, place value charts, and hundred charts to help students visualize numbers in different ways.

Activity 2:
Place Value Bingo

1. Make bingo cards using different numbers. You may want students to make their own bingo cards using one-, two-, or three-digit numbers and then have them swap cards with other students.
2. Then call out different numbers or clues such as "any number with 3 in the ones place" or "any number with no tens."
3. The first person to get bingo can call out numbers in the next round.
4. Repeat this with several numbers until a student runs out of his/her index cards.

Activity 3:
Bean Bag Number Toss

1. Take 10 separate pieces of paper and label them each from 0 to 9.
2. Then give a student one, two, or three bean bags to throw at different numbers to create a number. For example, if a student throws bags on a 2 and a 3, he or she forms the number 23.
3. Write the number on the board and have students say the number out loud and model the number using manipulatives.
4. Have students take turns throwing the bean bags.

Activity 4:
Number Clues

1. Model a number story for your students, such as "There are 7 tens, 1 one, and 9 hundreds."
2. Then have students write their answers.
3. Divide the students into small groups and have them write or tell each other their own number stories.
4. You may want them to use place value charts to help them solve problems.

Activity 5:
Roll to 100

1. Students work in pairs to play this collaborative game.
2. They take turns rolling one or two dice and then showing the total of their roll with interlocking cubes or base-ten blocks.
3. They keep rolling and amassing more cubes or blocks and when they have a group of 10 ones, they can swap it for a rod of 10.
4. They can keep track of how many cubes they have by lining them up on or next to a hundred charts. When they have collected 100 cubes, they can play again.

Activity 6:
Empty Number Line:

1. The activity focuses on identifying numbers, their place value and comparing numbers.
2. Draw the number line on the board.

3. Ask: *Where would you draw the number 70?*
4. Get the student to put a mark on the number line.
5. Ask: *Why did you put it there?*
6. Repeat with other volunteers.
7. Repeat the discussion with other numbers.
8. Now follow the same sequence of steps by drawing a number line for a 3-digit number. For instance, you may take an empty number line from 154 to 786 etc.

Activity 7:
Greater than and smaller than >, <, and =
Teacher's/Students resource:

- Video 'Comparing Numbers' from the link https://youtu.be/UF4QlDAJJPQ

1. Teachers may view the video to develop their notes for explaining >, < and + signs or they may show it to their students during the lesson.
2. When your students practice comparing numbers, they develop number sense and build number relationships.
3. We recommend using plenty of counters, base-ten blocks, number lines, hundred charts, and place value charts to help them understand how numbers are ordered.

4. In Maths, an inequality is a statement about the relative size or order of two objects, numbers, or values.
5. Introduce your students to the three basic symbols used in inequalities: greater than (>), less than (<), and equal to (=).
6. Show your class two small groups of cubes, pennies, or other small objects and ask them which group has the greater number. Explain that in Maths the word "greater" usually means "more".
7. Draw or show a number line from 0 to 10 to your students and pick a number, such as 4. Ask them to pick a number on the number line that is greater than 4.
8. Students should pick 5, 6, 7, 8, 9, or 10. Explain that since these numbers come after 4 on a number line, they are larger or greater.
9. Have students practice writing or saying a statement using the term "greater than." For example, a student might say that "5 is greater than 4."
10. Try the activity again using a hundred chart and broadening the range of numbers they can choose.
11. Review with your students that > is greater than sign. Have them rewrite their sentences using the symbol, as in "5 > 4". The wider part of the symbol faces the bigger number.
12. Repeat these same activities, starting with the number line, to introduce the symbol for "less than". Show your students that the corner, or point, of the symbol faces the smaller number.
13. Many students become confused with the direction the greater than and less than signs should face. It is helpful for many students to imagine that the symbol is the mouth of a hungry alligator or duck. It always wants to eat a bigger number!
14. Have students practice writing different inequalities using the symbols. Point out how if you reverse the positions of a number in an inequality, the sign reverses direction too, as in $3 < 4$ and $4 > 3$.
15. Together, create a number sentence, such as $2 + 3 = 5$. Point out the equal sign and remind them that the equal sign means that the values on either side are equal, or the same.
16. You may want to use counters to demonstrate that a group of 2 and a group of 3 have the same number of counters in all as a group of 5, and show the corresponding number sentence on a chart.
17. Both sides of the equal sign are the same value. Pick a number on a number line or hundred chart and ask them what number is equal.
18. Explain that when you compare larger numbers that are two or three digits long, they should look at the highest place value. So 138 is greater than 41 because 138 has one hundred while 41 has no hundred.
19. If numbers have the same number of places, students should compare the highest and then go down by place to compare the numbers. So, while 245 and 238 both have two hundreds, 245 has four tens while 238 only has three tens. Therefore, 245 is greater than 238.
20. Remind them to look carefully and make sure they compare the same place values in each number. For example, just because 245 has more tens than 327, doesn't mean that it is a larger number.
21. Expose your students to number lines and hundreds charts and give them plenty of manipulatives so they can have hands-on experience working with numbers. Concrete

examples help students develop strong number sense and allow them to see patterns and understand how numbers are connected.

Activity 8:

1. On the board write sets of numbers with a blank space (containing a dot) in between.
2. You may write some of the numbers in dots/asterisks (e.g. **** _____ *******)
3. The blank space is the placeholder for students to put the greater than '>' or smaller than '<' or '=' sign.
4. Now ask students to take turns and put the relevant sign between the sets of numbers on the board.

Activity 9:

Class Hundreds/Thousands Chart

1. Using hundred pieces of scrap paper, index cards, sticky notes, or chalk, have your whole class create a large hundred chart on the floor.
2. Extension: You may ask students to create a thousands chart by ones or by tens.
3. Then have a few student volunteers pick a number and stand on it (the hundred's chart or the thousands chart).
4. Each student should call their number out.
5. Then give different directions, such as "Find a number that is greater than the number you are standing on" or "Find a number that is 10 less than the number you are standing on."
6. Take turns, so every student gets to stand and move on different numbers.

Addition and Subtraction:

Students will be able to:

- *Find, recall and use addition and subtraction facts to 100.*
- *Add and subtract numbers mentally and in formal written form (with and without regrouping) including:*
  - *3-digit number and a 1-digit number.*
  - *3-digit number and tens.*
  - *3-digit number and a 2-digit number.*
  - *Two 3-digit numbers.*
- *Estimate the answer to an addition and subtraction question (using various approaches).*
- *Identify international currency and denominations (for instance, dollars).*
- *Solve real-world word problems with addition and subtraction (involving missing numbers, money, quantities and measures).*

Activity 10:

Addition and Subtraction fact families:

Resources required: Video Addition and Subtraction fact families from the link https://youtu.be/ujuCuY7MPAU; internet, index cards (with one addition and subtraction sentence written on it)

1. Preview the movie 'Addition and Subtraction Fact Families' to plan for any adaptations.
2. Write out sets of addition/subtraction fact families on index cards with one number sentence per card, so there are enough for the whole class. For example, 22 + 43 = 65; 43 + 22= 65; 65 - 43 = 22; 65 - 22 = 45).
3. Write the following two number sentences on the board: 22 + 43 = 65; 43 + 22= 65. Ask students what they notice? They should notice that both sentences include the same numbers. They may also observe that the order of the two numbers you're adding doesn't matter--that either way the sum is 6.
4. Now write these two sentences on the board along with the first two: 65 - 43 = 22; 65 - 22 = 45. Again, ask students what they notice. They should observe that both sentences include the same numbers and that both begin with 6.
5. Finally ask them to look at all four sentences together. What do they notice? Help them recognize that all four statements include just the numbers 22, 43, and 65. Explain that these are a fact family.
6. Tell students that today they will learn about fact families and then play a game where they reunite facts from the same family. Play the BrainPOP video 'Addition and Subtraction Fact Families' for the whole class.
7. Pause as needed to reinforce student understanding of key concepts and vocabulary.
8. After the movie, distribute a fact family index card (see Preparation) to each student. Tell students that they need to find the rest of their family for a family reunion! Allow students time to walk around the classroom finding the other three facts that make up their family.
9. Finally, invite each family to review their facts and then present themselves to the rest of the class. If time allows, challenge them to put the numbers that make up their fact family on a fact family triangle.
10. Conclude the lesson by challenging students to the Easy or Hard Quiz to assess their understanding.

Activity 11:

Fact Family Home

1. Invite students to draw a picture of a four-storey home with three windows in every storey.
2. Put two minus signs between the first two windows on the bottom floors, and a plus sign between the first two windows on the top floors.
3. Then put an equal sign between the last two windows on all four floors.
4. Ask students to fill the windows with fact family equations?
5. You can also fill in the fourth floor with 32 + 46 = 78 and have your student complete the other equations.

Activity 12:

Basic addition and subtraction using a variety of pictorial strategies.

Resources:

- Video 'Basic Addition' from the link https://youtu.be/cJ_boPjzKtI
- Video 'Basic Subtraction' from the link https://youtu.be/yTYVVV1_nJw.
- Video 'Doubles' from the link https://youtu.be/PGa0yVoOLVM.

1. Play the video ‘Basic Adding’ to help students know how addition can be done, as well as to know the vocabulary for addition and subtractions procedures.
2. Demonstrate a few questions to add.
3. Give a few questions to make students practice basic addition using any method that they prefer.
4. Now play the video ‘Basic Subtraction’ to help students know various strategies to subtract.
5. Demonstrate a few questions to subtract.
6. Give a few questions to make students practice basic subtraction using any method that they prefer.
7. Show the video ‘Doubles’ to build student understanding of this mental math strategy.

Activity 13:
Using variety of strategies to add single digit numbers through an online game
Resources:

- Online game ‘Addition blocks’ from the link https://www.brainpop.com/games/additionblocks/.
- Video ‘Doubles’ from the link https://youtu.be/PGa0yVoOLVM.

1. This lesson plan uses a free online game called Addition Blocks. The game is useful for providing practice with additional facts, but does not explicitly teach addition, so make sure students have already had some practice with mental math strategies prior to playing the game.
2. Before introducing the game to your students, preview it yourself by diving right into game play, or click on "How to Play" for directions. You can easily differentiate the game for students by instructing them to click "Options" and then select a specific speed and level of difficulty. The following is recommended:
   1st - 3rd grade Speed: Slow; Difficulty: Easy.
3. Show the video ‘Doubles’ as well as ‘basic adding’ to build student understanding as well as recap this mental maths strategy before playing the game.
4. Project the online game ‘Addition Blocks’ for the class to see. Show students how to set the speed and difficulty level by clicking on "Options," and then demonstrate game play.
5. Model how to play the game. Use think-aloud strategies to show students how you use mental math during game play. You might also want to have a few student volunteers play and share their thoughts, as well.
6. Provide 10-15 minutes for students to explore the game on their own or with a partner.
7. Lead students in a whole-class discussion about the mental maths strategies they used during game play. Was it easier to combine two numbers or more than two numbers to create the target number? Why? Which combinations were the easiest to add, and which were the hardest?
8. Explain that students will now practice mental maths strategies for addition by creating and playing a hands-on game with a partner. Pass out 25-50 blank index cards to each pair of students, or give students construction paper and have them create cards by folding and cutting the paper into equal sized squares. Instruct students to write one digit numbers on the cards. Younger students may want to write only digits from 1-9.

9. Encourage students to work with their partner to create an addition game using their cards. They can spread their cards in an array like in the Addition Block game, then take turns selecting a target number for their partner to make with cards. Or, they can create their own original concept for a game. Provide at least 10 minutes for students to plan and practice playing their games.
10. Allow students to revisit the Addition Blocks game as well as their original games throughout the school year to build fluency with addition facts. You might also want to pair students up with different partners and allow them to teach one another their games. Encourage students to talk about their mental maths strategies together.

Activity 14:
Using a variety of strategies to add and subtract 3 digit numbers.
Strategy 1: Base-Ten Blocks
Resources for teacher support:

- Video 'Adding Using base ten blocks' from the link https://youtu.be/aQMjLFlbsDA
- Video 'Subtracting using base-ten blocks' from the link https://youtu.be/hkQhlXQjGT0.

1. View the two videos 'Adding using base ten blocks and subtracting using base ten blocks' to know how to add and subtract up to 3-digit numbers with a single digit, a ten or another 3 – digit number.
2. If you are short of resources, you could always create rods by gluing ten beans/buttons on a popsicle stick to represent rods and using individual beans/buttons to represent ones. You could use pictorial representations such as sticks to represent tens, while circles or dots to represent ones.
3. You may search for other videos on Youtube to know how to use base ten blocks to add and subtract either through concrete experience or through pictorial representations.
4. Using base ten blocks to add and subtract two digit numbers is a very concrete model for students to use. It's very easy for them to visually see the process of putting together the tens and ones plus the act of regrouping is a lot easier to visually see here as well.
5. You can help students use base ten blocks in two ways:
   - The first would be to actually use base ten blocks as they're adding and subtracting for every single problem.
   - The next option would be to draw sticks and circles to represent tens and ones if your classroom is limited on base ten block materials.
6. If you give students a whiteboard it is very easy for them to draw out every single problem that they can add or subtract without using base ten blocks. But ideally they will have their hands on practice on those manipulatives to visually see their problems being solved.

Strategy 2: Break-apart (partitioning or expanding) strategy
Resources for teacher's support:

- Video 'Simple tricks to help with partitioning and addition' from the link https://youtu.be/1Cf08KP92zo.

- Website Addition with partitioning from the link https://www.mathswithmum.com/addition-by-partitioning/. (Interactive demonstration, video, worksheets and a lesson)
- Video 'Addition and subtraction: Mental calculations' from the link https://youtu.be/-18qLbg1Gmk.

1. View the 2 videos given above to know about the partitioning method to add numbers. You may search other videos and websites to learn more about this easy method to add numbers.
2. Strategy number 2 is all about the break-apart method which also could be known as the expanded form method. The reason it is called break apart is because the students are actually taking apart the two digits and splitting it into tens and ones.
3. Then they can add the tens from each number and the ones from each number and make their maths a little bit easier. It does get a bit difficult when students have to do some regrouping on their addition or subtraction problem so that is definitely a big step that you have to teach when using this strategy. However, without regrouping it is quite an easy method to use.
4. You may scaffold students learning of this method by providing blanks to help students develop a further understanding of how to break apart/partition numbers.

Strategy 3: Give and Take away (or Rounding and Adjusting):
Resources for Teachers support:

- Adding and subtracting using rounding and adjusting from the website link - https://classroom.thenational.academy/lessons/adding-and-subtracting-using-the-round-and-adjust-strategy-chk64e. (It includes a video, questions and other support material to help understand this method)
- Video 'Addition and subtraction: Mental calculations' from the link https://youtu.be/-18qLbg1Gmk.

1. Use the teachers resources provided to know in detail about this strategy. You may search more to gain further information about this strategy. The second resource gives a lot of strategies to add and subtract numbers (including partitioning, number line, bridging, rounding and adjusting etc.).
2. Third 3-digit addition and strategy is the give-and-take method. The process of this method is different between the addition and subtraction problems. So it is important that you give the students a lot of practice here.
3. When you have an addition problem if you take two/three from one number you have to add two to the other number.
4. However, on a subtraction problem if you take two/three from one number you have to take two from the second number as well.
5. This strategy does require a lot of practice because the students really have to focus on which strategy fits with addition or subtraction; however, once given practice it is the easiest to use. Giving them lots of hands-on ways to practice is one suggestion.
6. It's also very important to teach the strategy of finding the number thatis closest to a 10 to make their problem as easy as possible.

Strategy 4: Open number line
Resources for teachers support:

- Video 'Adding and subtracting – using a number line' from the link https://youtu.be/ucDucqYbffs.
- Video 'Addition and subtraction: Mental calculations' from the link https://youtu.be/-18qLbg1Gmk.

1. Use the resources provided for teachers support to know about addition and subtraction with an open number line. You may browse for more videos as there are many supportive resources available on net.
2. Open number lines are the fourth strategy for 2/3-digit addition and subtraction problems. An open number line is where students have make jumps in order to represent adding or subtracting tens and ones.
3. On a subtraction problem the students will begin on the biggest number. Then, they will jump back the number that they are supposed to subtract.
4. When a student makes these jumps, they will represent the tens with a bigger jump and the ones with smaller jumps.
5. It is important that the students label each of these jumps at the bottom (or top) of the number line. This will help them see the act of taking 10/1 or adding 10/1.

Strategy 5: Simple Algorithms

1. This 2/3-digit addition subtraction strategy is the standard algorithm.
2. The standard algorithm is lining up the addition or subtraction problem vertically where the tens and ones are stacked on top of each other.
3. This can be done with or without regrouping.
4. It is suggested that you break up your lessons into teaching the standard algorithm without regrouping first. Once your student has mastered that, then you can start teaching standard algorithm with regrouping.

Activity 15:
Addition with regrouping
Teachers /Students resources:

- Video 'Adding with regrouping' from the link https://youtu.be/pZuj5s-Yjsk.
- Video 'Basic Addition' from the link https://youtu.be/cJ_boPjzKtI
- Video 'Basic Subtraction' from the link https://youtu.be/yTYVVV1_nJw.
- Video 'Doubles' from the link https://youtu.be/PGa0yVoOLVM.

1. Use the video "Adding with Regrouping' to build your notes or show it to your students during the lesson.
2. You may also like to view videos "Basic Addition', 'Doubles' to add points to your teaching exposition.

3. Adding with regrouping can be a tricky concept for some students, so we recommend solving different number sentences together using number lines, hundred charts, and hands-on manipulatives, such as base-ten blocks.
4. We also recommend reviewing maths strategies that students can use to help solve number sentences that require regrouping. A few strategies are provided in the videos 'Basic addition' and 'Doubles' as well as strategies mentioned above in activity 13.
5. Show students the number sentence 8 + 6. Use a number line or hundred chart to solve together.
6. Then use base-ten cubes to show the numbers 8 and 6. Remind students that a tens rod is equal to 10 cubes. They can group 10 cubes together to form 1 tens rod. That means there will be 4 cubes left over. What number does that show?
7. Encourage students to count the ones and the tens to make the number instead of counting each cube one by one. Show that 8 + 6 = 14.
8. Explain to students that when they regroup, they gather ten ones to make one group of ten. Repeat the activity again to solve 15 + 9 and 39 + 6. Use base-ten blocks and have students combine the cubes into rods to find each sum.
9. After students are familiar with regrouping using manipulatives, invite them to solve number sentences using pencil and paper.
10. Show the number sentence 17+ 8 in vertical form. Remind students that when they add numbers with more than one digit, they add the ones column first, then add the tens column. What is 7 + 8?
11. Some students may remember that since 8 + 8 = 16, 7 + 8 will be one less than 16, or 15.
12. Teach them how to write 5 in the total and then carry the 1 over to the tens.
13. Then add the tens column: 1 + 1 = 2. Therefore, 17 + 8 = 25.
14. Solve more examples of number sentences together, such as 56 + 9 and 87 + 4.
15. Present different word problems to students and have them make up their own stories for other people to solve.
16. Have students verbally explain how they add and regroup while solving number sentences using base-ten blocks or with pencil and paper. This will help them visualize and explain the process to themselves and gives you an opportunity to guide their thinking process if they run into errors.
17. Encourage students to not give up or get too frustrated. Regrouping can be challenging but becomes much easier with time and practice.

Activity 16:
Regroup!

1. Divide students into small groups and give each group a set of base-ten blocks. If you do not have enough sets, print out base ten block drawings from the Internet and cut them out for students.
2. Then, have one student in each group show a large number using only ones cubes. Other group members can discuss how to regroup the ones.
3. Remind students that when they regroup, they gather ten ones to make one group of ten.
4. Have students trade in 10 cubes for a rod.
5. Then have one person in each group write the number represented by the base-ten blocks.

6. Have students swap roles and regroup different numbers.

Activity 17:
Addition Stories

1. Have students make up their own word problems or addition story problems.
2. Encourage them to use amounts that require addition with regrouping. You may wish to model a few examples for the class before having students write and illustrate their own word problems.
3. You may also allow them to use manipulatives such as base-ten blocks or counters to solve.
4. Afterwards, have students swap their work with a classmate to check over each other's work.
5. Collect each student's paper and staple them together into a class book.
6. Title the book "Our Addition Stories" and keep it in the class library for students to read throughout the year.

Multiplication and Division:

Students will be able to:

- *Recognize even and odd numbers.*
- *Count and write in 3s, 4s, 5s, 10s and 100s.*
- *Recognize counting in 3s, 4s as multiplication tables of three and four.*
- *Recognize multiplication as repeated addition and develop multiplication tables (times tables) for 2, 3, 4, 5 and 10.*
- *Write multiplication statements (i.e. sentences) using concrete and pictorial representations.*
- *Recognize using concrete and pictorial representations that the multiplication of any two numbers can be done in any order.*
- *Multiply mentally and in written form using the tables that they know:*
  - *1 digit number by another 1 digit number.*
  - *2-digit number by a 1-digit number using the multiplication grid.*
- *Multiply a number with 0 and 1.*
- *Recognize division as repeated subtraction through concrete and pictorial representation.*
- *Write division statements (i.e. sentences) using concrete and pictorial representations.*
- *Recognize using concrete and pictorial representation that the division of one number by another cannot be done in any order.*
- *Divide mentally and in written form:*
  - *1-digit number by another 1-digit number (without remainder).*
  - *2-digit number by a 1-digit number (without remainder).*
- *Solve real-world word problems involving multiplication and division using any method (for instance materials, repeated addition/subtraction, groups, arrays, mental and or written methods).*

- *Solve real-world word problems (including Pakistani currency) involving addition, subtraction, multiplication and division.*

Activity 18:
Even and odd numbers

1. Make available to the students, number strips, and coloured see–through counters. Have students work in pairs, sharing a number strip, and counters of *one colour only*. (Use a single colour to better focus the student on the concept being developed.)
2. Place in front of the students, a selection of pre-packaged food or drink, which has an even number of individual content items.
3. Have students handle and check the number of items in each package, and then place a counter on that number on their number strip. The result will be that their number strip has several even numbers each covered with a see-through counter.
4. On the class chart or modelling book, record these numbers and have the students tell you what they notice.
5. Elicit from the students, or tell them, that these are all **even numbers**.
6. Have the students suggest reasons why commercial packaging mostly works in this way and record their ideas. (For example, 'They're neater that way', 'There's no extra ones sticking out', 'The rows are equal', 'They're in pairs', etc.)
7. Agree that these are all reasons why the identified numbers are known as ***even numbers***.
8. Have students now place counters of the same colour on each even number on their number strip.
9. Have one student read even numbers to twenty aloud, removing the counters as they do so.
10. Then have the other student begin at twenty and count back in even numbers, replacing the counters as they do so.
11. Repeat if necessary. Recognize the pattern that they make: the counters are on every *second* number.

    Odd Numbers:
12. Place the same packages again in front of the student.
13. Ask if anyone has found packaging that has an **odd** number of items. Point out many packages (bags) of produce, (for example carrots, tomatoes) contain an odd number of items.
14. Discuss possible reasons. (E.g. the items are not always a uniform size and therefore it may take an odd number of them to make up the advertized weight.)
15. Record on the class chart or modeling book, student ***predictions*** of things that they think they will discover about odd numbers.
16. Accept all suggestions, including possible misconceptions such as odd number + odd number = odd number.
17. Make available number strips and see-through plastic and counters of *two colours*.

18. Have them work individually or in pairs, covering the **even numbers**, saying the numbers aloud as they do so.
19. Have them 'fill in the spaces', with another colour, saying the numbers aloud as they do so.
20. Identify these as the **odd numbers**.
21. Have them discuss what they notice about the way they are placed on the number strip.

Activity 19:
Even and Odd Numbers

1. Make available hundreds of charts.
2. Have students place counters on odd numbers greater than 20.
3. Record on the class chart the patterns they see and what they notice about these numbers: 'they all end in 1, 3, 5, 7, or 9.
4. As they do so, have them notice the similarities and differences in the physical patterns made with the counters on the board, for odd and even numbers. (Columns of odd numbers alternate with columns of even numbers.)

Activity 20:
Variety of strategies to teach skip counting in 3s, 4s, 5s and 10s

1. Bead the thread: Use beads and a thread to teach students to skip count. Ask them to bead the thread according to selected skip counting. Ask them to count the beads in skip counting.
2. Use the websites:
   - https://www.weareteachers.com/skip-counting/ to explore, choose and use from amongst 21 skip counting activities. Another great website
   - https://earlyimpactlearning.com/19-counting-by-2s-activities-easy-medium-and-hard/ which though gives ideas on skip counting by 2s; however many of them could be adopted for skip counting in 3s, 5s and 10s.
   - https://mathgeekmama.com/skip-counting-activities/
3. Once you have given them ample practice of skip counting in two's, fives and tens, introduce these skip counts as multiplication tables.
4. Again make them skip count with different activities, but this time round ask them to read them as times tables and write them as multiplication statements (such as 2 x 3 = 6 read as 2 three times is six etc.)

Activity 21:
Teaching multiplication through groups and arrays; Introducing and explaining Arrays to students:

NOTE: Multiplication and division need to be taught through concrete and pictorial representations at this early age. Therefore arrays are the suggested strategy for teaching multiplication and division. Students may use objects such as beans/buttons/ rocks/ marbles to develop arrays (while providing concrete experience) or draw dots/ flowers/circles etc. to represent arrays (while working through pictorial representations.

A brief introduction to arrays as well as how to introduce arrays and groups to students in order to multiply is provided below for teachers new to concept.
The activity steps provided below and the videos shared serve two purposes. One is to provide guidelines on introducing and using (or drawing) arrays and the second is to introduce repeated addition (with or without arrays) to multiply and find answers.

1. Arrays can help your students develop concepts of multiplication and division. An array is a set of objects organized into equal groups. For example, 6 objects can be arranged into several different arrays: 1 group of 6 objects, 6 groups with 1 object in each group, 3 groups with 2 objects in each group, or 2 groups with 3 objects in each group.
2. Arrays is a set that shows equal groups arranged in rows and columns. Arrays are all around us: A pack of socks might have 3 pairs, a carton of eggs might have 2 rows of 6 eggs, a tray of muffins might have 3 rows of 2 muffins, etc. Together with your students, think of objects that are grouped in sets.
3. Watch the following videos to understand what arrays are and how do you make arrays from groups: you may show it to your students (if resources are available)
   - Arrays from the link https://youtu.be/DdVj0qhvtiU
   - Multiplication using Arrays from the link https://youtu.be/z8lcZUWbqT0
4. Familiarize your students and yourself with arrays by organizing objects in different ways during your demonstration. Give lots of practice of arrays by demonstrating through different examples, for instance 5 x 3; 4 x 4; 1 x 5 etc.
5. Use both concrete and pictorial representations during your demonstration so that students have ample visual practice of arrays. Explain purpose of arrays using beans/buttons /rocks /counters (or through drawing dots/circles/flowers to represent arrays).
6. Give practice questions and resources to students to solve multiplication sums by developing arrays. If resources are not available, you may ask students to draw arrays to find answers to your given questions.
7. Remind your students that when they multiply, they put equal groups together to find the total. Like addition and subtraction, multiplication is an operation, a way to manipulate numbers.
8. We use the symbol *x* to show multiplication. In the number sentence 3 x 2, you must add the number 3 two times in order to find the product, or answer. This is called repeated addition. You can also add the number 2 three times in order to find the answer.
9. Explain that Arrays can help people count more easily. Explain to your students that instead of counting objects one by one, they can organize the objects into equal groups and count the groups.
10. At this point, show them the videos given below or see them yourself (before the lesson) to make notes for yourself on how to explain arrays and how to use them for multiplication (including explaining multiplication as repeated addition):
    - Making equal groups from the link https://youtu.be/Gh5psiNzayk
    - Arrays and repeated addition from the link https://youtu.be/IXQO5jo2utg
    - Array multiplication from the link https://youtu.be/lRgKavUxvKY
    - multiplication with arrays from the link https://youtu.be/sIIiROTvPKY

11. Remind students that the order in which numbers are multiplied does not affect the outcome: 3 x 2 will yield the same answer as 2 x 3.
12. Draw or model different arrays and have students write multiplication number sentences that describe them.
13. Introducing your students to arrays at an early age will help build a solid foundation for multiplication and division. Arrays can help your students visualize and understand more complicated maths operations.

NOTE: The same notion of arrays is to be used to explain both multiplication and division. Use the same videos given above (making equal groups) as well as the ones provided below in **activity 24 – Division through arrays** to build your understanding about arrays and division. Remember multiplication and division are opposites of one another, making groups of equal size and finding the product in an array would yield multiplication while finding the share for each person or group in an array would yield division.

Activity 22:

Multiply with a number (including 0 and 1) – Formal written method including repeated addition method:

Teacher's/students resources:

- Video 'Multiply with 0 or 1' from the link https://youtu.be/JIZ30u9N67s.

1. Use the video to develop your teacher exposition or show it to your students during the lesson.
2. This activity will explore multiplying by numbers including 0 and 1.
3. These concepts can be confusing for some students, so we recommend doing plenty of hands-on activities and that is why arrays were explained before the formal written method of multiplication.
4. You may want to solve number sentences together using counters and creating arrays, and watch the video 'Arrays' to build background knowledge.
5. Remind students that when they multiply, they put equal groups together to find the total.
6. Write the number sentence 3 + 3 + 3 + 3 = on the board or on a piece of paper.
7. Then use counters and cups to solve the number sentence. Place 3 counters into each of 4 cups and have students count or add the counters to find the sum: 3 + 3 + 3 + 3 = 12.
8. Explain that multiplying is much easier than adding the same number over and over again: 3 x 4 = 12. The multiplication sentence shows that you are adding the number 3 a total of 4 times.
9. Use cups and counters to repeat the same activity with other number sentences, such as 1 + 1 + 1 + 1 + 1 + 1 + 1 = and 5 + 5 + 5 =.
10. Then show 4 cups without counters. How many counters are there?
11. Explain that while there are 4 cups, they are all empty. There are 0 counters in each cup.
12. You can use the number sentence 0 + 0 + 0 + 0 = to show how you are adding 0 counters a total of 4 times.
13. Explain that since there are 0 counters in each cup, there are 0 counters in all.
14. Then write the following multiplication sentence: 4 x 0 = 0.
15. Repeat the activity again, this time with 10 cups without any counters. What multiplication sentence shows the number of counters? 10 x 0 = 0.

16. Help them understand that they could have a million or trillion cups, but if the cups have nothing in them, they are left with 0.
17. Explain that if a number is multiplied by 0, the answer is always 0.
18. Now show 4 cups with 1 counter in each cup. What is the total number of counters?
19. You can use the number sentence 1 + 1 + 1 + 1 = 4 to show how you are adding 1 counter for a total of 4 times. But, an easier way to solve is by using multiplication: 1 x 4 = 4.
20. Repeat the activity again using 12 cups with 1 counter in each cup.
21. Guide students to write the multiplication sentence 12 x 1 = 12. Explain that if a number is multiplied by 1, the answer is always that same number.
22. So if you have 10,000 cups and each has 1 counter, then you have 10,000 counters.
23. Provide different multiplication sentences with 0 or 1 and have students use cups and counters to find the answer.
24. Then create a set of cups with 0 or 1 counter in each cup and have students write a multiplication sentence that describes the set.
25. Ask: *How is multiplying easier than adding the same number over and over again?*
26. Discuss together.
27. Have students continue to practice solving multiplication sentences with 0 or 1.
28. Then extend the concepts by having them solve multiplication sentences with very large numbers.

Activity 23:
Bean Bags

1. Divide students into small groups and provide each group with clear plastic baggies and small counters, such as blocks or dried beans.
2. Then write multiplication sentences with 0, 1 and another number on the board, such as 3 x 1 = __ or 10 x 1 = __ or 5 x 3 = __.
3. Have students use the baggies and beans to solve the number sentences.
4. Then have one group member put a different number of beans into the baggies and challenge the other group members to come up with the number sentence.

Activity 24:
Addition/Multiplication

1. On index cards, write a multiplication sentence, such as 3 x 0 = __, 4 x 1 ____, 2 x 6 = ____ etc.
2. On another card, write its related addition sentence, such as 0 + 0 + 0 = __; 1 + 1+ 1+1= ____; 6 + 6=_____ or 2+2+2+2+2+2= _____.
3. Give an index card to each student and have everyone mingle around the room to find their related partner.
4. Then have the partners solve the number sentences together.
5. You can repeat this activity several times so students get an opportunity to solve different sentences.
6. You may wish to have students make more pairs of cards by writing addition and multiplication sentences they create on their own.

Activity 25:
Division through arrays:
Activity 20 – Teaching multiplication through groups and arrays does give information of how to connect division as you teach for multiplication. However for further guidance, a few videos and websites are shared.
Both these activities involve a good comprehensive demonstration by teachers followed by practice questions by students regarding multiplication and division.
Therefore the focus of these activities is to help teachers develop their demonstration and exposition as they explain multiplication and division through arrays (and not through the traditional methods)

1. Watch the following videos to make notes for demonstrating (once again) how arrays can be used to divide.
   - Division array strategy from the link https://youtu.be/EAd8fOTC8Dk
   - Arrays division from the link https://youtu.be/RXdb9X2d-_k.
2. Visit the following websites to develop your understanding regarding arrays and how multiplication and division are interrelated. It also gives in-depth understanding for the teacher to ensure that students are able to know and understand that multiplication and division are opposite of each other and developing arrays would help solve not only multiplication but division problems as well.
   - Teaching relationship between multiplication and division using arrays from the link https://www.hmhco.com/blog/teaching-relationship-between-multiplication-division-using-arrays#
   - Arrays, multiplication and division from the link https://nrich.maths.org/8773
   - dividing with arrays through the link https://www.ixl.com/math/lessons/dividing-with-arrays.
3. Once you have developed a good understanding, demonstrate for students through simple examples such as 15 ÷ 3; 24 ÷ 4 etc. and explain as you develop arrays using beans/buttons/rocks/counters.
4. Give practice questions and resources to students to solve division sums by developing arrays. If resources are not available, you may ask students to draw arrays to find answers to your given questions.

Activity 26:
Division through Making Equal groups
Teachers/students resources:

- Video 'Making Equal groups' from the link https://youtu.be/Gh5psiNzayk.

1. There are many approaches to teaching division and we recommend employing different strategies and providing plenty of examples to help students visualize and understand division.
2. Making equal groups and exploring different ways to share helps students understand the basic principles behind dividing.
3. You may use arrays as given in the activity – division through arrays to help students understand the relationship between multiplication and division.

4. Explain to your students that when groups are equal, they each have the same number of items.
5. Division can be a difficult for some students to grasp, so it is important to use tangible materials to model real-life division situations.
6. Present your student with 6 counters (pennies, beans, buttons, etc.) and pretend they are cookies. Using cookies or another treat is always a good way to get kids engaged. As soon as you tell them that they will be working with cookies, their investment in making sure there are "fair" groups goes up and their maths skills suddenly improve!
7. Then ask your student to split them into two fair groups. He or she can dole them out one by one or draw pictures or make a tally chart to divide the counters equally to figure out there will be 2 groups with 3 pennies each.
8. Continue practicing with different numbers of counters and dividing them into different numbers of equal groups.
9. Then present your student with a story problem to model, such as "There are 12 cookies that must be divided among 4 friends. How many cookies does each friend get?"
10. Provide your student with 12 counters and have him or her divide them into 4 equal groups.
11. Your students can create an array to help divide them into equal groups. An array is a set of items that show equal groups in rows and columns. Your students can make an array to show 4 rows of 3 counters each. This means that each friend, as represented by the rows, get 3 cookies each. Pose different division problems and have your student use arrays to solve them.
12. Provide another problem for your student that requires him or her to make and count groups. For example, you can pose the following problem: "Aliya collects stickers in a sticker album. She has 15 stickers, and 3 stickers can fit on each page. How many pages can she fill?"
13. To solve this problem, your students can model using counters, drawing pictures, or making tallies.
    - He or she can also use a number line and skip count. Have your student start at 0 and skip-count by 3's to get to 15. Then your student can count the number of times he or she skip-counted to find the answer.
    - Your student can also start at 15 and subtract 3 as many times needed to get to 0: 15 – 3 = 12, 12 – 3 = 9, 9 – 3 = 6, 6 – 3 = 3, 3 – 3 = 0. Then count the number of times he or she subtracted.

    Have your student practice solving problems using different strategies, and then discuss which strategies work best for which type of problem.
14. Remind your students that the symbol ÷ means to divide. To write a division sentence, he or she should write the larger number first, as in 18 ÷ 3 = 6. The number you divide into is called the dividend. The number you are using to divide is called the divisor. The answer to a division problem is called the quotient.
15. In the number sentence above, the dividend is 18, the divisor is 3, and the quotient is 6.
16. Help your student understand the relationship between multiplication and division and realize that they are inverse, or opposite, operations.
17. You can use arrays and a number triangle to help your student see the connection. For example, the equations 3 x 2 = 6 and 2 x 3 = 6 are related to 6 ÷ 2 = 3 and 6 ÷ 3 = 2. Fact families use the same numbers and different operations, so 3, 2, and 6 are in the same fact family.

18. Division can be a tricky subject for students, but students can grasp concepts more easily by working through different examples and employing different strategies and visualization techniques.
19. We encourage students to use counters and model problems to help them understand basic operations and how they are connected.

Activity 27:
Division with Remainders – Formal method of division with signs:
Teachers/Students Resource:

- Video 'Division with remainders' from the link https://youtu.be/npmF_zwQhp4.

1. This activity will introduce students to division with remainders. Watch the video to make notes for yourself or show it to your students at the beginning or during the lesson.
2. Encourage students to use counters or draw pictures as they practice division with remainders. Help them employ different strategies so they can find the one that works best for them as they develop their maths skills.
3. Teach how to make equal groups. Present 8 counters and tell students to split them into 2 equal groups. How many counters will be in each group?
4. Divide the counters to show that 4 counters will be in each group (Create 2 groups and place /divide/share counters one by one or place 4 counters each altogether in each group).
5. Guide students to write a number sentence to describe what they did: $8 \div 2 = 4$.
6. Then present the same number of counters and tell students to split them into 3 equal groups. What happens? Each group can have 2 counters, but there are 2 left over.
7. Help students understand that they cannot divide 8 by 3 equally.
8. Explain that a remainder is the number left over after dividing two numbers.
9. Create a division sentence that represents what happened: $8 \div 3 = 2$ R2. Explain that when you divide 8 items into 3 groups, you have 2 items in each group, and 2 items left over.
10. Be sure to point out that the *R* stands for "remainder."
11. Solve other number stories that involve division with remainders. For example, you might want to pose the following problem: "Farrukh and Alishba share 11 stickers. How many does each person get? How many are left over?"
12. You can use counters to model the number story together. Have students divide 11 counters into 2 groups, making sure each group has the same number of counters. There will be 5 counters in each group. Then point out how there is 1 counter leftover—that is the remainder.
13. Write the division sentence together: $11 \div 2 = 5$ R1.
14. Repeat the activity with other scenarios, helping students use their manipulatives and write division sentences. Be sure that students have practice in writing the division problems using both algorithms—in the equation format and in the "long division" format.
15. Break down a division sentence for students: In $22 \div 5 = 4$ R2, the total number of items is 22, the number of groups is 5, and the number of items in each group is 4. The number of items left over is 2.
16. Encourage students to check their work after they finish solving division number sentences.

17. They can multiply the number of groups by the number of items in each group. Then they can add the product to the remainder. The answer should be the total number of items. So in 22 ÷ 5 = 4 R2, they can multiply 5 x 4 = 20 and then add the remainder: 20 + 2 = 22.
18. Have students solve division sentences and then check their work by multiplying and adding. They should get into the habit of going back over their work, which will not only empower them to self-check but also develop their multiplication and addition skills!
19. Help students understand that in the real world, division problems often have remainders.
20. Have them think of scenarios they have encountered where they could not divide something equally. What did they do? Discuss with students and share stories.

Fractions:

Students will be able to:

- *Identify, name and write:*
  - *Unit fractions*
  - *Non-unit fractions*
  - *Like fractions*
  - *Unlike fractions*

  of a discrete set of objects using pictorial representations.
- *Compare and order unit fractions and like fractions (with denominators up to 10) using <, > and = sign.*
- *Add and subtract like fractions within one whole (e.g.* $\frac{1}{4} + \frac{3}{4} = \frac{4}{4}$*).*
- *Know and recognize that tenths arise by dividing an object into ten equal parts and in dividing single digit numbers and quantities by ten (using concrete and pictorial representations).*

Activity 28:

Introduction to Fractions:

Teachers Support Resource/Students resources:

- Video 'Basic Parts of a Whole' from the link https://youtu.be/6UJLduCBjno.
- Video 'More Fractions' from the link https://youtu.be/5Eoo2RnGgAM.

1. It is highly recommended to review the videos 'Basic Parts of a Whole' and 'More Fractions' before explaining fractions to students.
2. The two videos introduce fractions and explore unit fractions, including one-half, one-third, and one-fourth. This movie will go beyond unit fractions and further investigate fractions of sets. We encourage students to work with counters, small objects, or even food to help them experiment with different parts of a whole or set.
3. Show the two videos to students.
4. Review with students that a fraction is a number that shows part of a whole.
5. You may wish to introduce a simple fraction such as one-half. You can take a piece of paper and cut it in half to show that there are two equal parts. Remind students that since there are two equal parts, two goes in the denominator, or the bottom of the fraction. Then take one half away. What fraction of the whole paper is left? Point out that there is only one of two parts

remaining, so one goes in the numerator, or the top of the fraction. Thus, one-half of the paper is left.

6. You may wish to continue this activity with other unit fractions, (including one-third if you wish), one-fourth, three-fourths, two-fourths.
7. Help students move beyond unit fractions. You can divide a piece of paper into eighths and color two sections blue. Ask students to identify the fraction of the paper that is blue. Help them count the total number of sections (eight) and put that number in the denominator. Then count the total number of blue sections (two) and put that number in the numerator. Thus, two-eighths of the paper is blue (which is one-fourth actually).
8. Repeat the activity by having students identify the fraction of the paper that is *not* blue. Six-eighths of the paper is not blue.
9. Repeat the activity again to explore other fractions, such as three-fourths, (five-sixths, and eight-tenths provided your students are ready and interested to explore further).
10. You may wish to have students work in pairs and trade off coloring in squares and writing fractions that name the colored and plain parts.
11. Help students understand how fractions can name a whole. Divide a piece of paper into fourths and color all the sections blue. What fraction of the paper is blue? Guide students to understand that there are four equal parts, so four is the denominator. How many parts are blue? Guide students to count the blue sections and put four in the numerator. So four-fourths of the paper is blue. That means the whole paper is blue. Help students understand that four-fourths, five-fifths, eight-eighths and so on, all represent a whole.
12. Explain to students that fractions can also name no parts! Take a piece of white paper and divide it into sixths. Since there are six equal parts, six goes in the denominator. How many parts are blue? Since none of the parts are blue, you put zero in the numerator. Repeat this activity to represent other fractions.
13. Explore fractions of sets together. Show a collection of fruit, such as three apples and two bananas. What fraction of the pieces of fruit are apples? Guide students to count all the fruit and put that number (five) in the denominator. Then have them count the number of apples and put that number (three) in the numerator. Thus, three-fifths of the fruit are apples.
14. Then show the same collection and ask what fraction of the fruit are oranges. Help them understand that zero out of the five fruit are oranges!
15. You may want students to work in pairs and use counters or objects to create a set. Then have them challenge each other to name fractions that describe their sets, being sure to write their fractions down.
16. Fractions can be challenging for some students, but hands-on exploration can help young learners understand and practice the concepts so they can become experts!

Activity 29:
Unit fractions/non-unit fractions and comparing fractions
Students resources:

- Cut out of a whole pizza.
- Pizza Cut-out each showing: ½
- Pizza cut-out showing ¼

- Pizza cut out showing 1/3
- Pizza cut out showing 1/8.

1. Begin the lesson with the class in a circle. Have pizza cutouts ready with you.
2. Give four students one half, two halves, three halves, and four halves, respectively. Ensure that the pieces are not visible to any students. Tell them that '*I gave each person a different number of pieces of pizza. Please reach behind you and count how many pieces of pizza you have.*
3. After each student has told their number of pieces. Ask: *Who has the most pizza pieces?*
4. Students might think the question is trivial, but some may realize that the size of pieces matters, as well as the number of pieces. Having more pieces results in a greater amount only if the pieces are the same size.
5. Ask each student to reveal the amount of pizza they have by arranging the pieces at the front of the class. Record the total amount they have as both words, e.g. three halves, and symbols, e.g. 3/2.
6. Creating improper fractions (numerator greater than the denominator) helps students to recognize the role of both numbers in determining the size of a fraction.
7. Ask: *How else could we write two halves? …three halves? …four halves?* (1, 1 1/2, 2). *What does the top number, the numerator, of a fraction tell you? What does the bottom number, the denominator, tell you?*
8. Ask your students to name the fraction for other amounts of pizza you made. Show each cut out i.e. pizza's with ½; ¼, 1/3, 1/5, 1/8 one at a time and ask them to name the fraction.
9. Ensure the fractions are non-unit and some fractions are improper.
10. You might also invite students to make or draw given fractions. Asking students to anticipate the size of the amount before it is made is important to their development of imaging, and possibly number properties. High achievers might notice that dividing numerator by denominator gives the number of ones (whole pizzas) that can be made, e.g. 9/3 = 3 found by 9 ÷ 3 = 3.

Activity 30:
Tenths:

Dividing by 10 to make tenths

1. Revisit familiar fractions. Use different representations, including paper shapes, number lines and clocks, to focus on the concept of 'equal parts'. Also show representations that are not divided into equal parts.
2. Ask: *If Shama says 1/10 is comes after ½ because 10 is greater than 2. Ali says, No! 1/10 is smaller than ½ since the whole is cut into 10 equal parts which is smaller than when the whole is cut into 2 equal parts.* Ask: *Who do you think is correct? How do you know each one shows tenths?*
3. Use a place-value chart to explore the movement of the digits as you divide by ten. Start with the numbers 20 and 30. Model how the single digit, one, can also be divided by ten to show that 1 ÷ 10 = 1/10, 2 ÷ 10 = 2/10
4. Label the new column 'tenths' and further explore dividing two by ten.

5. Look at the way in which division statements can be written as fractions and vice versa.
6. Now draw a number from 0 to 1 and show 10 equal divisions on it.
7. Mark 1/10, 2/10, 3/10 and so on ….on divisions in sequence and help students understand tenths.

References:

BrainPop (2021) Retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Elementary Nest (2021) Retrieved from: https://elementarynest.com/teaching-strategies-for-2-digit-addition-and-subtraction/

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Algebra

STEP 1

Standard.: *Students will be able to explore patterns in a variety of ways.*

Student Learning Outcomes: *Students will be able to:*

- *Complete geometrical patterns (e.g. on a square grid) according to one or two of the following orientations:*
  - *Shape*
  - *Size*
  - *Color*
- *Explore patterns in a variety of ways using 2-D and 3_d shapes.*
- *Identify and extend repeating, increasing and decreasing number patterns (for e.g. on a number line or on a hundreds chart).*

Knowledge:	**Skills:**
Students will be able to: ● Know about patterns (including patterns by shapes, objects, colour, size, orientation and number patterns).	Students will be able to: ● Complete geometrical patterns (e.g. on a square grid) according to one or two of the following orientations:

	- Shape - Size - Color ● Explore patterns in a variety of ways using 2-D and 3- D shapes. ● Identify and extend repeating, increasing and decreasing number patterns (for e.g. on a number line or on a hundreds chart). *Advanced/Additional:* ● *Identify and extend growing and shrinking patterns using shapes and objects.* ● *Explore simple tessellations.*

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

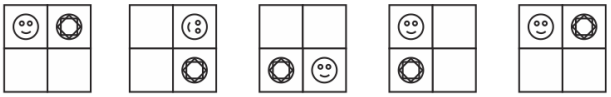
Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

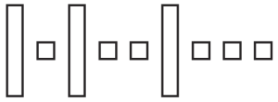
1. Cross figure that does not belong to <u>each pattern?</u>

i. 

ii. 

2. What <u>comes</u> next? Draw the shapes.

i.  _____

ii.  _____

3. ⊙ × 6 = 30
   ⊙ × 8 = ☐

The missing number in ☐ is _____

STEP 3

Learning Activities

Students will be able to:

- *Complete geometrical patterns (e.g. on a square grid) according to one or two of the following orientations:*
  - *Shape*
  - *Size*
  - *Color*
- *Explore patterns in a variety of ways using 2-D and 3 - d shapes.*
- *Identify and extend repeating, increasing and decreasing number patterns (for e.g. on a number line or on a hundreds chart).*

Activity 1:

Patterns Introduction and exposition:

Teachers/Students resources:

- Video 'Patterns" from the link https://youtu.be/MBrdGGqUu1E.

There are many tasks provided within this activity 1. You may split it into number of lessons as per your need or follow the sequence and do all tasks of this activity (if you have ample time).

1. Patterns are great ways to introduce and develop algebraic thinking. Encourage your students to build patterns and experiment in different ways by using shapes, colors, sounds, or movements.
2. Challenge your students to find patterns all around them, in their surroundings, on their clothes, or even in music. Help them to identify the unit that repeats in the pattern and predict what comes next.
3. **Review** with your students that a pattern is something that repeats over and over again. Patterns can use colors, shapes, sizes, sounds, and movements, as in dance routines.
4. Show different examples of patterns and encourage your students to find them on their own.
5. Show the video 'Pattern' to students to help explain patterns.
6. Then go through different patterns of movement, such as alternating jumping jacks with hopping once. You can also create sound patterns together by stomping, clapping, snapping, and tapping. If possible, play music for your students or bring in examples of music and have students identify the pattern.
7. **Encourage** your students to make their own patterns using two to four elements in a unit. They can use pattern blocks, different coloured marbles or counters, or other small objects. They can also draw pictures or draw or paint stripes of different colours.
8. Instruct them to select two to four items or colors, and arrange them in a specific order. This is their unit of pattern. Then have them build the pattern by repeating the unit over and over again.
9. Have your students practice creating patterns using a variety of materials and challenge them to break the patterns into individual units.
10. Then, ask them to begin patterns for someone else to continue. Help your students to identify what type of pattern they have created: ABAB, ABC, ABB, or others.
11. **Present** a simple pattern to your students and have them figure out what comes next. Guide them to look for the individual unit first. Then follow the pattern with the unit in mind to figure out what comes next.
12. They may want to take notes, use words or sounds, or draw pictures to help them keep track of items in the pattern. For example, when using a sound pattern, such as clap, clap stomp, clap, clap, stomp, clap, clap, stomp, students can write down what happens in words, use abbreviations, or use colours or counters to represent each movement. Then help them read their symbols to figure out what comes next; a clap!
13. **Draw** or use shapes to create a pattern, but leave one shape out. Ask your students to find the missing shape. Guide them to find the unit and see where the missing shape falls in the sequence.
14. Invite students to create their own missing shape patterns and take turns guessing. This activity promotes algebraic thinking and problem solving skills.
15. Explain that patterns are everywhere. There are plenty of examples found in nature, such as stripes on a zebra or the arrangement of petals on a flower. Encourage your students to explore the world around them and see maths in unexpected places.

Activity 2:

1. Clap out a simple pattern and invite students to join in. Experiment with other basic patterns using clapping, foot stomping, and other movements. Invite students to describe and explain the patterns you created. Introduce the term pattern, which means "something that repeats over and over again."
2. Provide some experience with visual patterns. Read the pattern out loud together (e.g. "triangle, triangle, square") and help students decide what comes next.
3. Use the website https://www.topmarks.co.uk/Search.aspx?q=FINISH%20THE%20PATTERN to choose an interactive game for your students where they complete the patterns.
4. Allow students to explore patterns in small groups using manipulatives. They may want to make patterns with cars and trucks, different colored bears, etc. Other students may want to create patterns using art supplies.
5. Have volunteers share patterns they created. Encourage students to look for more patterns throughout the day.
6. You may want to line them up in a boy-girl pattern on the way to lunch and have them identify patterns in the school that they see on their walk.

Activity 3:
Clap and Tap

1. Clap and tap out a pattern for your students to follow, such as clap, clap, tap, clap, clap, tap, clap, clap, tap. Make sure you repeat the pattern at least three times to help students find the unit.
2. Stop the pattern and have students figure out what comes next, a clap or a tap. Then invite student volunteers to clap and tap their own patterns for other students to guess.

Activity 4:
AABB

1. Post a pattern for your students to follow, such as AABB, ABC, ABCD, etc.
2. Then have them use whatever items they wish to create the pattern. They may want to use beads, marbles, pattern blocks, connecting cubes, or draw pictures.
3. Have students check each other's work. Then have student volunteers share their patterns with the class.

Activity 5:
In the Garden

1. Give each student a piece of square grid paper, for example a 4x4 grid.
2. Students are to draw a design by colouring in the squares to make a pattern.
3. They make 3 or 4 copies of this pattern.
4. Stick these in a row to make a row of tiles with repeating patterns.

References:

BrainPop (2021) Retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Measurement

STEP 1

Standard *1, 2, 3, etc.*: *Students will be able to measure, compare and order lengths, mass, and capacity using standard units such as meters/centimeters, kilograms/grams and liters/ milliliters; read, write and compare time (hours and minutes).*
They will also be able to solve problems in context involving lengths, mass/weight, capacity and time.

Student Learning Outcomes: *Students will be able to:*

- *Measure, compare and order lengths, mass, capacity using standard units such as meters/centimeters, kilograms/grams and liters/ milliliters using <, >, and = signs.*
- *Add and subtract lengths, mass, capacity given in the same units.*
- *Read and write time in hours and minutes (with five minute intervals, half past, quarter past and quarter to) from analogue and digital clocks.*
- *Show time in hours and minutes on an analogue clock.*
- *Read and write temperature to the nearest appropriate unit i.e.* (℃) *using pictorial representations and relating temperature scale to number line.*
- *Compare and order temperature using <, >, and = signs.*
- *Recognize intervals of time (for instance to estimate/give a rough calculation of the time taken by particular events or tasks).*
- *Use Solar and Islamic Calendar to find a particular day/date in real-life situations.*
- *Recognize perimeter and area.*

Knowledge: Students will be able to know: ● Appropriate standard units that can be used to measure: - heights/ lengths of two or more objects (m/cm).. - mass/ weight of two or more objects (Kg/g). - capacity of two or more objects (litres/ml). ● Appropriate symbol/sign to compare and order : - heights and lengths of two or more objects in any direction. - Mass/ weight of two or more objects - Capacity of two or more objects. ● Addition of length, mass, capacity (given in the same units) to solve real world problems. ● Intervals of time. ● Reading of temperature scale as numbers on a horizontal and vertical number line. ● Particular days of the week and date of both Solar and Islamic calendar year. ● Area and perimeter of 2 D shapes (square and rectangle). *Advanced/Additional*: ● *Know appropriate standard unit to measure temperature (*℃ *)*	**Skills:** Students will be able to: ● Measure and record the: ● Lengths of different objects using standard units (meters/centimeters). ● Mass of different objects using standard units (Kilograms/ grams) ● Capacity using standard units (liters/ milliliters). ● Compare the lengths of different objects and record the result using <, >, and = signs. ● Compare the mass of different objects and record the result using <, >, and = signs. ● Compare the capacity of different objects and record the result using <, >, and = signs. ● Add and subtract length, mass and capacities given in the same units to solve real life problems. ● Read and write time in hours and minutes (with five minute intervals, half past, quarter past and quarter to) from analogue and digital clocks. ● Read and write temperature to the nearest appropriate unit i.e. (℃) using pictorial representations and relating temperature scale to number line. ● Draw the hands on an analogue clock face to show the time in hours and minutes. ● Compare durations of events [e.g. to estimate/give a rough calculation of the time taken by particular events or tasks] ● Find a particular day and date from solar calendar and from Islamic calendar. ● Recognize area and perimeter of 2D shapes. *Advanced/Additional:* ● *Measure area and perimeter of 2D shapes (square and rectangle).*

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry chart
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

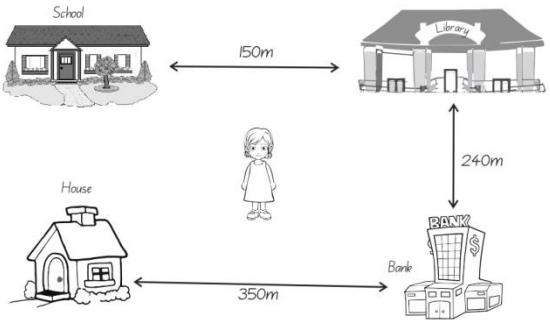
- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. One line has 2 endpoints. How many endpoints does 3 and a half lines have?

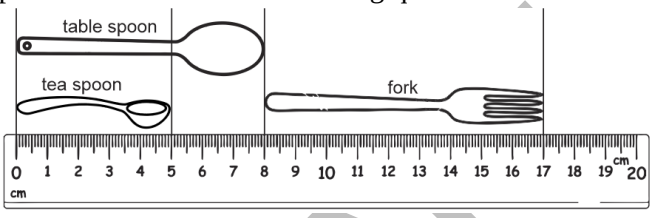
   _____
   _____
   _____
   _____

2. Fill in the blanks.



a) Ayesha cycled from home to the library. _____
b) The Bank is _____ m from the home.
c) The school is _____ m from the library.
d) The total distance between Ayesha's home to school is _____.
e) How far did Ayesha cycle from her house to the library? _____

3. Look at the picture and answer the following questions.



i. The tea spoon is _____ cm shorter than the table spoon.
ii. The fork is _____ cm longer than the table spoon.
iii. The _____ is the longest.
iv. The table spoon is _____ than the tea spoon by _____ cm.
v. The _____ is the shortest.

STEP 3

Learning Activities

Students will be able to:

- *Measure, compare and order lengths, mass, capacity and time using standard units such as meters/centimeters, kilograms/grams and liters/ milliliters using <, >, and = signs.*
- *Add and subtract lengths, mass, capacity given in the same units.*

Activity 1:

Teacher Exposition and Introduction to Standard Units of Measurement:

Teacher's/Students response:

- Video Inches and Feet from the link https://youtu.be/QdA_ZcngoJI.
- Video 'Centimeters, meters and kilometers' from the link https://youtu.be/1OBf_dmp9n0.

1. Explain that measurement is an important part of every elementary curriculum. Students should become familiar with working with nonstandard and English/U.S. customary units and using different measurement tools such as rulers, tape measures, and yardsticks.
2. The metric system is also an important part of elementary education and will be covered as a separate topic.
3. Review with your students that length is how long an object is and the width is how wide an object is. The height is the measurement of how tall or high the object is.
4. Show them the video, 'Inches and Feet' to begin explaining the standard units of measuring length and width. Note: Please ensure that you see it before the lesson.
5. Most students use nonstandard units when they first learn how to measure. Encourage them to use different objects to measure lengths. Explain that objects that are flat and straight work best when measuring length. The objects should be lined up, end to end with no gaps, next to the object they are measuring. Students should start measuring from the end of the object to get an accurate measurement.
6. Explain that standard units of measurement are important because they provide reference points that everyone can use. Historically, an inch was equivalent to the width of a thumb and in many languages the word for *inch* is the same as the word for *thumb*. Similarly, the length of a person's foot represented a foot. Since hands and feet differed in size, a more accurate system of measurement was necessary.
7. The customary units used in the U.S. include inches, feet, yards, and miles. Students should know that 1 foot is equal to 12 inches.
8. Inform students that the abbreviations for customary units: inch (in.) and foot (ft.).
9. Give a few flat things to students to measure. Remember when young students use a ruler to measure, it should be stressed to line up the end of the object with the 0 on the tool. When they identify the number and mark on the ruler that lines up with the end of the object, they should record their results with both the number and the unit of measurement.
10. Familiarize students with the language and vocabulary associated with measurement. For example, *about, close to, between, just under, less than,* and *greater than* are all words used to help describe measurements.
11. Encourage them to notice that many things do not measure to an exact inch or foot. Prompt them to use describing words(adjectives) to help explain how close the object is to the nearest inch or foot.
12. Encourage your students to explore the world around them and measure objects using nonstandard and standard units of measurement. They will begin to notice particular units and tools work better for different tasks.

Activity 2:
Teacher Exposition and Introduction to measuring lengths using centimeters and meters.
Teacher's/Students response:

- Video 'Centimeters, meters and kilometers' from the link https://youtu.be/1OBf_dmp9n0.
- Video 'Comparing Numbers' from the link https://youtu.be/UF4QlDAJJPQ.

1. Familiarize students with metric measurements.

2. Show them the video 'Centimeters, meters and kilometers'. You may pause the video when it explains kilometers (if you feel students are not ready for it). It will help students get an understanding of each measurement and how they are related.
3. It is recommended that plenty of hands-on activities with rulers and tape measures and with non-standard units of measurement are done by the students.
4. After seeing the movie, review with students that a centimeter is a unit of measurement. A thumbnail is about 1 centimeter wide. Ask: *What else is about 1 centimeter wide?* Brainstorm different objects.
5. Then have students measure small objects using a centimeter ruler.
6. Remind them that when they measure, they should line up the end of the object with the 0 on the ruler. Talk about what might happen if they do not line up the 0 with the end of the object. You may want to demonstrate.
7. Review with students that centimeters are often used to measure small or medium-sized objects. Ask: *What is the length and width of a desk? What is the height of a glass?*
8. Practice measuring objects and writing down the measurements in a chart. Then order the objects you've measured from shortest to longest. At this point, you may not use the symbols to compare lengths.
9. Be sure to remind students that the abbreviation for centimeters is *cm*, and that unlike customary units of measure, no periods are used after metric abbreviations.
10. Review that a meter is equal to 100 centimeters. A student's arm span is about 1 meter, as is the length of a baseball bat. Ask: *What else is 1 meter long or wide?*
11. Brainstorm ideas and measure to find examples.
12. Explain that we use meters to measure longer or bigger dimensions. For example, we can use meters to measure the height of a ceiling or the length of a swimming pool.
13. Ask: *Why would we use meters instead of centimeters?* Have students explain their answers.
14. Use a meter stick or a tape measure to measure different objects and order the measurements from shortest to longest.
15. Remind students that the abbreviation for meter is *m*.
16. Help students choose the correct unit to use to measure different objects. Ask: *Why would you measure a pencil in centimeters? Why shouldn't you use a meter to measure a crayon?*
17. Discuss together and have students point out what units they would use to measure different objects.
18. Provide opportunities to students to measure different lengths and widths of objects in the classroom.
19. Optional: Explain that lengths are represented by numbers. We can compare numbers. Show them the video 'Comparing Numbers' and explain that we can use symbols to compare numbers. (NOTE: This is a good opportunity to explain <, > signs, if you have not already done so in the strand 'Numbers and Operations').
20. Explain symbols >, <, and + sign to compare objects, numbers and quantities. Ask them to use the symbols to compare lengths/widths which they have measured in step 18.
21. Understanding metric measurements is important because most parts of the world use the metric system. In addition, people in science and engineering fields work with metric units. Help students become masters of measurement!

Activity 3:
Measurement Hunt

1. On an index cards, write different measurements such as 5 centimeters, 3 meters, and 1 meter/centimeter.
2. You may also want to use abbreviations so your students become accustomed to reading them.
3. Put the index cards in a hat and have each student or pairs of students draw a card.
4. Then have them measure things in the classroom to find an object that matches the measurement.

Activity 4:
Body Part Measurements

1. Have pairs of students draw an outline of their bodies on large sheets of butter paper.
2. Then have students measure their body parts in nonstandard and standard units.
3. You may wish to provide a list of parts to measure, such as the length of the foot, width of the neck, the hip bone to the knee, the span of the shoulders, and the distance between the middle finger tip to the elbow.
4. Students can help each other measure using different units and record their measurements on their outlines.
5. Post the outlines around the classroom so students can compare measurements with each other.

Activity 5:
Dinosaurs

1. Some dinosaurs were much bigger than animals living today. The Argentinosaurus was about 37 meters from head to tail!
2. Have students research the lengths of different dinosaurs. Record their lengths on a piece of paper.
3. Then have small groups or pairs go outside with sidewalk chalk and a meter stick or tape measure.
4. They can measure and mark the animals' lengths on the ground. This is a fun activity that allows students to explore dinosaurs and help them understand relative sizes.

Activity 6:
Teacher Exposition and Introduction to measuring volume using millilitres and litres
Teacher's/Students resource:

- Video 'Millitres and Litres' from the link https://youtu.be/aemJphVn9KM.
- Video 'Comparing Numbers' from the link https://youtu.be/UF4QlDAJJPQ.

1. Show students a bottle filled with water. Ask: *How much water do you think the bottle holds?*
2. Take their responses.
3. Now introduce that just like length, there are standard units of measurement for measuring volume. Ask: *Do you know what is volume?* Take their response.

4. Show them the video ‘ Liters and Milliliters’ to explain and to understand volume and standard measurement of units for measuring volume.
5. After watching the video, review with your students that volume is the amount of space something takes up, and that it describes how much a container can hold.
6. Remind students that we measure volume using different units, such as cups or pints. Invite them to brainstorm other units we use to measure volume.
7. Remind students that to measure small amounts of volume, we use a unit called a milliliter, which we abbreviate as ml. Explain that a big drop of water is equal to about a milliliter. A milliliter of water doesn’t even fill a teaspoon! Show examples of items measured in milliliters, such as a small water bottle, small milk container, and a bottle of shampoo. Have them look at the containers to identify how many milliliters are in each. Ask what else we might measure in milliliters.
8. Now display items measured in liters, such a pitcher of water, large soda bottle, can of paint, etc.
9. Explain that we use liters to measure larger amounts of volume and review that 1 liter is equal to 1,000 milliliters.
10. Remind students that we abbreviate liters as l.
11. Point out that a pitcher of water holds about one liter.
12. Have students look at different bottles and identify the number of liters in each.
13. Ask: *What else do we measure in liters?* Lead a discussion.
14. If possible, show a dropper and a measuring cup. Ask students which they’d use to measure milliliters and which they’d use to measure liters.
15. Help them recognize that they’d use the dropper to measure milliliters since it’s such a small unit, while a measuring cup is more useful for measuring liters.
16. Ask: *When might they measure in milliliters? When might they measure in liters?* Answers may include baking, cooking, conducting experiments, and measuring medicine.
17. Discuss why we wouldn’t measure water in a swimming pool in milliliters. Remind students that it is important to choose the right unit when they measure.
18. Provide opportunities for students to measure volume in liters and milliliters. Ask them to compare their volumes. Ask them to measure and compare different volumes of objects and use key terms such as “greater than” or “less than” as you compare. You may want to have students record volumes in a chart or graph.
19. Optional: Explain that lengths are represented by numbers. We can compare numbers. Show them the video ‘Comparing Numbers’ and explain that we can use symbols to compare numbers. (NOTE: This is a good opportunity to explain <, > signs, if you have not already done so in the strand ‘Numbers and Operations’)
20. Explain symbols >, <, and + sign to compare objects, numbers and quantities. Ask them to use the symbols to compare volumes which they have measured in step 18.
21. Model how to pour liquid into a measuring tool, such as a measuring cup or a graduated cylinder.
22. Explain how to read the measurement—by looking at the bottom of where the liquid curves in the vessel and seeing where it lines up with the numbers on the tool.

Activity 7:
Volume Match-Up

1. Bring in a variety of containers such as a shampoo container, soda bottle, soup can, milk carton, etc.
2. On separate pieces of paper, write the liter or milliliter information for each container. Keep a key for yourself.
3. Then remove the labels or cover the volume information.
4. Now have students try and match the volume with the container!

Activity 8:
Comparing Volume

1. Have your students bring in different empty containers from home, such as water bottles, large and small milk cartons, shampoo containers, medicine bottles, soda cans, soda bottles, etc.
2. Then have students identify the volume of each container.
3. Have students order the containers from smallest to largest volumes.

Activity 9:
Teacher Exposition and Introduction to measuring Mass using grams and kilograms
Teacher's/students resources:

- Video 'Grams and kilograms' from the link https://youtu.be/bPwCNT26R_g.
- Video 'Comparing Numbers' from the link https://youtu.be/UF4QlDAJJPQ.

1. Show students a mobile and a brick (or a sack of potatoes). Ask: *what do you think is the weight of this mobile or of this brick(sack of potatoes)?*
2. Take their responses.
3. Now introduce that just like length and volume, there are standard units of measurement for measuring mass. Ask: *Do you know what is a mass?*
4. Take their response.
5. Show them the video 'GGrams and Kilograms' to explain and to understand mass and standard measurement of units for measuring mass. This video will explore grams and kilograms. It will also explain how to use a balance scale and compare masses.
6. Remind students that everything around us is made of matter. Our computer, keyboard, mouse, table, chair, and the clothes on our backs are made of matter. Even the air we breathe is made of matter. Mass is the amount of matter in something. We can use metric units like grams and kilograms to measure mass.
7. Explain that a gram is the base unit of mass. A paper clip, a pen cap, and a peanut each have a mass of about one gram. Ask: *What other objects have a mass of one gram?* If possible, use a scale to measure masses of small objects. Remind students that the abbreviation for grams is "g."
8. Provide plenty of hands-on experience by encouraging students to explore and measure the objects around them. Ask them to measure and compare different masses of objects and use key terms such as "greater than" or "less than" as you compare. You may want to have students record masses in a chart or graph.

9. If possible, have students use a balance scale to measure or compare mass. Explain that a balance scale has a tilting beam with a container or pan on each end. To calculate the mass of an object, you can place it on one end of the beam and place known weights or masses on the other until the beam is balanced. Most scales have a guide that tells when the scale is balanced. You can also use the balance scale to compare the weights or masses of objects.
10. Together with students, use a balance to compare masses. Which has a greater mass, an apple or an orange? A pencil or a pen? A marble or an eraser? Have students make predictions and use the scale to test their predictions.
11. Ask students to note down the masses of the things they measured.
12. Optional: Explain that lengths are represented by numbers. We can compare numbers. Show them the video 'Comparing Numbers' and explain that we can use symbols to compare numbers. (NOTE: This is a good opportunity to explain <, > signs, if you have not already done so in the strand 'Numbers and Operations')
13. Reinforce symbols >, <, and = sign to compare objects, numbers and quantities. Ask them to use the symbols to compare masses which they have measured in step 10.
14. Remind students that a kilogram is equal to 1,000 grams. A baseball bat, a dictionary, a pineapple, and a bag of flour are each about one kilogram. Remind students that the abbreviation for kilograms is "kg."
15. Provide large/heavy objects to measure such as a book, a sack of potatoes, a pack of sugar, a dictionary, a watermelon, or a pair of boots etc. Ask them to calculate the masses of large objects in kilograms and if possible, use a scale to compare larger masses. Have students predict the masses of large objects.
16. It is important for students to choose appropriate units when they measure mass. Explain that grams are a good unit to use when they measure thing with smaller masses. For example, a carrot, a zucchini, and an onion are pretty lightweight and most likely have masses less than a kilogram. So, it makes more sense to measure in grams. In contrast, a pumpkin can be fairly heavy and have a mass greater than a kilogram. Thus, using kilograms is a better option.
17. Provide opportunities for students to now measure objects in grams or kilograms. Give a mix of small/light as well as large/heavy objects so that they also learn to choose whether a certain thing would be measured in grams or in kilograms. Help them get familiar with units of mass.
18. Challenge students to make a prediction about an object's mass using the appropriate measurement unit and test their predictions with a scale.

Activity 10:
Comparing Mass

1. Show the video 'Comparing Numbers' (link shared above) and then have small groups of students use a scale to measure and compare the mass of different objects.
2. They can write number sentences to compare the measurements by using the greater than, less than, or equal symbols.
3. If students are using a balance scale, they may want to draw pictures of their scales to go along with their number sentences.
4. Be sure to remind students that on a balance scale, the beam tilts toward the object with the greater mass.

Activity 11:
As Big As A Whale

1. Have students pair up to research the mass of different animals.
2. Encourage them to choose different types of animals, both large and small.
3. Then have them find equivalent masses to help put the measurements in perspective. For example, a lion has a mass of about 200 kilograms. That's the same as about eight students in their class!
4. Have students work together to come up with facts and share them with the whole class.

Student Learning outcomes:
Students will be able to:

- *Read and write time in hours and minutes (with five minute intervals, half past, quarter past and quarter to) from analogue and digital clocks.*
- *Show time in hours and minutes on an analogue clock.*
- *Read and write temperature to the nearest appropriate unit i.e. (C) using pictorial representations and relating temperature scale to number line.*
- *Compare and order temperature using <, >, and = signs.*
- *Recognize intervals of time (for instance to estimate/give a rough calculation of the time taken by particular events or tasks)*

Activity 12:

- Video 'Time to the hour' from the link https://youtu.be/0TDtQMW4ZGo.
- Video 'Parts of a clock' from the link https://youtu.be/PJ7LBQo_t58.

1. Explain the notion of time to students. Tell them that time is how we divide the day into units. Learning to tell time will help you schedule your day and gain greater control of your surroundings.
2. Explain that although many clocks that you will see are digital, learning to tell time from an analog clock is a necessary skill.
3. For a quick and fun review, show the video "Parts of a Clock" to your students. This video covers the basics of the clock—its parts, how the hands move, and how we use time to plan our day. You may wish to do some of the activities or assign the quizzes to ensure that your students have a firm grasp on the parts of a clock. Then they will be ready to tell time to the hour.
4. Now show the video 'Time to the hour' to students.
5. Revise that on a clock, the hour hand, or short little hand, points to the hours while the minute hand, or big long hand, points to the minutes.
6. Explain that when we say the time, we tell the hours first, followed by the minutes. For example, when the hour hand is on the 10 and the minute hand is on the 12, we say the time is ten o'clock.
7. Emphasise that the term "o'clock" means "of the clock" or "according to the clock." This phrase is used only with times that are exactly on the hour. Ten o'clock can be written in two

other ways: 10 o'clock and 10:00. When we write the time using only numbers, we use a colon to separate the hours from the minutes. Furthermore, we always write the minutes to two places (10:00, 10:01, 10:02, and so on).

8. Explain to your students that as time passes, the hands move. When the minute hand moves all the way around the clock, the hour hand moves from one number to the next. This is an hour.
9. Prompt your students to observe that the minute hand moves faster than the hour hand. Since there are twenty-four hours in a day, but only twelve numbers on a clock, the hour hand must go around the entire clock twice. This is why we have a six o'clock in the morning and a six o'clock in the evening.
10. Explain that Twelve o'clock during the day, when the sun is high in the sky, is commonly known as *noon*. Twelve o'clock when the moon is high in the sky is known as *midnight* because it is the middle of the night.
11. The hands on a clock only move in one direction—toward the right, or clockwise. The opposite direction is called counterclockwise. Though the hands never move that way, the term is important to learn.
12. The best way to learn how to tell time is to practice. Use a demonstration clock or any analog clock and present different times on the hour for your student to read. This will help them prepare to learn time to the quarter-hour, half-hour, and minute in the future.

Activity 13:

1. Ask students to watch the sand running through a one minute timer to get an idea of how long one minute is. Explain that the best way to get to know how long a minute is, is to do something in that minute, such as hopping or clapping. Do an activity while students count how many times you do it. Ask if they think you would do the activity more or less times if you did it faster. Repeat the same activity faster to show that you do more. Give students lots of opportunities to time themselves for a minute.
2. Revisit to explore the concept of slowness. Explain that when you do something slower, you take more time to do it so you can do less of it in a particular length of time. It takes more time to do the same thing when you do it slower.

Activity 14:

Earlier, later

1. Talk about how we use our senses to tell us that time is passing, e.g. we feel hungry because it is a long time since we last ate.
2. Explain that clocks and calendars help us to think about time passing. Show students an analogue clock and talk through what each hand does. Starting with both hands pointing to 12 o'clock, show how to move the minute hand all the way round the clock, so one hour has passed; the hour hand must now move on to the 1 to show 1 o'clock, an hour later. Explain that you are just showing how the clock hands work and that over an hour, the hands move so slowly that we don't notice them moving.
3. Once students are familiar with setting the clock to a particular hour, explore one hour later (one more hour) and one hour earlier (one less hour), being careful not to cross 12 o'clock at this stage.

Activity 15:
Gone in Sixty Minutes

1. Have students make their own clocks out of paper plates, construction paper, and brass brads.
2. Students can label the numbers on their clocks, but instead of using hatch marks between the numbers, they can write out the minutes. This will help students understand that each hatch mark represents one minute and there are sixty minutes in an hour.
3. Talk about what happens when sixty minutes have passed. Then have students work in small groups or pairs and move the hands around their clocks to show different times.
4. Have students write each time down in a list, and later, they can call out each time on the list for a different partner to show on the clock.

Activity 16:
Time to Write

1. Have each student write a time on an index card to the minute, quarter hour, half hour, or hour.
2. This time can be written with numbers, words, or with numbers and words.
3. Have students place the index cards in a box or hat. Then draw a card from the hat and have students show the time on individual clock manipulatives.

Activity 17:
Begin and End

1. On a piece of paper, have your students draw two separate clocks without hour and minute hands.
2. Before they begin an independent activity, have them draw the hands on one clock to show their start time.
3. When they complete the activity, they should fill in the second clock to reflect their end time.
4. Students should label the clocks with the name of the activity or assignment they completed.
5. You may want your students to draw several pairs of clocks in order to record the time for different activities.

Activity 18:
Timeline

1. Assign each student a time to the hour, half hour, or quarter hour during the school day.
2. When their time comes up on the clock, the student is responsible for recording the activity that class is doing at that particular time. For example, a student who is assigned 10:15 may write a description about their activity or draw a picture.
3. At the end of the school day, collect all the pictures and/or descriptions and put it up in a timeline in the classroom.

Activity 19:
Line time

1. On index cards, write different times, such as 9:00, 9:15, 9:30, 10:00, 10:15, 10:30, etc.

2. You may want to add pictures of clocks with the corresponding times or give picture cards to some students and number cards to others, depending on their abilities and needs.
3. Then have each student draw an index card out of a box or hat.
4. Explain to students that they will put themselves in time order without talking.
5. Students can show each other their cards and decide if their times come before or after.
6. You can repeat the activity using A.M. and P.M. times.

References:

BrainPop (2021) retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Geometry

STEP 1

Standard *1, 2, 3, etc.*: *Students will be able to use properties to describe two dimensional and three dimensional shapes and describe positions, movement, directions, turns using appropriate vocabulary.*

Student Learning Outcomes:

Students will be able to:

- *Recognize and identify 2-D shapes (Rectangle, square, circle and triangle) and 3-D shapes (cube, cuboid, cone, cylinder and sphere) with respect to their characteristics/properties.*
- *Make 3-D shapes using varied modelling materials.*
- *Describe the position, direction, movement and turns of an object using appropriate positional language including moving clockwise, anti-clockwise, quarter, half and three quarters turns.*

- *Recognize turn as a rotation.*
- *Identify straight lines, horizontal and vertical lines and curved lines.*
- *Identify pairs of perpendicular and parallel lines.*
- *Identify quarter turns.*

Knowledge:

Students will be able to know:

- 2- D shapes (rectangle, square, triangle, circle, semi-circle and quarter circle) and their properties.
- 3-D shapes (cube, cuboid, cone, cylinder and sphere) and their properties.
- Pairs of parallel and perpendicular lines using 3-d shapes.
- Position, direction, movement and turns as rotation.
- Straight lines, horizontal and vertical lines and curved lines.
- Pairs of parallel and perpendicular lines.

Additional/Advanced:

Students will be able to know:

- *2-D shapes (Rectangle, square, circle, triangle, semi-circle and quarter-circle) with respect to their characteristics (i.e. vertices, sides and line of symmetry in a vertical line).*

Skills:

Students will be able to:

- Recognize and identify 2-D shapes (Rectangle, square, circle, triangle, semi-circle and quarter-circle).
- Describe 2-D shapes with respect to their characteristics/properties including the number of sides and corners)
- Draw 2-D shapes.
- Recognize and identify 3-D Shapes in different orientations (cube, cuboid, cone, cylinder and sphere).
- Use modelling material (such as play dough, tooth picks, popsicle sticks, match sticks, glue, cardboards, recycled material etc.) to make 3-D Shapes
- Describe 3–D shapes with respect to their characteristics/properties including the number of sides, vertices and edges.
- Identify pairs of perpendicular and parallel lines.
- Describe the position, direction and movement of an object including moving clockwise, anti-clockwise, quarter, half and three quarters turns (for instance, on a grid, on the floor etc.) using positional language (for instance: inside, outside, above, below, over, under, far, near, before, after, beside, between, left, right and in front of, quarter turn, half turn, three quarter turns, clockwise, anti- clock wise and behind).
- Recognize turn as a rotation.
- Identify and differentiate between a straight and curved line.
- Identify quarter turns.
- Identify horizontal and vertical lines.

Advanced/Additional:

	• *Recognize and identify 2-D shapes (Rectangle, square, circle, triangle, semi-circle and quarter-circle) with respect to their characteristics (i.e. vertices, sides and line of symmetry in a vertical line.)* • *Recognize and identify 3-D Shapes in different orientations (cube, cuboid, cone, cylinder, sphere, prism and pyramid).* • *Recognize and identify quarter turns as a right angle (and vice versa), half and three quarters turns (clockwise and anti-clockwise) as two and three right angles respectively.*

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represent what they believe is the correct answer. The top left room corner can be an option A, the bottom-left can be B and so on.

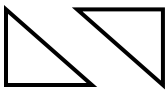
Summative Assessments

Some of the forms of summative assessment are:

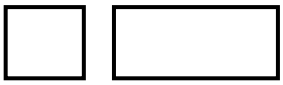
- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. Look at the word below.
   PAKISTAN
   - **i.** Which letters contain straight lines only? _____
   - **ii.** Which letters contain curves only? _____
2. Which shape can you get if you join two triangles of the same size?



3. What is similar in these two shapes?



STEP 3

Learning Activities

Students will be able to:

- *Recognize and identify 2-D shapes (Rectangle, square, circle and triangle) and 3-D shapes with respect to their characteristics/properties.*
- *Make 3-D shapes using varied modelling materials.*

Activity 1:

Plane Shapes and Solid Shapes

Teacher's /students resources:

- Video 'Plane Shapes' from the link https://youtu.be/sp_r5zC2g_E.
- Solid resources that have a circle, a rectangle, a square, a triangle and an oval as one of its face.
- Video 'Solid shapes' from the link https://youtu.be/KSPG24GMufo.

1. Show the video 'Plane shapes'.
2. After the video draw the plane shapes on board and explain each one by one.
3. Explain that a circle is a round shape with no corners or sides. The distance from the center to any point on its line (circumference) is equal. A wheel, analog school clock, and coin are all usually circles.
4. An oval is shaped like an egg—an oblong circle.
5. A square is a shape with four corners and four sides. The length of each side is equal. A sandwich, window, and a tile can be squares.
6. A rectangle is a shape with four corners and four sides. Each pair of opposite sides has the same length. Most refrigerators, computer screens, and bookcases are rectangles.
7. A triangle is a shape with three corners and three sides. The sides do not have to be the same length, nor do all of the angles need to be the same. A slice of pizza, a sail in a sailboat, and a yield sign are all triangles.
8. Explain that shapes are everywhere—in the items we use every day and the things we see all around us.
9. Encourage your students to look for shapes in their surroundings. How are shapes useful? When would using a square shape be more useful than using a round shape?
10. Now show the video 'Solid Shapes'.
11. Now show the objects that you have brought again. Build on their knowledge about solid figures, which are three-dimensional shapes such as cubes, rectangular prisms, pyramids, cylinders, cones, and spheres.
12. Make students identify basic plane shapes on the faces of these objects.
13. Begin by encouraging your students to find basic solid shapes all around them.
14. Most students are familiar with cubes. Give examples that number cubes or dice, ice cubes, and some boxes are shaped like cubes.
15. Now introduce fundamental concepts and vocabulary in Geometry, such as vertex/vertices, edges, faces, and bases as you display a cube and explain the characteristics of a cube.

16. Explain that a cube has six flat surfaces, or faces. Each face is shaped like a square with equal lengths of sides. A cube also has twelve edges and eight vertices.
17. Remind your students that a vertex is a corner of a shape. The plural form of the word *vertex* is *vertices*.
18. Present different examples of cubes to your students and help them identify the faces, edges, and vertices.
19. Pick up a cuboid (such as a rectangular tissue box) and explain that a cuboid is a solid figure that has the same number of faces, edges, and vertices as a cube. The faces of a cuboid are shaped like rectangles. Some cuboids have faces that are shaped like rectangles and squares.
20. Explain to your students that a cube is a special kind of a cuboid. Encourage your students to find examples of a cuboid and point out the different faces. Bulletin boards, cereal boxes, shoeboxes, and books are all cuboids.
21. Next pick up an object which is a cylinder. Explain that a cylinder is a solid shape that has two circular faces, no edges, and no vertices. A cylinder has a curved surface and is able to roll. Tuna cans, soup cans, poles, and pipes are all examples of cylinders.
22. You may wish to show how a cylinder can be created by rolling up a rectangle into a tube and attaching two circles to the ends. Conversely, you can take a toilet paper tube and cut it down lengthwise to show that it can turn into a rectangle.
23. Help your students understand that plane shapes can be manipulated to form solid shapes.
24. Next pick up an object which is a cone. A cone is a solid shape that has one curved surface, no edges, and one vertex. Traffic cones, funnels, and ice cream cones are all examples of cones. You may want to draw different examples of cones so students can see how they can vary in dimensions.
25. Lastly show a sphere (such as a ball) and explain that a sphere is a solid figure familiar to all students. Balls, marbles, and oranges are all spheres. A sphere has no face, no edge, and no vertex. Spheres have a curved surface and are able to roll.
26. Studying shapes, both two-dimensional and three-dimensional, are fun ways for your students to explore the world around them. Ask: *How do we use cubes every day? What kind of shape do we drink out of?*
27. Encourage your students to find examples of solid shapes all around them and ask questions about how they use them. Would they rather play soccer using a ball or a box? Why?

NOTE: Please refer to class I suggested guidelines for additional activities on 2-D shapes.

Activity 2:
Shape Hunt

1. Provide a list of solid and plane shapes for your students to find on a scavenger hunt.
2. You can list shapes or write clues, such as “Find a shape that rolls and has two faces.”
3. Then have students or pairs go on a walk at school, on the playground, or in the classroom to find the shapes.
4. Students can draw pictures and describe the items. Then after the activity, have students share the shapes that they found.
5. You can use this opportunity to discuss how shapes are alike and different.

Activity 3:
Trace it!

1. Use building blocks of different solid shapes and have your students trace all the faces on a piece of paper. What shapes make up a cuboid's faces? What shapes make up a cylinder's faces?
2. Together as a class, make tree diagrams showing how a solid figure can be broken down into its faces.
3. This will help your students relate three-dimensional solids with two-dimensional plane shapes.

Activity 4:
Make it

1. Cut index cards into shapes that fit together as faces of a cube, cuboid, or pyramid.
2. Then put the shapes into separate plastic bags with a drawing of the shape on the front.
3. Give students tape and have them work with partners to build the three-dimensional solids. As an extension, you can have students try to cut up their own cards to make their own three-dimensional shapes and trade them with friends.

Activity 5:
Solid Sort

1. Have students work in pairs or small groups. Give each pair or group a set of building blocks of different solid shapes or pictures of solid shapes.
2. You may want to cut out photos or pictures from magazines of objects of different solid shapes.
3. Then have one student sort the items and have the other students figure out the sorting parameters.
4. Encourage students to sort not just by shape, color, or texture, but by number of faces, vertices, or edges.
5. Have group members discuss each shape together.

Student Learning outcomes:
Students will be able to:

- *Describe the position, direction, movement and turns of an object using appropriate positional language including moving clockwise, anti-clockwise, quarter, half and three quarters turns.*
- *Recognize turn as a rotation.*
- *Identify straight lines, horizontal and vertical lines and curved lines.*
- *Identify pairs of perpendicular and parallel lines.*
- *Identify quarter turns.*

Activity 6:
Find the Treasure:

1. Dot various objects around the school grounds and give clues written on a 'treasure map' for reaching the objects.
2. Students should work in pairs or small groups. If you position the objects in a circuit you can get the students to start at different points while using the same instructions.

3. Use language that is appropriate to the age and ability of the students in the class. Examples might include, 'walk forward until you reach…', 'turn 90 degrees to the right' or 'walk six metres south west', 'turn clockwise/anti-clockwise' 'take quarter turn', take half/three quarters turn'.
4. You can also use this opportunity to talk about standard and non-standard measures and why you would use meters instead of paces.

Activity 7:
Follow the Leader

1. Divide the students into an even number of small groups.
2. Each group walks through the grounds and writes instructions on how to reach a given point (without saying what that point is).
3. Two groups then swap their instructions and follow the new instructions.
4. When they finish they have to write down where they think the end point was supposed to be.
5. This can also be adapted to support whichever topic you are working on – for example, a bear-hunt activity with one group acting as the bear and writing instructions on how to reach the picnic.

Activity 8:
A lion in the night
Teacher's/Students resource:

- Read aloud video of the book 'ALlion in the Night' from the link https://youtu.be/gl-R4sEcgls.

1. Prior to reading, explore the students' understanding of directions, turns and positions and what they represent.
2. Create/share a simple map on the whiteboard with some features such as a pond or river, a bridge, a bush area, a house and a road.
3. Tell a story emphasisng the key vocabulary of position and direction as you ask students to move a character around on your map.
4. You may want to create a word bank with the cards and blue tac, and stick them on the board for reference later on.
5. Share the story 'A Lion in the Night' with your students. As you get to one of the vocabulary words ask them to find it from the word bank and make sure the diagram on the card is understood in relation to the key word.
6. Explore the map given in the story book and trace the journey back to the castle emphasizing the vocabulary words again.
7. In response to the story, ask students to work in pairs to create a small scene from blocks or other materials such as toys or boxes.
8. Give each pair a set of the vocabulary cards and ask them to take turns as the director and the follower.
9. The director turns the cards over one at a time and gives a direction. The follower has to listen and move the toy through the scene.

10. Depending on the age and independence of the students you may need to model this before it becomes an independent activity. For example, the director can draw a card and say "*Move the car over the bridge. Now go through the town. Then go under the mountain. Now go across the desert".*
11. As an extension activity, students can take photos of their "stories" and create maps or slideshows.

Activity 9:
Simon Says 'Turn'

1. Explain to students that a turn is when a shape moves around so that it points in a different direction.
2. Show a clock and demonstrate how the hands rotate around and point to different numbers.
3. You may wish to use an arrow and turn it to show how a shape "points" in a different direction as it turns.
4. Have students turn a pattern block by placing one finger on a corner. That's the corner that will stay put.
5. Then have them place another finger on the shape and turn it around the corner.
6. Explain that during a turn, one spot of the shape stays in the same place.
7. Have them practice turning other shapes to the left and to the right.
8. Give your students a small non-symmetrical toy or object and play "Simon Says turn…" together.
9. Call out turns (three quarters, quarter, half, anti- clockwise, clockwise etc.), while your student holds the object and follows the instructions.
10. Make sure to pause and check your students' work.
11. Then have your students call out the directions and watch your movements with the toy.

Activity 10:
Leave a Trace:

1. Divide the class into small groups and give students pattern blocks or alphabet magnets.
2. Have each student select a shape or letter and trace it on a piece of paper.
3. Then have students trace a turn (three quarters, quarter, half, anti- clockwise, clockwise etc.) for their objects and label each one.
4. Have group members compare their drawings.
5. Then have one student from each group choose an object and ask the other group members to draw a corresponding turn.
6. Afterwards, the first student can move the object and trace it to show the correct answer and check the group's work.
7. Encourage students to help each other and discuss their choices.

Activity 11:
Amazing Mazes:

1. Draw a simple maze on the board (or photocopy one up to A3).

2. Personalize by creating a scenario that gives purpose to the maze. For example, a rabbit finding its way back to its burrow, a bee flying to its hive, a pirate finding the treasure.
3. Ask students if they can use their eyes to see the path through the maze. Alternatively, give the students copies of the maze and ask them to trace the path using their fingers and once they have found to trace the path using a pencil.
4. Choose a volunteer to come up and draw the path through the maze.
5. Ask students how they could explain to someone who can't see the maze where the line has been drawn. Encourage the use of accurate terms like up, down, left, and right. Follow the line through the maze as students describe it.
6. Draw another example on the board.
7. Ask students to describe the route they would take to get through the maze.
8. Draw the route as they describe it.
9. Individual students should only give one direction at a time (i.e. *Go down first*).
10. If students give unspecific instructions such as *go round the corner*, draw an incorrect line and guide them to describe the route accurately.

Activity 12:
Lines, Parallel and Perpendicular

1. Explain to students that a point is an exact location or position. We represent a point with a dot.
2. Students can visualize points as stars in the sky. Have them draw a series of points right next to each other in succession. What do they see?
3. Explain that a line is actually a set of points that are right next to each other. A line is endless and continues forever in both directions.
4. The arrowheads on each end of a line show that it goes on forever. Help students understand that a line is made up of an infinite number of points.
5. Draw a line segment and explain that it is part of a line. Help students see that there are endpoints on each end.
6. This means a line segment does not go on forever; it has definite ends.
7. Draw two parallel lines and have students observe.
8. Explain that parallel lines never cross and the distance between them is always the same. You can extend parallel lines forever and they will never cross.
9. Invite students to come up with examples of parallel lines or draw their own.
10. Remember, parallel lines can run horizontally, vertically, or diagonally, but never curved.
11. Come up with real-world examples of parallel lines or line segments together. For example, an equal sign is made up of two parallel line segments. A rectangle has two pairs of parallel sides. Telephone lines might be parallel to each other as they extend across the community.
12. In the word *parallel,* the *l*'s are parallel to each other. This could provide a good mnemonic for students to help remember the concept.

Activity 13:
Picture Hunt

1. Give small groups or pairs a list of items to find in the classroom or around the school grounds. For example, the list might include an item with two pairs of parallel sides or a shirt with parallel lines.
2. Then have students work together to find the items.
3. They can take digital photos of the items or draw pictures with a short description of where they found the item.
4. Encourage students to be creative and look for objects in unusual places.

Activity 14:
Reading a Map

1. Help students develop their map-reading skills.
2. Create a simple map of your community, or a fictional one.
3. Make sure street names are clearly marked as well as any landmarks.
4. Then have students answer questions about the map. Which streets run parallel? Which streets are perpendicular to one another? How do you know?
5. This is also a good opportunity to review the position and direction concept.

References:

Brain Pop (2021) retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

Brain Pop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

Maths - Position and Movement (2011) Retrieved from: https://outdoorclassroomday.com/wp-content/uploads/2016/05/Maths-Position-and-Movement.pdf

New Zealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Domain: Statistics and Probability

STEP 1

Standard: *Students will be able to read and interpret data using a variety of data management techniques. They will also be able to explore probability to find the likelihood of an event occurrence.*

Student Learning Outcomes: *Students will be able to:*

- *Read and interpret data using pictographs, block graphs and tally charts (including real-world problems).*
- *Describe the likelihood of an event occurring using mathematical language.*

Knowledge:	**Skills:**
Students will be able to know: ● Simple pictographs, block graphs, bar graphs and tally charts. ● Probability of the likelihood of an event occurring.	Students will be able to: ● Read and interpret data using pictographs, bar charts and tally charts and represent data using tally charts (including real-world problems). ● Describe the likelihood that everyday events will occur, using mathematical language (i.e. impossible, less likely, more likely, unlikely and certain).

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that

represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be a part of the formative assessment are:

1. Show a bar graph and ask questions related to the bar graph. For instance, if the bar graph shown is that of money saved by a few children. Ask:
    a. How much less did Hoor save than Rida?
    b. Abeera saved Rs. 30 more than Iza. How much did Iza save?
    c. How much more must Eshal save so that her saving is equal to the savings of Zahra?
    d. How much money did all children save altogether?

STEP 3

Learning Activities

Student Learning Outcome:

- *Read and interpret data using pictographs, block graphs and tally charts (including real-world problems.)*

Activity 1:

Favourite Fruit (plan for either pictograph/bar graph or block graph)

1. Create a survey together about students' favourite fruit. Come up with a question together and have students take the survey.
2. Record their answers on the board using a tally chart. You may want students to come up to the board and record their choice on the tally chart themselves. Be sure to instruct them to mark every fifth tally mark across the other four.
3. Then use the data in the tally chart to create a pictograph. To challenge students, have each symbol in the graph stand for more than one vote, such as two or three.
4. Display the pictograph in the classroom. If possible, serve the fruit that gets the most votes.

Activity 2:

Data Miners

1. Have students bring in a pictograph, bar graph, or other graph into class. Students may want to clip graphs from magazines or newspapers, or find them online and print them out.
2. Then choose a few graphs to discuss and analyze together.
3. Challenge students to take the same information in the graph and display it using another kind of graph.

Activity 3:
Vote for a Sport (plan for either pictograph/bar graph or block graph)

1. Be active with your students! Create a survey about favorite sports, such as swimming, soccer, basketball, or baseball.
2. Then have your students survey his or her friends about their favorite sport.
3. You may want to review how to record votes using a tally chart. Then create a pictograph to display the information.
4. Afterwards, gather the friends together to play the sport that got the most votes!

Activity 4:
Take a Walk (plan for either pictograph/bar graph or block graph)

1. Plan a hike or walk with your students. Before your trip, make predictions about what interesting things you might see and create a tally chart to organize the possibilities.
2. Bring the tally chart along on your walk and have your students record what he or she sees.
3. After, analyze the data together. How many birds did you see? How many dogs? How many more squirrels did you see than people? What did you see the most of? The least?
4. Have your students turn the tally chart information into a pictograph and share it with the rest of the family.

Activity 5:
Balloon Investigation

1. Explain that today we will make a pictograph of our favourite balloon shapes. We are going to answer the investigative question "*What different balloon shapes do the students in our class like?"*
2. Take a bag of balloons and spread out. Discuss shapes. Suggest the investigative question *"What colour balloons do the students in our class like?"*
3. Students choose their favourite shape (or colour if different shaped balloons are not available) and draw it on a piece of paper (one eighth of an A4).
4. As a class, discuss ways to display the data. If matching pictures in 1:1 lines (pictograph) is not suggested, the teacher will need to direct them to this.
5. Students attach their drawings to the class chart.
6. Ask the students what they notice about the information shown on pictograph. Use the prompt *"I notice…"* to start the discussion. These "noticings" could be recorded as "speech" bubbles around the chart.
7. Talk about the need to label the axes and give the chart a title so that others could make sense of the display. A good idea is to write the investigative question as the chart title.

8. Ask analysis questions, to extend the noticing, about the results that require students to combine sets:
   - *How many students liked long wiggly balloons?*
   - *How many students liked long straight balloons?*
   - *How many students liked long balloons **altogether**?*
   - *How can you add the numbers together?*
   - *How many students liked balloons that were not long?*
   - *How many **more** students liked long wiggly balloons than long straight balloons?*
9. Model and reinforce the use of subtraction or addition rather than counting on or back to solve this type of question.
10. Try to find analysis questions that will allow students to use strategies such as near doubles and adding to make 10s.

Activity 6:

Popcorn or Chips

1. Explain that today we are going to look at using tally marks to record the number of chips in a snack bag or the number of pieces of popcorn in a small cup and a bar graph to display the data. We are focusing on the data collection and analysis phases.
2. Display a snack bag of chips (or a small cup of popcorn) and ask the students to guess how many chips (popcorn) they think are in the bag (cup).
3. Pose the investigative question: *How many chips are in XXX brand snack bags? (How many popcorns are in the small cups?*
4. We are going to collect data to answer our investigative question by counting how many chips are in each of the snack bags I have here (count the number of popcorns in the small cup).
5. Ask: *How should we do that?*
6. Elicit ideas, including counting them all.
7. *Ask how we could count them and keep a track?*
8. Accept all ideas including using tally marks to keep a track.
9. Now model using tally marks to track how many chips (popcorns) she/he eats.
10. Distribute individual bags of chips to small groups.
11. Students eat chips and use tally marks to record the number of chips each student ate and then altogether in each bag by adding the total of the tally marks each student in the group recorded.
12. Gather the total tallies on the board or a chart.
13. Using a prepared bar graph outline, construct a bar graph with the information from the individual total tallies.
14. Discuss features of the graph and summarize the information shown.
    What was the most common number of chips (popcorns)?
    What was the least common number of chips (popcorns)?
    How many more chips (popcorns) were there in the packet (cup) with the most than there were in the one with the least?
15. As a class challenge, try to work out how many chips (popcorns) the class ate altogether.
    How many chips (popcorns) did the boys eat?
    How many chips (popcorns) did the girls eat?

16. *Discuss strategies for adding the numbers together* (for example: combine the numbers that add to 'tidy' numbers; add the tens and then the ones; use doubles or near doubles).

Student Learning outcome:

- *Describe the likelihood of an event occurring using mathematical language.*

Activity 7:
Weather Forecast

1. Ask: what will the weather be like today? Together as a class, review different weather forecasts.
2. Use different forecasts from the internet, newspaper, radio, and news programs on television.
3. You may want to research the weather for the same date in previous years.
4. Then, test their predictions.
5. Have students measure the temperature every day and record their observations of the weather.
6. You can make a rain or snow gauge by placing a plastic ruler in a clear cup and leaving it in an open space. How accurate were the forecasts?

Activity 8:
Toss a Coin

1. Remind your classroom that it is equally likely for a coin to land on head or tail.
2. Have small groups or pairs toss a coin one hundred times.
3. Have them make a tally chart to record their results.
4. After the tenth, fiftieth, and seventy-fifth tosses, have your students assess how the results have changed. Did their coin land on head or tail the same number of times? Why might tossing the coin over a thousand times get a more accurate result?

Activity 9:
Certain

1. Discuss what is certain and impossible with your students.
2. Then make a list of goals that you and your students will be certain to accomplish. Goals might include reading every day, learning a new word each day, or learning a new skill.
3. Post the goals in your classroom and refer to them when needed.

Activity 10:
Spinning Spinner

1. Find a board game that uses a spinner.
2. Together with your students, make your own spinner for the game.
3. Model the same spinner, except change a few elements, such as colours or the size of the sections on the spinner. You can use a pin or a brad to fasten an arrow that spins.
4. Then play the game together using the new spinner. How did the game change? Was it fair or unfair? Why?

References:

Brain Pop (2021) retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

Brain Pop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

New Zealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

References:

BrainPop (2021) Retrieved from: https://educators.brainpop.com/topic-lesson-directories/bp-jr-topic/?brainpop-subject=math&subject-title=Math

BrainPop Jr. (2021) Retrieved from: https://jr.brainpop.com/math/

NewZealand Government (2021) Retrieved from: https://nzmaths.co.nz/units-work

Elementary Nest (2021) Retrieved from: https://elementarynest.com/teaching-strategies-for-2-digit-addition-and-subtraction/

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

Maths - Position and Movement (2011) Retrieved from: https://outdoorclassroomday.com/wp-content/uploads/2016/05/Maths-Position-and-Movement.pdf

Growing Success- Assessment, Evaluation and Reporting in Ontario Schools (2013); and Assessment, Evaluation and Reporting Handbook (2013) retrieved from http://www.edu.gov.on.ca/eng/policyfunding/success.html

Rising Star Mathematics. Teacher's Guide. (2017) Hodder Education: London. UK

DRAFT

Mathematics - Class 3
Suggested Guidelines

DOMAIN: Numbers and Operations
Sub-Domain: Numbers and Place Value

STEP 1	
Standard 1: Students will be able to identify numbers, ways of representing numbers and comparing numbers.	
Student Learning Outcomes: Students will be able to: ● Count, read and write numbers up to 9999 (4-digit numbers) ● Recognize the place and place value of 4-digit numbers ● Compare two numbers up to 4 - digit numbers using symbols "<", ">", or "=" ● Order the given set of numbers in ascending and descending order (up to 4 - digit numbers) ● Round off numbers to the nearest tens, hundreds and thousands ● Read Roman numbers up to 20. ● Write Roman numbers up to 20.	
Knowledge: Students will be able to: ● Know numbers upto 9999 in numerals and words. ● Understand the use of place value charts to read, write and represent up to 4-digit numbers. ● Identify the place value of each digit up to 4-digit numbers. ● Express a 4-digit number in its expanded form. ● Know comparison of two numbers using symbols (>, < or =) and appropriate language '*greater than', 'smaller than'*,	**Skills:** Students will be able to… ● Count numbers up to 9999 using various materials (e.g. block charts, base ten materials, abacus, hundreds chart etc.). ● Read numbers to 9999. ● Write numbers upto 9999 in numerals and words. ● Find the numbers in the sequence between any two given numbers forward and backward from 0 to 9999 ● Identify the place and place value of each digit up to 4-digit numbers. ● Expand numbers up to 9999 using place values (partition). ● Use whole numbers in real-life problems.

• Know comparison of more than two numbers up to 9999 using appropriate language: '*Greatest', 'smallest'* and '*same as'*. • Arrange the numbers from greatest to smallest. • Understand rounding numbers to the nearest tens, hundreds and thousands using different concrete and pictorial representations. • Know Roman Numbers up to 20. • Define even and odd numbers. • Differentiate between even and odd numbers within a given sequence.	• Solve a variety of questions involving place value concepts. • Compare numbers using symbols (>, < or =). • Arrange numbers up to 9999 using appropriate language and from greatest to smallest. • Read and write Roman Numbers up to 20. • Develop rounding skills to build number sense and round off numbers to the nearest tens, hundreds and thousands. • Identify, recognize and sort even and odd numbers up to 4-digit numbers.

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment the teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (including MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests.
- External Exams

Following questions can be the part of formative assessment:

1. If there are 3 hundreds, 0 tens and 7 ones, would you write this number as 37 or 307?
2. What is the smallest 4-digit number?

3. What is the greatest 4-digit number?
4. What is the place value of the digit '5' in 8510?
5. Do all digits have the same values in number 4444? Why?
6. How do we write a number in expanded form?
7. How are the following numbers similar? 3718, 5610

Summative Assessments

Some of the sample questions are:

1. Choose the correct answer.

i. Which of the following is eight thousand and forty?

a) 8014 **b)** 840 **c)** 8400 **d)** 8040

ii. 7053 is the same as _____

a) 700+50+3 **b)** 700+500+3

c) 7000+500+3 **d)** 7000+50+3

iii. Which one of the following numbers is greater than 9609?

a) 9601 **b)** 9069 **c)** 9099 **d)** 9690

iv. In 4957, the digit 9 is in the _____ place.

a) ones **b)** tens

c) hundreds **d)** thousands

v. 8 thousands + 1 ten + 2 ones = _____

a) 812 **b)** 8012 **c)** 8102 **d)** 8120

2. What is the greatest number that can be formed using the digits 8, 3, 9 and 4?

3. Use the digits 6, 8, 3 and 5 to form the smallest 4-digit number.

4. I am a number with the digits 0, 3, 7 and 9.

I am the greatest odd number between 3000 and 9000.

What number am I?

5. Read clues and cross out (X) the incorrect numbers.

(i) The number is an odd number.

It is between 72 and 80.

72	27
77	17

(ii) The number is between 20 and 40.

_____

It has 1 in one place.

It is 1 more than 30.

31	33
21	29

(iii) The number is between 440 and 450.

The sum of all digits is 15.

449	448
447	446

STEP 3

Learning Activities

Numbers to 9999 (Building Numbers)

Resource:

- Number cards with 4-digit numbers up to 9999
- A4 size pages to write the numbers in different ways.

Directions:

1. Students will work individually.
2. Pick a number card.
3. Write the number on the page.
4. Using drawings or base ten blocks, build the number.Write how many thousands, hundreds, tens or ones, and write the number in expanded form.
5. Show it to the class and share how the number was built.

Scavenger Hunt

Resource:

- Magazines, newspapers or catalogs
- Glue

Directions:

1. Use magazines, newspapers or catalogs to find the numbers that match the place value clues.
2. Cut and paste the number next to the matching clue in the following table.

Place Value Clue	Number
A number that has 0 in the ones place	

A number with 9 in tens place	
A number greater than 1000	
A number with 3 in hundreds place	
A number smaller than 36	
A number written in word form	
Any number with two of the same digits	

Comparing and Ordering Numbers (Greatest Number Wins)

Resource:

- 3 sets of number cards with numbers 0 to 9 for each group of students.

Directions:

1. Students will work in groups of 3.
2. Mix up the cards and place them in a stack.
3. Each student will draw 4 cards from the stack.
4. Each student will use his number cards to make the greatest 4-digit number.
5. As a group, arrange all the four digit numbers in order. Begin with the greatest.
6. Give scores of 3 points (biggest number), 2 points (middle number) and 1 point (smallest number) to the players.
7. Repeat steps 2 to 6 for three rounds. The player with the most points at the end of the game wins.

Domain: Numbers and Operations

Sub-Domain: Addition and Subtraction

STEP 1 ___ _____

Standard: Students will be able to add and subtract (up to 4-digit numbers), including computation in simple contextual problems.

Student Learning Outcomes: Students will be able to:

- Add multi-digit whole numbers (up to 4 digit) with and without regrouping.
- Subtract multi-digit whole numbers (up to 4 digit) with and without regrouping.
- Use mental and written strategies to add and subtract.
- Estimate the sums and differences of numbers.
- Solve real word problems involving addition and subtraction.
- Evaluate the reasonableness of answers.

Knowledge:
Students will be able to …

- Recognize the language of addition and subtraction, for example
  - Add
  - Sum
  - Plus
  - Minus
  - Difference
- Understand addition and subtraction up to 4–digit numbers with and without regrouping.
- Demonstrate strategies for memorizing addition and subtraction number facts.
- Understand situations involving addition and subtraction.
- Estimate sums and differences.
- Understand word problems involving real life situations of addition and subtraction with and without regrouping.

Skills:
Students will be able to…

- Add numbers
  - Simple Addition within 9999
  - Addition with Regrouping in Ones and Tens
  - Addition with Regrouping in Ones, Tens and Hundreds
- Subtract numbers
  - Simple Subtraction within 9999
  - Subtraction with Regrouping in Ones, Tens and Hundreds
  - Subtraction with Regrouping in Ones, Tens, Hundreds and Thousands
- Describe and use mental and written strategies for adding and subtracting numbers.
- Use fast recall of addition and subtraction number facts in real-life problems.
- Select an appropriate method for solving a problem, for example mental or written strategies.
- Apply estimation strategies to find sums and differences of two numbers in a problem-solving context.
- Use strategies to evaluate the reasonableness of answers.

STEP 2 _____ _____

Assessments
Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,

- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

Fill in the crossword puzzles to make the equations true.

26	+		=	51			+	72	=		
				+		+					
	+	32	=			66	+	47	=		
				=		=					
		23	+	98	=						

Summative Assessments

Some of the sample questions that can be used as part of summative assessment are:

1. Answer these.

i. What is the sum of 1479 and 275? _____

ii. What is the difference between 276 and 2187? _____

iii. Subtract 555 from 1000. _____

iv. What is the missing number?

2361 + _____ = 4589

v. What digit does * represent?

- 6 4 0 0

	*	0	9	5
	*	*	0	5

vi. Find the digits represented by **A** and **B**.

	7	8	3	6
+				
	1	**A**	2	7
	9	3	**B**	3

2. Look at the numbers below.

3631, 4152, 2793, 4015

(a) Find the sum of the greatest odd number and the smallest odd number.

(b) Find the difference between the greatest number and the smallest number.

3. Solve these. Show the working clearly.

i. Ibrahim has 759 marbles

If Ibrahim and Faizan have 1305 marbles altogether, how many marbles does Faizan have?

ii. Ali had 435 toy cars.

His mother gave him 99 more toy cars.

How many toy cars did Ali have altogether?

iii. Zarqam has 1190 books.

He has 186 fewer books than Jawwad.

How many books does Jawwad have?

iv. School A has 1532 students.

It has 354 more students than School B.

How many students does School B have

4. The difference between two numbers is 159.

If the smaller number is 46, what is the first number?

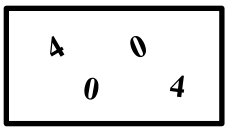
5. There are 3 groups of digits.

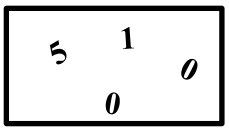
Form a 4-digit number using the digits in each group.

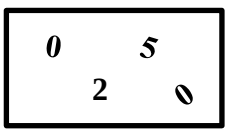
Each number should be smaller than 5000.

Then add all the 4-digit numbers.

Your answer should **not be more than 8000.**







_____ + _____ + _____ = _____

STEP 3 _ _____ _____

Learning Activities
Sum it up!

Resource:
- Sets of number cards with numbers 0 to 9

Directions:
1. Get into groups of four.
- Mix the sets of number cards and place them face down on the table.
- Each player will pick four cards and form two sets of four-digit numbers. Write an addition sentence with both numbers on a piece of paper.
- Take turns to solve each others addition sentences.

Domain: Number and Operations
Sub-Domain: Multiplication and Division

STEP 1 _____ _____

Standard: Students will be able to multiply (up to 4-digit by 1-digit) and divide (up to 4-digit by 1-digit numbers), including computation in simple contextual problems.

Student Learning Outcomes: Students will be able to
- Develop multiplication tables for 6, 7, 8 and 9
- Multiply whole numbers (up to 4 digit numbers) by 1 digit numbers
- Divide whole numbers (up to 4 digit numbers) by 1 digit numbers with and without renaming
- Use fast recall of multiplication and division number facts in real-life situations
- Use mental and written strategies for multiplication and division
- Solve real word problems involving multiplication and division
- Estimate the product and quotient of numbers

- Evaluate the reasonableness of answers
- Use appropriate operations to solve multi step word problems

Knowledge:
Students will be able to:

- Find multiples of 6, 7, 8 and 9
- Understand writing multiplication sentences using concrete and pictorial representations
- Understand the use of concrete and pictorial representation to divide any of two numbers.
- Know that two numbers cannot be divided in any order (commutative).
- Understand how to multiply 2-digit numbers by 1-digit numbers.
- Understand how to multiply 3-digit numbers by 1-digit numbers.
- Understand how to multiply mentally and in written form
- Understand how to solve real-world word problems involving multiplication.
- Recall through concrete and pictorial representation that the division of any two numbers cannot be done in any order (commutative).
- Understand how to divide 2-digit numbers by 1 digit numbers (without remainder) mentally and in written form.
- Understand how to divide 3-digit numbers with 1-digit numbers (without remainder) mentally and in written form.
- Understand how to divide a number by 1 and itself.
- Understand how to solve real-world word problems involving division.
- Understand how to solve real-world word problems involving addition, subtraction, multiplication and division.

Skills:
Students will be able to:

- Develop multiplication tables for 6, 7, 8 and 9
- Describe and use mental and written strategies for multiplication and division.
- Use fast recall of multiplication and division number facts in real-life situations
- Select an appropriate method for solving a problem, for example ,mental or written strategies.
- Apply estimation strategies to predict product and division of two numbers in a problem-solving context.
- Use appropriate operations to solve multi step word problems.
- Use strategies to evaluate the reasonableness of answers.

STEP 2 _____ _____

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests.
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. Answer these.

ii. 8× _____ = 48

iii. What is the value of 42 ÷ 6?

iv. 0×8 = 9 - ☐

v. 9 × 7 = _____

vi. 56 ÷ _____ = 8

vii. 50 – 20 = 6 × ☐

viii. Multiply 54 by 7.

ix. Find the product of 312 and 8.

x. Multiply 600 by 5.

xi. What is the product of 314 and 7?

xii. Multiply 6 by 972.

xiii. 7 × 90 = _____ tens

xiv. 8 × 300 = _____ hundreds

xv. What is 659 ÷ 9?

6. Use the digits 4, 1, 6 and 7 to form the smallest 3-digit number. Multiply the number by 8.

7. Use the digits 3, 7, 2 and 6 to form the greatest 3-digit number. Multiply the number by 3.

8. Find the missing number.

$$\begin{array}{r} 5\ 8 \\ \times\ 6 \\ \hline \\ 3\ \square\ 8 \\ \hline \end{array}$$

6. Solve these. Show your working clearly.

i. Aiza bought 4 packets of butter cookies and 5 packets of chocolate cookies.

ii. How many packets of cookies did she buy altogether?

iii. There were 9 cookies in each packet. How many cookies did she buy altogether?

iv. Ali packed 54 books equally into 9 boxes. How many books did he pack in each box?

v. A spider has 8 legs. How many legs do 9 spiders have?

STEP 3

Learning Activities
Flashing Times

Resource:

- A set of multiplication sentence cards of 6, 7, 8 and 9 for each pair.

Directions:

1. Get into pairs.
2. Mix up the multiplication sentence cards and place them face down in a stack.
3. Take one card and flash it quickly in front of your friend. Your friend must say the answer to the multiplication sentence shown on the card within 5 seconds.
4. If the answer is correct, your friend gets a point. Play until all the cards have been taken.
5. Repeat steps. Take turns to flash the multiplication cards.
   The winner is the person with more points at the end of the game.

Domain: Number and Operations
Sub-Domain: Fractions

STEP 1

Standard: Students will be able to recognize fractions as parts of wholes or collections; find equivalent fractions and represent final result in simplest form; compare and order unlike fractions; add and subtract unlike fractions.

Student Learning Outcomes: Students will be able to:

- Express, recognize and differentiate fractions
- Identify and write equivalent fractions
- Represent fractions in simplest form
- Compare fractions
- Order fractions
- Add like and unlike fractions
- Subtract like and unlike fractions
- Recognize that tenths arise by dividing a whole into ten equal parts

Knowledge:
Students will be able to:

- Recall parts and wholes both visually and numerically.
- Recall which number in a fraction is the numerator and which the denominator is.
- Understand Proper fractions
- Identify equivalent fractions and show families of equivalent fractions.
- Understand how to simplify fractions to the lowest term.
- Understand how to compare and order unlike fractions using symbols <, > and = and order fractions.
- Understand how to add and subtract like fractions (using pictorial representations).
- Know tenths.

Additional/Advanced Content:

Knowledge:
Students will be able to:

- Know reading, comparing and ordering numbers with one decimal place.
- Understand rounding decimals with one decimal place to the nearest whole number.

Skills:
Students will be able to:

- Use fractions in real life situations
- Read, write, compare and order fractions
- Develop Create equivalent fractions
- Simplify fractions
- Add and subtract unlike fractions
- Recognize that tenths arise by dividing an object, single digit number and quantities into ten equal parts (e.g. 2/10 = 0.2)

Additional/Advanced Content:

Skills:
Students will be able to …

- Read, write, compare and order numbers with one decimal place.
- Round decimals with one decimal place to the nearest whole number.

STEP 2

Assessments

Formative Assessment:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests.
- External Exams

Formative Assessments

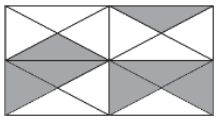
Some of the sample questions that can be used as part of formative assessment are:

1. What are like and unlike fractions? Give examples.
2. What are equivalent fractions? Give examples
3. How can we find an equivalent fraction of a given fraction?
4. How do we simplify a fraction?
5. How do we compare two like fractions?
6. How do we compare two unlike fractions?
7. How do we add or subtract two like fractions?
8. How do we add or subtract two unlike fractions?

Summative Assessments

Some of the questions that can be used as part of summative assessment are:

1. Answer these.



a) What is the fraction of the shaded parts?

b) Write a fraction equivalent to $\frac{12}{24}$.

c) $\frac{2}{5} - \frac{1}{10} =$ _____

d) Write $\frac{4}{24}$ in its simplest form.

e) What is the missing numerator? $\frac{9}{12} - \frac{1}{4} = \frac{\quad}{6}$

f) Which fraction is smaller? $\frac{1}{2}$ or $\frac{1}{4}$

2. Arrange the fractions in order, beginning with the greatest. $\frac{2}{3}, \frac{5}{6}, \frac{7}{12}$

3. Solve these. Show your working clearly.

   a) Azan is thinking of two fractions? The first fraction is $\frac{1}{6}$.
   The second fraction is $\frac{1}{3}$ more than $\frac{1}{6}$.
   What is the second fraction?

   b) Taha painted a door. $\frac{5}{12}$ of it was painted white and $\frac{1}{4}$ It was painted gray.
   The rest was not painted. What fraction of the door was painted?

4. Find the sum of $\frac{2}{4}$ and $\frac{2}{8}$.
   Give the answer in its simplest form.

STEP 3

Learning Activities

Simplify Fractions

Resource:

- Fraction cards

Directions:

1. Students will perform it individually.
2. Pick a card from a set of fraction cards. Explain the fraction shown on the card in its simplest form.
3. Simplify the fraction if it's not in its simplest form.
4. Repeat steps 1 and 2 until all cards are used.

Comparing and Ordering Fractions

Resource:

- Paper strips of same length
- Colour pencils.

Directions:

1. Students will work in groups of three and each group will use 3 strips of paper.
2. Divide a strip into 8 equal parts and shade 7 parts.
3. Divide the other strip in 4 equal parts and shade 3 parts.
4. Divide the third strip in 2 equal parts and shade 1 part.
5. Write the fractions of shaded parts on all three strips.
6. Arrange the fractions in order, beginning with the smallest or greatest.

DOMAIN: Measurement

STEP 1 _____ _____

Standard: Students will be able to measure lengths, mass and capacity; solve problems involving lengths (centimeter, meters, kilometers), mass (gram and kilogram), volume (milliliter and liter), and time (minutes and hours); identify appropriate types and sizes of units and read scales.

Student Learning Outcomes: Students will be able to:

- Recognize the standard units to measure length, mass and capacity
  - Lengths using standard units (kilometre, metre and centimetre).
  - Mass using standard units (kilograms and grams).
  - Capacity using standard units (litres/ millilitres)
- Use different tools to measure
  - Ruler, meter stick, tape meter, dial indicator etc. for length
  - Balances or scales for mass
  - Measuring cylinders for capacity
- Record the measurements of length, mass and capacity
- Add lengths, masses and capacities to solve real-world word problems
- Subtract lengths, masses and capacities to solve real-world word problems
- Use square grid to find area and perimeter of 2D shapes (Squares and rectangles)
- Read and write time using analogue and digital clocks
- Use a.m. and p.m. to record the time for 12 hour clocks
- Add and subtract time to solve real-life word problems
- Read and write days and dates from the Solar and Islamic calendars.

Knowledge:
<u>Length, Mass, Capacity</u>

Students will be able to:

- Know the standard units to measure length, mass and capacity.
- Choose different tools to measure.
  - Ruler, meter stick, tape meter, dial indicator etc. for length
  - Balances or scales for mass such as mechanical, spring, platform, bench and digital scales.
  - Measuring cylinders for capacity
- Read the measuring scales to find lengths in kilometre, metre and centimetre.
- Read the measuring scales to find masses in kilograms and grams.

Skills:
<u>Length, Mass, Capacity</u>

Students will be able to:

- Use new units of measurements.
- Measure and record the:
  - Lengths using standard units (kilometre, metre and centimetre).
  - Mass using standard units (kilograms and grams).
  - Capacity using standard units (litres/ millilitres)
- Add and subtract measures of length, masses and capacities in same units without regrouping.
- Solve real life problems of length, mass and capacity in the same units involving addition and subtraction without regrouping.

- Read the measuring scales to find capacity in litre and millilitre
- Know addition and subtraction of measures of lengths, masses and capacities in same units without regrouping.

Area and Perimeter

Students will be able to:

- Understand the terms area and perimeter.
- Know the units of measurement of area and perimeter.
- Understand the use of square grid to find the perimeter and area of 2-D figures (Squares, rectangles) and irregular figures (figures cover either ½ or 1 square unit only).

Time

Students will be able to:

- Understand the use of clocks:
  - Analogue clock
  - Digital clock
- Understand the time is measured using universal units of measure, hours and minutes.
- Understand how to read and write the time in hours and minutes.
- Tell time to the minutes using the terms 'past' and 'to' tell time.
- Select a.m. and p.m. to record the time for the 12-hour clock.
- Know addition and subtraction of time given in the same units to solve word problems.
- Find dates and days from the solar and Islamic calendars.

Area and Perimeter

Students will be able to:

- Recognize and identify the units of measurement of area and perimeter.
- Find the perimeter and area of 2-D figures (Squares and rectangle) on a square grid.
- Find the perimeter and area of irregular figures (figures cover either ½ or 1 square unit only) on a square grid.

Time

Students will be able to:

- Read and write time in hours and minutes using analogue and digital clock.
- Read and write time to the minutes using the terms 'past' and 'to' tell time.
- Identify various events, what time they take place, and identify whether the time is a.m. or p.m.
- Add and subtract measures of time given in the same units to solve word problems.
- Determine the days and dates from the solar and Islamic Calendar.
- Subtract units of time using the same units of time involving hours and minutes.

STEP 2

Assessments

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and

their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam Tests
- External Exams

Some of the sample questions that can be used as part as part of formative assessment are:

1. How many grams are there in 1 kg?
2. How many centimeters make 1 meter?
3. When do we use kilometers instead of meters or centimeters?
4. What is the difference between area and perimeter?
5. Why 'past' and 'to' are used to tell the time?
6. Sara got engaged in February 2021. 7 months later, she got married.

   When did she get married?
7. Answer these. Use a calendar to help you.
   - **i.** What is the date after 2 weeks of 25 January?
   - **ii.** What is the date after a month of 6 October?
   - **iii.** Which is the third Solar month?
   - **iv.** Which month comes before January?
   - **v.** Which is the first Islamic month?
   - **vi.** Which is the ninth month of Islamic calendar?
   - **vii.** How many days are in December?
   - **viii.** How many days are in an Islamic month?
   - **ix.** List all the months which have 30 days.
   - **x.** List all the months which have 31 days.
   - **xi.** Which month has either 30 or 31 days?
   - **xii.** How many days are there in the first and the second six months?
   - **xiii.** How many days are there in the whole year?

Summative Assessments

Some of the sample questions that can be used as part of summative assessment are:

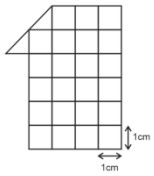
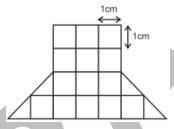
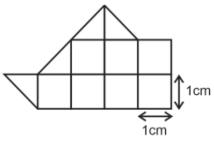
1. There are 5 lamp posts along a road. The distance between two lamp posts is equal. If the distance between two lamp posts is 12cm. What is the length of the road? What is the length of the road in meters?

2. Yellow bucket can hold $5l\ 60ml$ of water. White bucket can hold $1850ml$ less water than the yellow bucket. What is the capacity of white bucket?
   Give your answer in liters and milliliters.

3. Fill in the boxes.

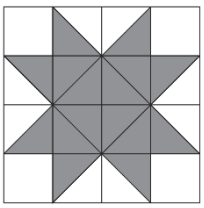
i.	$3705ml$	=		l		ml
ii.	$7411kg$	=		k		g
iii.	$5000ml$	=		l		ml
iv.	$6354m$	=		m		$cm,$

4. What is the area of each figure?

		
A	**B**	**C**

a) Area of figure A = _____
b) Area of figure B = _____
c) Area of figure C = _____
d) Figure _____ has the greatest area.

5. What is the area of the shaded figure?



6. What time is 20 minutes past in the morning?

7. If it is half past 11 in the morning. What is the time 3 hours and 10 minutes from now? Include a.m. or p.m. in your answer.

STEP 3

Learning Activities

Activity 1: Litres and Millilitres

Resource:

- A beaker
- 1-L measuring cylinder
- Water

Directions:

1. Fill a beaker with 100 ml of water.
2. Pour the water of the beaker into a 1-L measuring cylinder.
3. Repeat this process until the measuring cylinder is filled with water to the 1-L mark.
   Count by hundreds to know how many beakers with 100 ml water were put in the 1-L cylinder.
   How many millilitres make 1-L?

Activity 2: Measure!

Resource:

- Ruler or measuring tape.

Directions:

1. Work in pairs.
2. Measure any four objects for example width of teacher's table, length of door, width of black/white board, doorknob height, length of garden or front bench etc.
3. Record the lengths using metres and centimetres both.

Activity 3: The Dates

Resource:

- Solar Calendar of the current year
- Islamic Calendar of the current year
- List of questions

Directions:

1. Students can work in pairs or in groups of 3.

2. They will use Islamic calendar of the current year to find the answers of the following questions that will be part of the list.
   (a) What is the solar date and the day on the first day of Islamic year?
   (b) Write the Islamic dates of all the Fridays of the holy month of Ramadan?
   (c) What are the solar and the Islamic dates today?
   (d) Write the solar date of the last Sunday in March.
   (e) Write the days for the dates of 1st May, 10th Zil hajj and 14th August.

Activity 4: Area and Perimeter

Make a Robot, Monster, Animal or Any Kind of Object and find its Area and Perimeter.

Resource:

- Square grid paper for each student
- Colour pencils.

Directions:

1. Distribute a sheet of square grid paper to each student.
2. Ask them to make a robot, monster, person or animal of their choice.
3. Then they will figure out the area and perimeter of the shape and then color the squares in the object.

DOMAIN: Geometry

Step 1:
Standard: Students will be able to analyze characteristics and properties of 2D and 3D shapes;use elementary properties to compare two-dimensional shapes (circles, triangles, squares, rectangles, and other polygons); identify line, line segment and reflective symmetry.
Student Learning Outcomes: Students will be able to: ● Describe the characteristics of 3-D objects and 2-D shapes. ● Analyze the relationships among 3D and 2D shapes. ● Understand the properties of regular and irregular polygons (pentagon, hexagon, octagon and decagon) according to the number of sides. ● Identify and differentiate between prisms and pyramids with respect to the number of edges, faces and vertices. ● Identify line segments. ● Identify and recognize lines of reflective symmetry.

- Recognize quarter turns as right angles, half turns as two right angles and 3-quarter turns as three right angles.
- Identify and recognize center, radius and diameter of circles.
- Describe the position and movement.

Knowledge:
Students will be able to:

- Understand that there are relationships between 2D shapes and 3D objects.
- Understand the properties of regular and irregular polygons according to the number of sides (pentagon, hexagon, octagon and decagon).
- Identify and differentiate between prisms and pyramids with respect to the number of edges, faces and vertices.
- Recognize point, line (horizontal and vertical lines), ray and line segment.
- Identify quarter turns as right angles (and vice versa).
- Identify half and 3-quarter turns (clockwise and anti-clockwise) as two and three right angles respectively.
- Identify the centre, radius and diameter of a circle.
- Identify reflective symmetry in 2-D shapes.
- Understand that examples of symmetry and transformations can be found in their immediate environment
- Understand that directions can be used to describe pathways, regions, positions and boundaries of their immediate environment .

Additional/Advanced Content:
Knowledge:
Students will be able to:

- Parallel and non-parallel lines (through real-life examples)

Skills:
Students will be able to:

- Sort, describe and label 2D and 3D shapes.
- Analyse and describe the relationships between 2D and 3D shapes.
- Differentiate between line and line segment.
- Draw and measure line segments in centimeters.
- Recognize quarter turns as right angles, half turns as two right angles and 3-quarter turns as three right angles.
- Identify lines of reflective symmetry
- Interpret, create and use simple directions, describing paths, regions, positions and boundaries of their immediate environment.
- Recognize and explain simple symmetrical designs in the environment.
- Apply knowledge of symmetry to problem-solving situations.

Additional/Advanced Content:
Skills:
Students will be able to:

- Recognisz and identify parallel and non-parallel lines.

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

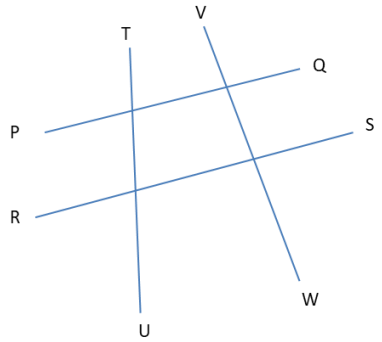
- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

1. What is an angle?
2. Where can you find angles? Give examples.
3. How is the size of an angle measured?
4. How many quarter turns make a right angle?
5. How many angles do 3, 4 and 5-sided figures have? Give examples.
6. *Tell names of any two objects from real life that have parallel lines.*

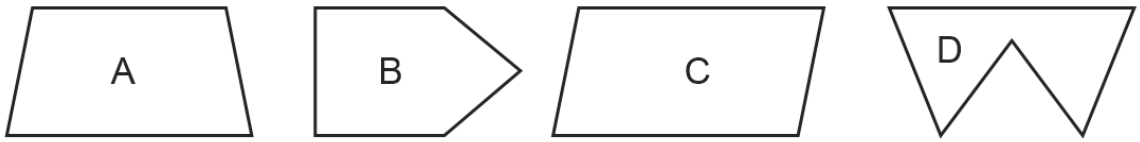
Some of the sample questions that can be used as part of summative assessments are:

1. Look at the following figure. Circle “True” or “False”.

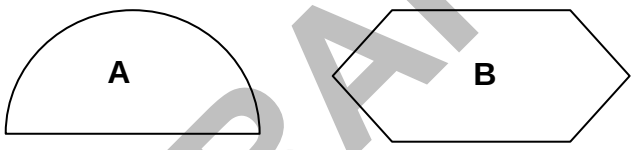


i.	PQ // RS	True / False
ii.	TU // VW	True / False
iii.	TU ⊥ PQ	True / False
iv.	RS ⊥ TU	True / False

2. Circle (○) the figure that has both parallel and perpendicular lines.



3. How many inside angles are in the figures below?



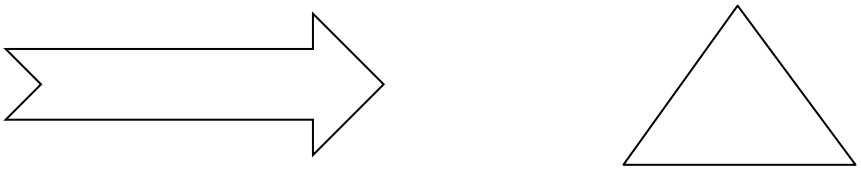
ii. There are _____ inside angles in figure A.

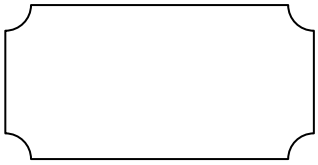
iii. There are _____ inside angles in figure B.

4. Study the angles in each figure and answer the questions.

How many right angles are there in all three figures? _____

5. Draw a line of symmetry on each shape.





STEP 3

Learning Activities
Activity 1: Angles (Finding Angles In Classroom)

Directions:

1. Work in groups of 3.
2. Make a list of objects in your classroom in which you can find angles.
3. Share your list with other groups.

Activity 2: Finding Letters with Angles

Directions:

1. Students can work in pairs or in small groups.
2. They will find the following letters of the alphabet:

(a) Letters that do not have any angle.
(b) Letters that have right angles.
(c) Letters that have an angle bigger than a right angle.
(d) Letters that have an angle smaller than a right angle.

Activity 3: Angles in Pictures (Resource: Math Smart Alston)

Resource:

- 20 toothpicks
- A4 Paper
- Sticky tape or glue
- Red, blue and green colour pencils.

Directions:

1. Students will work in pairs.
2. Use toothpicks to form a picture on the paper. The picture should have at least one acute angle, one right angle and one obtuse angle.
3. Paste the toothpicks onto the paper using sticky tape or glue.

4. Mark all the angles in the picture. Then, colour the acute angles red, the right angles blue and the obtuse angles green.
5. Share and discuss the picture and the set of angles in it with your classmates.

DOMAIN: Algebra

STEP 1 _____ _____	
Standard: Students will be able to analyze a well-defined pattern (e.g., describe the relationship between adjacent terms and generate pairs of whole numbers given a rule); identify or write expressions or number sentences to represent problem situations that may involve unknowns.	
Student Learning Outcomes: Students will be able to: ● Identify the number patterns using basic operations of mathematics ● Extend and create patterns in numbers ● State the rules that are followed to write a pattern ● Recognize the inverse relationship between adze and use the associative and commutative ● properties of addition	
Knowledge: Students will be able to: ● Know that patterns can be found in numbers, for example, odd and even numbers, skip counting. ● *Know* that patterns can be analyzed and rules identified. ● Understand the inverse relationship between addition and subtraction . ● Understand the associative and commutative properties of addition.	**Skills:** Students will be able to: ● Recognize a given increasing and decreasing pattern by stating a pattern rule. ● Extend and develop patterns in numbers. ● Use number patterns to represent and understand real-life situations. ● Use the properties and relationships of addition and subtraction to solve problems.

STEP 2 _____ _____

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. What will be the next five terms if we count in twos and start from 14?
2. What will be the pattern of the next 5 even numbers if we start from 24?
3. Write the pattern rule for the given patterns.
    a) 212, 222, 232, 242, 252
    b) 95, 90, 85, 80, 75
    c) 110, 210, 220, 320, 33

Some of the sample questions that can be used as part of summative assessments are:

1. What is the pattern rule of the given shapes?

Image by: http://www.mstworkbooks.co.za/mathematics/gr8/gr8-mathematics-04.html

2. Farah was overweight. She wanted to lose weight so she put her on a diet. Farah lost 12kg in the first month, 10kg in the second month and 8kg in the third month, when she was on the diet. Her mass loss followed a number pattern.

    Use the information to complete the table below.

Month	1st	2nd	3rd	4th	5th	6th
Mass loss	12kg	10kg				

3. Find the missing number in the given pattern.
   a) 7200, 7220, 7240, 7260, _____, _____.
   b) 9480, 9280, _____, 8880, 8680, _____.
   c) 11, 13, 14, 16, 17, 19, 20, _____, 23.

STEP 3 _ _____ _____

Learning Activities
Activity 1: Pattern Roll
Resource:

- A dice
- 14 pattern-rule cards with words such as count on in twos, count back in threes

Directions:

1. Work in pairs.
2. Mix up the cards and place them face down in a pile.
3. One player rolls the dice four times to form a 4 digit number.
   The same person then picks a card from the pile and places it face up on the table.
4. Based on the pattern rule written on the card, get your friend to write down the next three numbers, starting from the four-digit number that was formed.
5. Take turns to roll the dice and pick a card. Repeat steps.
6. Continue doing this until all the cards have been used up.

DOMAIN: Statistics and Probability

STEP 1 _____ _____

Standard: Read and interpret data from Carroll diagram. Organize and represent data to help answer questions. Identify chance in daily events.

Student Learning Outcomes: Students will be able to:

- Use Carroll diagram to display the data.
- Interpret Carroll diagram.
- Display, and analyze data to solve problems.
- Use data to solve problems.
- Use the concept of chance (probability) in daily events.
- Express the chance of an event happening using words or phrases;

- possible
- impossible
- less likely
- more likely
- equally likely
- unlikely
- certain

- Classify events as certain, possible, or impossible.
- Find probabilities in events.

Knowledge:
Students will be able to:

- Understand Carroll diagrams.
- Understand the use of data to solve problems.
- Understand the concept of chance (probability) in daily events.
- Express the chance of an event happening using words or phrases;
  - possible
  - impossible
  - less likely
  - more likely
  - equally likely
  - unlikely
  - certain
- Classify events as certain, possible, or impossible.
- Find probability in real-life situations.

Additional/Advanced Content:
Knowledge:
Students will be able to:

- Know bar graphs and column graphs.

Skills:
Students will be able to:

- Display and interpret data for the purpose of answering questions.
- Represent and interpret the data using Carroll diagrams.
- Organize and represent data to solve problems.
- Identify and describe chance in daily events.
- Connect and use correct terms related to probability in real world events.
- Use probability to determine mathematically fair and unfair games and to explain possible outcomes.
- Solve problems involving probability of simple events.

Additional/Advanced Content:
Skills:
Students will be able to:

- Read and interpret bar graphs and column graphs.

STEP 2

Assessments
Formative Assessments
Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and

their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments
Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of the summative assessments are:

1. Put the following numbers in the correct position in the Carroll diagram.

33	21	5	13	28
14	30	18	24	9
50	29	7	15	11

	Multiple of 3	Not a multiple of 3
Even		
Odd		

2. Put the following numbers in the correct position in the Carroll diagram.

30	21	5	13	28
14	30	45	24	65
50	29	7	15	20

	Multiple of 3	Not a multiple of 3
Multiple of 5		
Not a multiple of 5		

STEP 3

Learning Activities
Activity 1: Carroll Diagram

Resource:

- A set of 10 coloured 2-D shapes
- a sheet of paper with blank Carroll Diagram

Directions:

1. Get your students into groups of 3 or 4. Teacher will give each group the material students need.
2. Groups will discuss how they can sort the shapes in two different ways.
3. Fill in the Carroll diagram by following the steps below:
   - Write the correct labels, for example, 'Red' and 'Not red' or 'Triangles' and 'Not triangles'.
   - Draw and colour the different shapes under their correct labels. Present your Carroll diagrams to your classmates.

Resource:

http://www.mstworkbooks.co.za/mathematics/gr8/gr8-mathematics-04.html

https://oup.com.pk/school-textbooks/mathematics/new-syllabus-mathematics-book.html

Alston Publishing House-Math SMART Textbooks

MY PALS ARE HERE! MATH 3rd Edition

DRAFT

Mathematics - Class 4
Suggested Guidelines

DOMAIN: Numbers and Operations
Sub-Domain: Numbers and Place Value

STEP 1	
Standard: Count, read and write numbers; identify place value of numbers up to 99,999, compare and order numbers up to 99,999; round off numbers to the nearest tens, hundreds, thousands and ten thousand; read and write Roman numbers up to 100	
Student Learning Outcomes: Students will be able to: ● Count, read and write numbers up to 99 999 (5-digit number) ● Recognize the place value of each digit in a 5-digit number ● Compare two numbers up to 5 - digit numbers using symbols "<", ">", or "=" ● Order the given set of numbers in ascending and descending order (up to 5 - digit numbers) ● Round off numbers to the nearest tens, hundreds, thousands and ten thousands ● Read and write Roman Numbers up to 100	
Knowledge: Students will be able to: ● Know numbers up to 99999 in numerals and words. ● Know the use of place value charts to read, write and represent up to 5-digit numbers. ● ● Express a 5-digit number in its expanded form. ● Know comparison of two or more than two numbers using symbols (>, < or =) and appropriate language 'greater than', 'smaller than'. ● Know comparison of more than two numbers up to 99999 using appropriate language: 'Greatest', 'smallest' and 'same as'.	**Skills:** Students will be able to: ● Count numbers up to 99999 using various materials (e.g. Block charts, base ten materials, abacus, hundreds chart etc.). ● Read numbers up to 99999. ● Write numbers up to 99999 in numerals and words. ● Find the numbers in the sequence between any two given numbers forward and backward from 0 to 99999 ● Identify the place and place value of each digit up to 5-digit numbers. ● Expand numbers up to 99999 using place values (partition). ● Use whole numbers in real-life problems. ● Solve a variety of questions involving place value concepts. ● Compare numbers using symbols (>, < or =).

● rounding numbers to the nearest tens, hundreds, thousands and ten thousand using different concrete and pictorial representations. ● Know Roman Numbers up to 100. ●	● Arrange numbers up to 99999 using appropriate language and from greatest to smallest. ● Develop rounding skills to build number sense and round off numbers to the nearest tens, hundreds, thousands and ten thousand ● Read and write Roman Numbers up to 100.

STEP 2

Assessments
Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Following questions can be part of formative assessment:

1. What is the smallest 5-digit number?
2. What is the greatest 5-digit number?
3. What is the place value of the digit '7' in 74001?
4. In 70 531, the digit having the **samllest value** is in the _____ place.
5. In 35 703, the **greatest digit** stands for _____ .
6. Do all digits have same values in number 66666? Why?
7. How are the given numbers different? 37108, 37017
8. What is the smallest 5-digit number that can be formed using 7, 3, 0, 4, 5
9. **Find the 5-digit number by using the clues below.**
   - All digits are different.
   - The value of the digit 2 is 2.
   - The digit 5 is in the **ten thousands** place.

- The digit in the **thousands** place is **1 more than** the digit in the **ones place**.
- The **sum** of the digit in the **tens place** and **hundreds place** is 16.
- The digit in the hundreds place is greater than the digit in the tens place.

STEP 3

Learning Activities
Scavenger Hunt
Resource:
- Magazines, newspapers or catalogs
- Glue

Directions:
1. Use magazines, newspapers or catalogs to find the numbers that match the place value clues.
2. Cut and paste the number next to the matching clue in the following table.

Place Value Clue	Number
A number that has 0 in the ones and tens places	
Any Roman number	
A number greater than 1000	
A number with 3 in the thousand place	
A number smaller than 25	
A number written in word form	
Any number with three of the same digits	

Domain: Numbers and Operations
Sub-Domain: Addition and Subtraction

STEP 1	
Standard: Students will be able to add and subtract (up to 5-digit numbers), including computation in simple contextual problems; estimate the sums and differences.	
Student Learning Outcomes: Students will be able to: ● Add multi-digit whole numbers (up to 5 digit) with and without regrouping ● Subtract multi-digit whole numbers (up to 5 digit) with and without regrouping ● Use mental and written strategies to add and subtract ● Estimate the sums and differences of numbers ● Solve real word problems involving addition and subtraction ● Evaluate the reasonableness of answers	

Knowledge:
Students will be able to:
 	
● Recognise the language of addition and subtraction.
● Understand addition and subtraction up to 5–digit numbers with and without regrouping.
● Demonstrate strategies for memorizing addition and subtraction number facts.
● Understand situations involving addition and subtraction.
● Estimate sums and differences.
● Understand word problems involving real life situations of addition and subtraction with and without regrouping.
	Skills:
	Students will be able to:
	
	● Add numbers
	  ● within 99999
	  ▪ Addition with Regrouping in Ones, Tens, Hundreds and Thousands
	● Subtract numbers
	  ● within 99999
	  ● Subtraction with Regrouping in Ones, Tens, Hundreds, Thousands and Ten Thousand
	● Describe and use mental and written strategies for adding and subtracting numbers.
	● Use fast recall of addition and subtraction number facts in real-life problems.
	● Select an appropriate method for solving a problem, for example, mental or written strategies.
	● Apply estimation strategies to find sums and differences of two numbers in a problem-solving context.
	● Use strategies to evaluate the reasonableness of answers.

STEP 2

Assessments
Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. Encircle the correct answer:

i. 5 ones + 7 ones = _____ ten + 2 ones.

A) 1 b) 2 c) 3 d) 4

ii. 6 tens + 8 tens = 1 hundred + _____ tens.

A) 1 b) 2 c) 3 d) 4

iii. 5 046 + 200 = _____

A) 7 046 b) 5 246 c) 5 066 d) 5 048

iv. 3 985 – 300 = _____

A) 985 b) 3 385 c) 3 685 d) 3 955

v. 2 tens – 8 ones = 1 ten + _____ ones.

A) 1 b) 2 c) 3 d) 4

2. Fill in the crossword puzzles to make the equations true.

	+	78	=				+	65	=	89

+				+		+				
35			+		=	92				
=				=		=				
57				147			+		=	140

3. What digit does * represent?

	6	2	4	0	5
-	3	4	0	9	*
	2	*	*	1	0

STEP 3

Learning Activities

Resource:

- A 6 faced dice for each pair of students
- A blank sheet

Directions:

1. Students will work in pairs.
2. One student will roll the dice to make a 4-digit number.
3. Then his partner will roll the dice to make another 4-digit number.
4. Estimate the sum of the first and the second number.
5. Add the numbers.
6. Make a table of 6 by 2 (6 rows and 2 columns) on the sheet with the following headings: Estimated Sum, Actual Sum
7. Students will record their estimated sum and actual sum.
8. Repeat steps 2 to 7 five times.
9. Compare the answers with the estimated sums. Are the answers reasonable?

Domain: Number and Operations

Sub-Domain: Multiplication and Division of Whole Numbers, Factors and Multiples

STEP 1

Standard: Multiply up to 4-digit numbers by 2-digit numbers (with and without regrouping) and divide 4-digit numbers by 2-digit numbers (with and without regrouping). Solve real world scenarios involving multiplication and division and further involving all four operations. Test the divisibility up to 4-digit number by 2, 3, 5 & 10. Identify, differentiate, and find factors (factor pairs) and multiples. Find common factors and common multiples. Also identify and differentiate prime and composite numbers.

Student Learning Outcomes: Students will be able to:

- Multiply up to 4-digit numbers with 1-digit and 2-digit numbers mentally and in written form
- Divide up to 4-digit numbers by 1-digit and 2-digit numbers in written form
- Solve real-world word problems involving multiplication and division
- Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication, and division
- Identify divisibility rules for 2, 3, 5 and 10 and use them up to 4-digit numbers
- Identify and differentiate between multiples and factors and find:
  - All factor pairs of a number
  - Common factors of two numbers
  - Common multiples of two or more 2-digit numbers
- Identify and differentiate between 2-digit prime and composite numbers up to 50

Knowledge:

Students will be able to:

- Know multiplication of 4-digit number with 1 & 2-digit number with and without regrouping.
- Know division of 4-digit number with 1 & 2-digit number with and without regrouping.
- Know the divisibility rule of division by 2, 3, 5 and 10.
- Understand the use of appropriate operation(s) to solve real-world problems.
- Understand how to solve real-world word problems involving addition, subtraction, multiplication and division.

Skills:

Students will be able to:

- Multiply 4-digit number with 1 & 2-digit numbers without and with regrouping.
- Divide 4-digit number with 1 & 2-digit numbers without and with regrouping
- Use mental methods to multiply and divide numbers.
- Use the divisibility test to ascertain the divisibility of a 4-digit number by 2, 3, 5 and 10.
- Select appropriate operations to solve real-world word problems involving addition, subtraction, multiplication, and division.
- Apply estimation strategies to predict product and division of two numbers in a problem-solving context.
- Use appropriate operations to solve real life problems.
-

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. The product of 3 and a number is 393.
   What is the number?

2. When a number is divided by 5, it has quotient 1241 and a remainder of 0. What is the number?

3. The product of three numbers is 1200.
   What are the three numbers?

4. Tick (✓) the numbers that are divisible by 5.

30	**38**	**785**	**551**	**5 041**

050	**3 000**	**. 423**	**3 511**	**L43**	**9 835**

5. **Fill in the blanks by putting 2, 3 or 5.**
   a) 24 is divisible by _____ and _____.
   b) 75 is divisible by _____ and _____.
   c) 12540 is divisible by _____ and _____.
   d) 92745 is divisible by _____ and _____.
   e) Write any 3 digit number which is divisible by 2, 3 and 5 _____.

STEP 3

Learning Activities
Activity: Statement Cards

Resource:
- Cards with different statements such as “I am 250, who is 12 x 12? I am 144, who is 25 x 8? I am 200, who is 50 x5?”

Directions:
1. Each student will get a card.
2. One student will read his card such as "I am 250, who is 12x12?”
3. Everyone in the class gets involved. The student who has 144 speaks up next by reading his own card.
4. The process will continue until everyone has read out their card and found the answers.

Domain: Number and Operations
Sub-Domain: Fractions

STEP 1

Standard: Differentiate among different forms of fractions. Interconvert improper and mixed fractions. Compare and order like and unlike fractions. Add and subtract fractions with same and different denominators. Multiply different forms of fractions with whole numbers and two fractions. Solve real life scenarios related to fractions.

Student Learning Outcomes
Students will be able to:
- Differentiate among,
  - Proper fractions
  - Improper fractions
  - Mixed numbers
- Convert improper fractions to mixed numbers and vice versa.
- Compare and order unlike fractions.
- Add and subtract fractions with,
  - Same denominator and
  - Denominators that are multiples of the same number

  And write the answer in mixed numbers (if applicable).
- Multiply and divide proper, improper fractions and mixed numbers by a whole number.
- Multiply two fractions and/or mixed numbers.
- Solve real-world word problems involving fractions by identifying appropriate operations.

Knowledge: Students will be able to: ● Know the difference between proper fractions, improper fractions and mixed numbers. ● Understand the conversion of improper fraction into mixed number using the operation of division. ● Understand the conversion of mixed number into improper fraction using operation of multiplication and addition. ● Differentiate between like and unlike fractions. ● Convert unlike fractions into like fractions by using the concept of equivalent fraction. ● dfhgjfh	**Skills:** Students will be able to: Students will be able to: ● Identify and differentiate; – Proper fractions – Improper fractions – Mixed numbers ● Convert improper fractions to mixed numbers and vice versa. ● Compare and order two unlike fractions ● Add and subtract fractions with: – Same denominator and – Denominators that are multiples of the same number (either using the concept of LCM / Equivalent Fractions) And write the answer in mixed numbers (if applicable). ● Multiply proper, improper fractions and mixed numbers by a whole number. ● Multiply two proper or improper fractions and/or mixed numbers. ● Solve real life situations involving addition and subtraction of fractions.

STEP 2

Assessments

Formative Assessment:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests

- External Exams

Formative Assessments
Some of the sample questions that can be used as part of formative assessment are:

1. Look at the shapes. Then answer the following questions.

   i. What fraction of the shapes are stars?

   ii. What fraction of the shapes are circles?

2. Answer these
   i. How many sevenths are there in $2\frac{5}{7}$?
   ii. What is $\frac{5}{8}$ Of 48?
   iii. Write a mixed number to represent the shaded parts.

   iv. What is an improper fraction of $3\frac{5}{9}$?
   v. Find $\frac{3}{7}$ Of 21.
3. Ali had to travel $\frac{8}{9}$ Km from his home to the library and then to school.
   The distance between his home and the library was $\frac{1}{3}$ Km.
   How much was the distance between the library and school?

STEP 3

Learning Activities
Pair Activity
Resources:

- Paper chits
- Two empty boxes tagged as proper fractions and improper fractions.

Directions:

- Students will work in pairs.
- Provide each pair with blank paper chits (4 or 5).
- All pairs of students will write some proper and improper fractions on the given blank chits.
- All pairs of students will exchange their chits.
- Each pair will now sort out the proper and improper fractions and place them in the tagged boxes accordingly.
- Make sure every pair has some fractions to sort into boxes.
- Check the boxes at the end for any wrong placements.

Domain: Number and Operations
Sub-Domain: Decimals

STEP 1	
Standard: *Recognize, read, write, compare and order decimal numbers up to three decimal places along with their place value along with rounding off. Also* interconvert fractions and decimals*. Add, subtract, multiply and divide decimal numbers. Solve real life scenarios involving decimals using appropriate operation. Recognize percent symbol and its relevance to parts per hundred and fractional form.*	
Student Learning Outcomes: Students will be able to: ● Understand tenths, hundredths and thousandths. ● Recognise, read and write decimal numbers. ● Identify the place value of decimal numbers up to three decimal places. ● Recognise the result of dividing numbers up to digits by 10, 100 or 1000. ● Express decimal numbers as fractions. ● Compare and order decimal number up to three decimal places. ● Round decimal numbers (with three decimal places) to the nearest whole number, one decimal place and two decimal places. ● Add and subtract decimal numbers. ● Multiply and divide decimal numbers. ● Solve real-world word problems of decimal numbers. ● Solve mathematical expressions using correct order of operation involving whole numbers, decimals, and fractions. ● Recognize the percent symbol (%) and understand that per-cent relates to; number of parts per hundred, and write percentage as fraction with denominator 100.	
Knowledge: Students will be able to: ● Understand Tenths, Hundredths and Thousandths ● Understand decimal as a fraction up to three decimal ● Understand fractions with denominator 10, 100 or 1000 as equivalent decimals. ● Know comparison of two decimal numbers up to three decimal p[laces ● Know comparison of more than two decimal numbers up to three decimal places ● Arrange the decimal numbers ● Know rounding off of decimal numbers up to three decimal places.	**Skills:** Students will be able to: ● Recognize, read and write decimal numbers. ● Identify the place value of decimal numbers up to three decimal places. ● Recognize the result of dividing numbers up to digits by 10, 100 or 1000. ● Express a decimal number up to three decimal places as a fraction. ● Compare and order decimal numbers up to three decimal places. ● Round decimal numbers (with three decimal places) to the nearest whole number, one decimal place and two decimal places. ● Add and subtract numbers up to three decimal places. ● Multiply and divide numbers up to three decimal places by;

● Know the addition and subtraction of decimal numbers ● Know the multiplication and division of decimal numbers ● Understand the order of operations in mathematical expressions ● Know the percent as parts per hundred	– A 1-digit number – A 2- digit number ● Multiply and divide decimal numbers up to one decimal place by 10 or 100. ● Use appropriate operations to solve real-world word problems of decimal numbers. ● Recognize the order of operations and solve mathematical expressions involving whole numbers, decimals, and fractions. ● Recognize the percent symbol (%) and understand that per-cent relates to; number of parts per hundred, and write percentage as fraction with denominator 100.

STEP 2

Assessments

Formative Assessment:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Formative Assessments

Some of the sample questions that can be used as part of formative assessment are:

1. Choose the correct answer. Write its number in the bracket given.

i. 27 tenths = _____ ones 7 tenths.

A) 0.02 b) 0.2 c) 2 d) 202

ii. 0.7 + _____ = 1.5

A) 0.5 b) 0.6 c) 0.7 d) 0.8

iii. By subtracting 0.9 from 2.7 we get;

A) 0.18 b) 1.8 c) 18 d) 0.6

iv. 0.09 · 5 = _____

A) 0.045 b) 0.45 c) 4.5 d) 45

v. 28 tenths ÷ 4 = _____ tenths

A) 4 b) 5 c) 6 d) 7

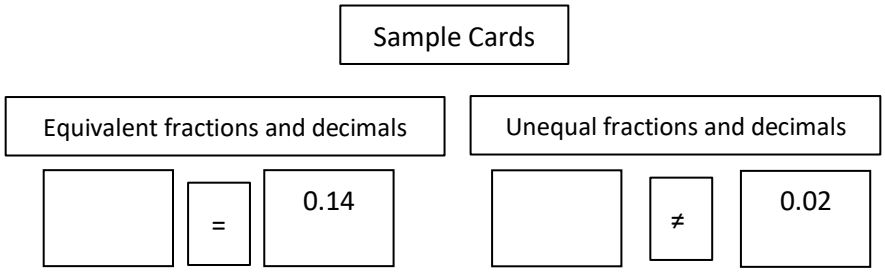
2. Add: 12.05 + 3.45
3. Subtract: 15.76 – 7.05
4. Multiply: 41.36 · 6
5. Divide: 3.91 ÷ 7
6. Divide: 5 ÷ 7 correct to the nearest hundredths.

STEP 3

Learning Activities

Resource:

- A set of 10 cards (5 Fraction cards and 5 cards of decimal numbers equivalent to fractions) for each group
- A set of 6 extra cards of fractions and decimals for each group



Directions:

- Students will work in groups of 4.
- Teacher will prepare fraction cards with denominators 10, 100 and 1000 and the cards of decimal numbers equivalent to the fraction cards.

- Prepare 6 extra fraction and decimal cards also that do not match.
- Distribute the set of 16 (10 equivalent and 6 extra) cards to each group.
- Students will match the fraction and decimal cards that are equal.
- The group who will match all the cards correctly will win.

DOMAIN: ALGEBRA

STEP 1

Standard: Identify, describe and complete patterns of numbers; identify and use relationships in a well-defined pattern.

Student Learning Outcomes:
Students will be able to:

- Describe the pattern found in a given table or chart using a pattern rule.
- Complete the given increasing and decreasing number patterns.
- Identify and write expressions or number sentences to represent problems that may involve unknowns.
- Identify and use relationships in a well-defined pattern (e.g., describe the relationship between adjacent terms and generate pairs of whole numbers given a rule).

Knowledge:	**Skills:**
Students will be able to: ● Understand pattern in shapes. ● Understand pattern in numbers.	Students will be able to: ● Describe the pattern found in the number sequence, tables and charts. ● Complete the given increasing and decreasing number patterns. ● Identify and write expressions or number sentences to represent problems that may involve unknowns. ● Identify and use relationships in a well-defined pattern (e.g., describe the relationship between adjacent terms and generate pairs of whole numbers given a rule).

STEP 2

Assessments

Formative Assessment:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Formative Assessments

Some of the sample questions that can be used as part of formative assessment are:

1. Observe the given chart and find at least 3 patterns. Also see the rules for these patterns.

21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70

Pattern 1: _____

Rule: _____

Pattern 2: _____

Rule: _____

Pattern 3: _____
Rule: _____

2. Observe the table given below and describe the rule of pattern. Complete the table.

(a)

Position	Term
1	2
2	3
3	5
4	8
5	12
6	
7	

(b)

Position	Term
1	40
2	35
3	29
4	22
5	
6	

Rule _____ Rule _____

STEP 3

Learning Activities

Activity 1:

Resource:

- White boards
- Whiteboard markers

Directions:

- Students will gather in the common area of the classroom with their whiteboards and whiteboard markers.
- Ask them to write or make any pattern of their choice on the whiteboards.
- Ask them to simply complete it.
- Teacher will notice whether students draw shapes, words, or numbers.
- Students will share their patterns with their classmates.

Activity 2:

Resource:

- Real life objects

Directions:

- Students will think of real-life patterns they have seen before. (e.g., the way bricks are organized on a building, a design that is on socks, the markings on a butterfly)

DOMAIN/STRAND: GEOMETRY

STEP 1

Standard: Students will be able to understand lines, angles, parts of circle and symmetrical shapes with line of symmetry.

Student Learning Outcomes:
Students will be able to:

- Recognize and identify parallel and non-parallel lines.
- Describe the radius, diameter, and circumference of a circle.
- Recognize and identify acute, right, and obtuse angles.
- Compare and order angles up to 180 degrees by size.
- Measure and draw angles (using a protractor) within 180 degrees.
- Recognize and draw lines of symmetry in 2-D shapes and complete symmetrical figures with respect to a given line of symmetry.

Knowledge:
Students will know:

- The condition for lines for being parallel.
- The condition not being fulfilled being non-parallel lines.
- The radius as the distance between center and boundary of a circle.
- The diameter as double of radius.
- The circumference as perimeter of a circle.
- The acute, right and obtuse angles.
- The measurement and drawing of angles.
- The symmetry in a shape if the one half is the mirror image of the other half.
- Line of symmetry as a line that passes through the center of the shape or object that divides it into identical halves.

Skills:
Students will be able to:

- Recognize and identify parallel and non-parallel lines.
- Describe the radius, diameter, and circumference of a circle.
- Recognize and identify acute, right, and obtuse angles.
- Compare and order angles up to 180 degrees by size.
- Measure and draw angles (using a protractor) within 180 degrees.
- Recognize and draw lines of symmetry in 2-D shapes and complete symmetrical figures with respect to a given line of symmetry.

STEP 2

Assessments

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects
- Selected responses (may include MCQs, true/false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts
- Four Corners: Gather students in the middle of the room, and read multiple choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized Tests
- External Exams

Some of the sample questions that can be used as part of summative assessments are:

1. Which unit should we use to measure the distance between two cities?
2. Which unit should we use to measure the length of a laptop?
3. How many meters are in 3 km?
4. How many millimeters are in 2 cm?
5. How many centimeters are in 5 meters?
6. How many meters are in 4 kilometers?
7. How many milliliters are in 5 liters?
8. Convert 1km 250 m into meters.
9. Convert 2 m 25 cm into centimeter.
10. Convert 3 cm 5 mm into millimeter.
11. Convert 2 kg 250 g into grams.
12. Convert *5 liters 125milliliters* into milliliters.
13. Usman rides his cycle 3 km per day. How many meters does he cycle in 4 days?
14. A tailor used 1m 23 cm of cloth to make a shirt and 1m 45 cm to make another shirt. What is the total length of the cloth used to make both shirts?
15. The height of box A is 65 cm 8 mm. The height of another box B is 12 cm 3 mm less than the box A. Find the height of the box B.
16. Abid purchased 3 kg 135 g of sugar, 2 kg 345 g of rice. What is the total weight of both items?

17. A tank holds 500 liters 850 milliliters of water. 255 liters 340 milliners of water is pumped out from it. How much quantity of water left in the tank?
18. How many **right angles** are there in the given figure?

19. What is the **property of an acute angle**?
20. Measure the angles.

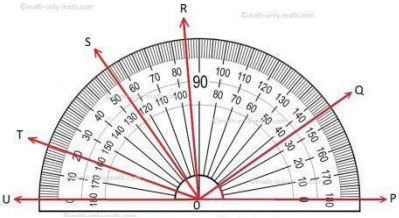


Image by: https://www.math-only-math.com/worksheet-on-angles.html

$\angle TOQ = \_\_\_\_$ $\angle SOP = \_\_\_\_$ $\angle SOT = \_\_\_\_$

STEP

Activity 1: Finding Angles

Resources :

- Activity sheets

Directions :

- Students will work in groups of 3 or 5.
- Students will visit their school ground and spend 10 minutes there looking for different kinds of angles around them.
- They will note down their findings in the activity sheet.
- Give them examples e.g. they may spot a tree branch making an obtuse or acute angle with the tree trunk etc.
- Students will identify the kind of angle that the object is making. They do not need to calculate it.

Activity Sheet	
Object	Kind of Angle

Activity 2:

Resources:

- Coloured tape/masking tape
- Measuring rulers
- Activity sheets.

Directions:

- Students will work in groups of 5 or 6.
- Ask each group of students to make different rectilinear shapes on their classroom floor or on the floor of any other area of the school using tape and name them A, B, C and so on.
- Make paper chits with letters A, B, C and so on. Fold them and ask each group to pick one chit.
- Each group will calculate the area and perimeter of the shape mentioned on their chit.
- Two groups can be given the same shape as well, so that they can compare their answers in the end.

DOMAIN/STRAND: MEASUREMENT

STEP 2

Standard: Students will be able to understand length, mass, capacity; perform basic operations to solve word problems, time intervals using analogue and digital clocks and area and perimeter of 2D shapes.

Student Learning Outcomes:
Students will be able to:

- Interconvert units of lengths, mass, time and capacity (to its multiples and submultiples).
- Add and subtract lengths, mass, time and capacity and solve real world scenarios.
- Read and write time from digital and analog clocks in 12-hour and 24-hour format.
- Interconvert units of time (hours, minutes, seconds, years, months, weeks, and days).
- Calculate duration of different events using start time and end time.
- Identify the units of measurement for perimeter and area.
- Differentiate between the perimeter and area of a square, rectangular, and rectilinear shapes.
- Apply formulas to find the perimeter and area of squares, rectangles, and rectilinear shapes.
- Know the other temperature measuring scales (in addition to centigrade), i.e., Kelvin and Fahrenheit.
- Interconvert different temperature scales, i.e., Centigrade, Fahrenheit, and Kelvin.

Knowledge:

<u>Length, Mass & Capacity</u>

Students will know:

- The standard units of length, mass, time and capacity and their multiple and sub-multiples.
- The interconversion criteria of standard units to its multiple and sub-multiple units (of length, mass, time, and capacity).
- Addition and subtraction of standard units.

<u>Time</u>

Students will know:

- About 12 hour timing
- About 24 hour timing
- The different formats of time (12 hour & 24 hour)

<u>Area & Perimeter</u>

Students will know:

Skills:

<u>Length, Mass & Capacity</u>

Students will be able to:

- Convert units of length from larger to smaller units (kilometer, meter, centimeter and millimeter)
- Convert, add and subtract lengths, to solve real-world word problems.
- Convert units of mass from larger to smaller units (kilogram, gram and milligram).
- Convert, add and subtract mass to solve real-world word problems.
- Convert units of capacity from larger to smaller units (liter and milliliter).
- Convert, add and subtract capacities to solve real-life word problems.

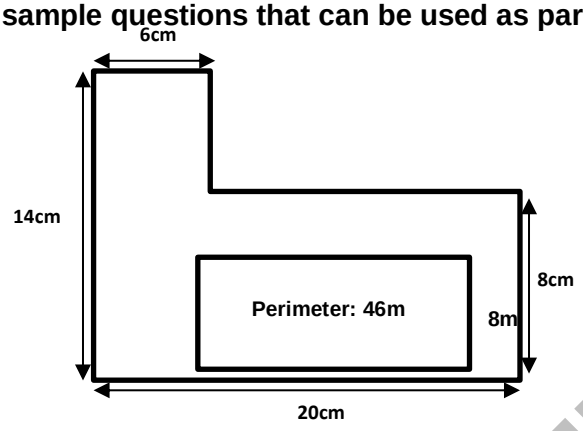
<u>Time</u>

Students will be able to:

● The concept of area and perimeter of square, rectangular, and rectilinear shapes. ● The units of measurement for perimeter and area. ● Difference between the perimeter and area. ● Formulas to find the perimeter and area of squares, rectangles, and rectilinear shapes. **Additional/Advanced Content**: ● Find area of irregular shapes on grid.	● Read and write time from digital and analog clocks in 12-hour and 24-hour format. ● Interconvert units of time (hours, minutes, seconds, years, months, weeks and days). ● Calculate duration of different events using start time and end time. ● Add, subtract and convert measures of time to solve real-life word problems. **<u>Area & Perimeter</u>** Students will be able to: ● Differentiate between the perimeter and area of a square, rectangular, and rectilinear shapes. ● Apply formulas to find the perimeter and area of squares, rectangles, and rectilinear shapes.
Step 2: Assessments	
Assessments **Formative Assessments:** Some of the types of formative assessment teacher may use are: ● Question & Answer(open and closed) ● Quick Quiz ● Learning Walks ● Projects ● Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc), ● Observation diaries ● Inquiry charts ● Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on . **Summative Assessments** Some of the forms of summative assessment are: a) End of Unit Test b) Class Test c) Periodic/Monthly Tests	

d) Mid-year Exam
e) End of Year Exam
f) Standardized Tests
g) External Exams

Some of the sample questions that can be used as part of summative assessment are:



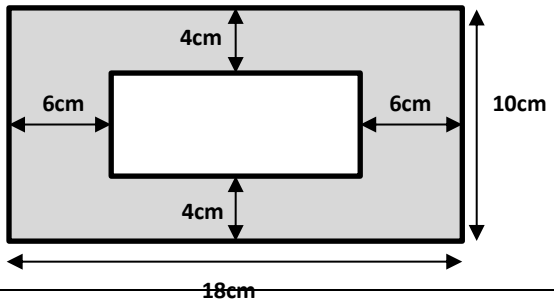
1. What is the perimeter and area of the figure below?

2. The perimeter of a rectanular field is 46m. its breadth is 8m**.** **(4)**

a) Find its length.

b) Find the area of the field.

3. Find the area of the shaded region.



STEP 3: Learning Activities

Activity:

Resources:

- Digital clocks
- Activity sheets (Sample sheet is given)

Time after every 5 minutes	Time in minutes

Directions:

- Students will work in pairs.
- Each pair of students will get the sheet and a digital clock. Make sure that all the clocks would represent different timings.
- Students will note down the starting time in the sheet and then the time after every 5 minutes; and will write that in the table.
- Ask them to convert the time in minutes.

DOMAIN: STATISTICS AND PROBABILITY

STEP 1

Standard: Draw, read and interpret horizontal and vertical single and double bar graphs; describe the outcome of a simple probability experiment using mathematical language.

Student Learning Outcomes:

Students will be able to:

- Draw, read and interpret horizontal and vertical single and double bar graphs (including real life problems).
- Describe the outcome of a simple probability experiment (spinner and dice), using mathematical language (i.e. impossible, less likely, more likely, equally likely, unlikely and certain).

Knowledge:	**Skills:**
Students will know: ● Graph as a visual representation of data.	Students will be able to:

• Comparison of two sets of data using the double bar graph. • Probability is the possibility of an event to occur. **Advanced/Additional**	• Draw, read and interpret horizontal and vertical single and double bar graphs. • Describe the outcome of a simple probability experiment (spinner and dice), using mathematical language (i.e. impossible, less likely, more likely, equally likely, unlikely and certain). **Advanced/Additional** • Use graphs to solve real-world problems.

STEP 2

Assessments:
Formative Assessments

- Q & A Sessions
- Quick Quiz
- Learning Walks
- VAK
- AFL Strategies

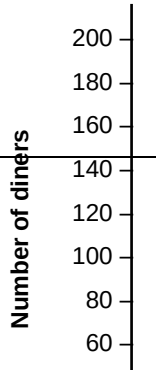
Summative Assessments

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- EOY Exam
- External Exams

Some of the sample questions that can be used as part of summative assessment are:

1. Use the information given in the table to make a line graph and answer the questions.

Time	1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.
Number of diners	200	140	30	50	120	180



a) During which 1 hour interval did the greatest decrease in the number of diners occur?

b) What was the differenece in the number of diners between the hours when the restaurant was the most crowded and the least crowded?

2. The table below shows Kashif's yearly income in $ from 2010 to 2014.

Year	2010	2011	2012	2013	2014	2015
Yearly Income	6000	10000	22000	18000	30000	

a) His yearly income in 2015 was $2000 more than his yearly income in 2013.

What was his yearly income for 2015? _____

b) Which year did he earn the least? _____

c) Which year did he earn 3 times as much as he earned in 2011? _____

d) How much did he earn from 2010 to 2015? _____

STEP 3

Learning Activities

Activity:

Resource:

- A set of 50 buttons of different colours (yellow, red, black, green, blue, pink, white or brown) for each group of students
- Colouring materials such as markers, colour pencils or crayons
- A blank template to record the data with questionnaire

Directions:

1. Students will work in groups of 3 or 4.
2. Teacher will distribute 50 buttons and a template to record the data with questionnaire and colouring material to each group.
3. Students will sort the buttons by colour and will record the number of buttons of each colour they received.
4. Later they will create a bar graph that will display the data and answer the following sample questions that could be the part of questionnaire.

- What is the colour of buttons that are most in number?
- Which colour of buttons did you get least?
- Did you get any colour of buttons that are same in number?

Resource:

Https://www.transum.org/Software/Fun_Maths/

https://www.math-only-math.com/worksheet-on-angles.html

My pals are here! Math 3rd Edition

DRAFT

Mathematics - Class 5
Suggested Guidelines

Domain: Numbers and Operations

Sub-Domain: Numbers and Place Value

STEP 1	
Standard: Count, read, and write numbers up to 9,999,999 and identify the place value of the digits in (up to) 7-digit numbers.	
Student Learning Outcome: Students will be able to ● Count, read, write up to 7-digit numbers (in numerals and in words). ● Identify the place value of each digit in them.	
Knowledge: Students will know: ● place value of each digit in up to 7-digit numbers. ● short and expanded form of a number.	**Skills:** Students will be able to: ● Count up to 9,999,999 (7-digit numbers) using various materials (e.g. block charts, base ten materials, abacus, hundreds chart etc.) ● Read up to 7-digit numbers in numerals and in words. ● Write up to 7-digit numbers in numerals and in words. ● Identify the place value of each digit in up to 7-digit numbers. (E.g. in 1,345,267 - 5 represents 5 thousands i.e. 5000). ● Expand up to 7-digit numbers using place value (partition).

STEP 2 _____

Formative Assessment:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. What comes after hundred thousands in a place value chart? (For example, tens comes after ones)
2. Give an example of a 7-digit number.
3. What is the place value of the digit '4' in the number 4 952 312?
4. Write the place values of the digits in the number 2 327 252 which are not repeating.
5. How do we write a number in expanded form?

Some of the sample questions that can be asked as part of summative assessment are:

1. Give various 7-digit numbers (for example 3 123 459) to the students and ask them to:
   (i)Write the numbers in words.
   (ii) Tell the place value of any specific digit in the given numbers.
   (iii)Write the given numbers in expanded form.
2. Write the given expanded form in standard form.
   For example: 9 000 000 + 300 000 + 20 000 + 4 000 + 100 + 80 + 6 = _____
   3 000 000 + 50 000 + 400 + 7 = _____
3. Write the missing numbers, digit, and word in the following.
   4 235 107 = 4 000 000 + 200 000 +_____ + 5 000 +_____ +7
   2 465 387 = 2_____ + 4 hundred thousands + 6_____+__thousands+3 hundreds+8 tens + .7 ones
4. Find the numbers with the help of the clues given below.
   - The digit in the thousands place is 8 more than the digit in the tens place.
   - The digit in one place is double the digit in the tens place.
   - The digit in the hundred thousands place is half of the sum of the digits in the tens and thousands places.

- The digit in the hundreds place is the sum of the digits in the tens and ones places.
- All the digits add up to 26.

5. Write the smallest 7-digit numbers having 8 in the thousands place and the digit in the tens place has place value 90.
6. Find the 5-digit number with the help of the clues given below.
    - 2 is in the ones place.
    - The place value of 1 is 100.
    - 5 is not in the tens place.
    - 4 is in the thousands place.
    - Five digits are 1,2,3,4,5.
7. I am a 4-digit number.
    - The digit in the thousands place is 2 less than the digit in the hundreds place.
    - The digit in the hundreds place is 2 less than the digit in the tens place.
    - The digit in the tens place is 2 less than the digit in the ones place.
    - The sum of my digits is 16.
    - What number am I?

STEP 3 _ _____

Learning Activities

Activity 1:

1. Discuss the place value chart:

Millions	Hundred thousands	Ten thousands	Thousands	Hundreds	Tens	Ones	Places
4	3	0	2	4	5	3	Stand for
1 000 000	100 000		1000	100	10	1	
1 000 000	100 000		1000	100	10	1	
1 000 000	100 000			100	10	1	
1 000 000				100	10		
					10		
3 000 000	300 000	0	2000	400	50	3	Place values

1. Tell students that the given number is 4 302 453.
2. Now inform students that:
   - 4 is in the **hundreds place.**
   - Therefore 4 **stands for** 4 hundred. Thus **place value** of 4 is 400.
3. Give another example to explain:
   - 3 is in the **hundred thousands place.**
   - 3 **stands for** 3 hundred thousand. **Place value** of 3 is 300 000.
4. Give several questions and ask students to tell you their place value.

Activity 2:

1. Ask students to form any four 7-digit numbers using their date of birth.
2. Give example: if my date of birth is 04/09/1996, I can form any four 7-digit numbers using the numbers in it. For example:
   4,009,961
   1,996,094
   6,090,914

4,916,900

Then, ask the students to:

- Write any one number in words.
- Write the place value of any one digit of all the numbers.
- (iii)Write the place value of all the digits of any one number.
- (iv)Write any one number in expanded form.

Activity 3:

1. Make flash cards of numbers from 0 to 9 (multiple copies of each number) and put them in a basket.
2. Ask each student to pick any seven cards from the basket and form a 7-digit number, using the cards he/she picked up.
3. Then ask a group of students to arrange the numbers they formed in ascending/ descending order and say them out loud or write them on the board.

Activity 4:

1. Ask students to Work in pairs.
2. Write down a 6-digit or a 7-digit number.
3. Give clues for your partner to guess your number. (For example, if you wrote down 347100, you could say: My number has six digits. The digit 4 is next to the digit 3, which has a value of 300 000. The digit 7 is in the thousands place. The value of the digit in the hundreds place is 100. There are two zeros in my number. What is my number?
4. Take turns to guess each other's numbers.

Domain: Number and Operations

<u>Sub-Domain: Addition and Subtraction</u>

STEP 1 _____

Standard 1: Students will be able to add and subtract numbers up to 6-digit numbers (with and without regrouping) and solve related real-world word problems.

Student Learning Outcomes*:* Students will be able to

- Add and subtract up to 6-digit numbers mentally and in written form (with and without regrouping) including 6-digit numbers with 1-digit, 2-digit, 3-digit, 4-digit, 5-digit and 6-digit numbers.
- Estimate the answer to an addition and subtraction question. (using various approaches).
- Solve related real-world word problems involving addition and subtraction using various approaches.

Knowledge:
Students will know:

- addition up to 6-digit numbers.
- subtraction up to 6-digit numbers.
-
- estimating sums and differences.

Skills:
Students will be able to:

- Add (with and without regrouping) mentally and in written form.:
  - 6-digit number with 1-digit number
  - 6-digit number with 2-digit number
  - 6-digit number with 3-digit number
  - 6-digit number with 4-digit number
  - 6-digit number with 5-digit number
  - 6-digit number with 6-digit number
- Subtract (with and without regrouping) mentally and in written form.:
  - 1-digit number from a 6-digit number
  - 2-digit number from a 6-digit number
  - 3-digit number from a 6-digit number
  - 4-digit number from a 6-digit number
  - 5-digit number from a 6-digit number
  - 6-digit number from a 6-digit number
- Solve addition and subtraction problems through different ways of estimation.
- Solve real-world word problems (one step and multi-step) involving addition, subtraction and estimation of numbers.

STEP 2 _____

Formative Assessment:
Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments
Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam

- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of the formative assessment are:

1. Do we need to regroup when adding 4 and 5?
2. Do we need to regroup when adding 6 and 8?
3. How do we regroup numbers while adding?
4. 5 ones +3 ones =?
5. 7 ones + 6 ones = 1 ten +?
6. 8 tens + 4 tens =? + 2 tens
7. 9 hundreds + 6 hundreds =1thousands +?

Ask students the following types of questions about rounding off:

1. While rounding off, when do we round down?
2. While rounding off, when do we round up?
3. What is the difference between estimated sum and actual sum?
4. What is the estimated sum of 254,132 and 146,801?
5. Do we need to regroup when subtracting 12 from 35?
6. Do we need to regroup when subtracting 29 from 36?
7. 5ones - 3 ones =?
8. 1tens +3 ones - 6 ones =? ones
9. 1 hundred + 4 tens – 7tens =? tens
10. 1 thousand+2 hundreds - 6 hundreds =? hundreds.
11. How do we regroup numbers while subtracting?
12. What is the difference between estimated difference and actual difference?
13. What is the estimated difference of 105,182 and 1003,409?

Some of the sample questions that can be used as part of the summative assessments are:

1. Questions of addition up to 6-digit numbers. For example:
   213,60 + 382,419 = _____ (without regrouping)
   567,341 + 574,875 = _____ (with regrouping)
2. Subtraction questions of up to 6-digit numbers. For example:
   142,232 - 382,467 = _____ (without regrouping)
   567,346 - 374,735 = _____ (with regrouping)
3. Real world word problems of addition.
   For example: Mr. Hamza earns Rs. 730,113 annually. This year he earned Rs. 52,150 extra through bonuses. How much did he earn in total this year?
4. Real world word problems of subtraction.
   For example: ABC foundation decided to raise Rs. 999,000 to help survivors of an earth quake. The foundation was able to raise Rs. 802,136 in one week. How much more money does it need to raise in order to meet the target?
5. Real world word problems involving addition and subtraction (one step and multistep).
   For example: In 2019 there were 400,234 people living in Ali's village. By 2020, 980 of them moved out and 1602 new people moved into the village. What is the total number of people living in Ali's village in 2020?
6. A Smart TV costs Rs. 20 340 more than an A.C but Rs. 15 340 less than a motorcycle. If the motorcycle costs Rs. 120 540, how much is the cost of the Smart TV and AC altogether?
7. Amir spent Rs. 103 549 on his vacation. Zafar spent Rs. 10 560 less than Amir on his vacation. How much did Amir and Zafar spend altogether on their vacations?

STEP 3 _____

Learning Activities:

Activity 1:

1. Make pairs of students and ask each student to form a 6-digit number of their choice.
2. Then, ask each pair to tell each other their formed numbers and find the sum and difference of the two numbers.

Activity 2:

1. Make pairs of students.
2. Ask each partner to write a word problem that involves addition or subtraction.
3. Ask the other partner to solve it.
4. Then, ask them to discuss their solutions.

Activity 3:

1. Make pairs of students.
2. Then give them addition and subtraction real-world word problems.
3. Ask them to find estimated answers using estimation tips.
4. Ask the students to find the actual answers.
5. Now ask students to compare their estimated answer with the actual answer to see if they are able to find an answer closer to the actual one.
6. Lastly, ask them to find the difference between their estimated and actual answers.

Domain: Number and Operations:
Sub-Domain: Multiplication and Division

STEP 1 _____

Standard: Students will be able to multiply up to 5-digit numbers with up to 3-digit numbers and divide up to 5-digit numbers with up to 2-digit numbers, and solve related real-world word problems.

Student Learning Outcomes: Students will be able to

- Multiply upto 5-digit numbers with 1-digit, 2-digit and 3-digit numbers in written form.
- Divide up to 5-digit numbers by 1-digit and 2-digit numbers in written form.
- Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.
- Identify divisibility rules for 7 and 11 and use them on up to 5-digit numbers.

Knowledge:
Students will know:

- multiplication up to 5-digit numbers with up to 3-digit numbers.
- division up to 5-digit numbers by up to 2-digit numbers.
- mental strategies of multiplying up to 5-digit numbers with 10, 100 and 1000.
- mental strategies of dividing up to 5-digit numbers by 10, 100 and 1000.
- divisibility rules for 7 and 11.

ADDITIONAL/ADVANCE LEVEL:
Students will be able to know:

- *mental strategies of multiplying numbers with multiples of 10, 100 and 1000. (e.g. 34 x 200 = 6800 [multiply 34 by 2 and then place 2 zeros])*

Skills:
Students will be able to:

- Multiply in written form:
  - 5-digit number with 1-digit number
  - 5-digit number with 2-digit number
  - 5-digit number with 3-digit number
- Divide in written form:
  - 5-digit number by 1-digit number
  - 5-digit number by 2-digit number
- Solve real-world word problems (one step and multi-step) involving multiplication and division.
- Use appropriate operations to solve real-world word problems involving addition, subtraction, multiplication and division.
- Apply divisibility rules of 7 and 11 on up to 5-digit numbers.

STEP 2 _____

Formative Assessments
Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments
Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam

- End of Year Exam
- Standardized tests.
- External Exams

Some of the samples of questions that can be used as part of formative assessments are:

1. What is the meaning of the product of 25 423 and 356?
2. Where (right or left) does the decimal point move when a number is multiplied by 10, 100 and/or 1000?
3. How many places does the decimal point move when a number is multiplied by 10, 100 and/or 1000?
4. Divide 84,550 by 95 and find the quotient.
5. Where (right or left) does the decimal point move when a number is divided by 10, 100 and/or 1000?
6. How many places does the decimal point move when a number is divided by 10, 100 and/or 1000?
7. What is the divisibility rule of 7?
8. What is the divisibility rule of 11?

Some of the sample questions that can be used as part of summative assessments are:

1. Multiplication questions of up to 5-digit numbers with 3-digit numbers.
   For example: 25 012 x 369 = ____
2. Multiplication questions of multiplying with 10, 100 and 1000 using mental strategies.
   - For example: 158 479 x 1 000 = _____
3. Division questions of up to 5-digit numbers with 2-digit numbers.
   - For example:14 950 ÷ 23 = _____
4. Division questions of dividing by 10, 100 and 1 000 using mental strategies.
   - For example:158 479 ÷ 1 000 = _____
5. Real world word problems related to multiplication.
   - For example: Every month Shaheena Apa pays Rs. 12 000 to Star school as school fees of her children. How much does she pay to the school annually?
6. Real world word problems related to division.
   - For example: If 14 850 cricket balls are to be packed in 99 boxes and each box must have an equal number of balls, how many balls should be packed in each box?
7. Real world word problems related to multiplication and division (involving multi steps).
   - For example: If the cost of 80 dolls is Rs. 10 400 and Sarah wants to by 12 dolls, how much does she have to pay?
8. Real world word problems involving addition, subtraction, multiplication, and division which allow students to solve by choosing the appropriate operation.
9. Give various numbers to students and ask them to identify the numbers that are divisible by 7 and those that are divisible by 11.
10. There were 260 more children than women at a park. There were 4 times as many men as women. There were 624 men at the park. How many children were there?
11. Abid thought of a number less than 100.When he divided it by 8, the remainder is 1. When he divided it by 9, the remainder is 2. What is his number?

12. Imran went to a store with Rs. 235. A water bottle costs Rs. 33, a pen costs $ 34 and a dictionary costs $ 35. Imran spent all his money to buy seven items. How many of each of the above -mentioned items did he buy?
13. Sheza and Hadia had 12 579 paper stars. Sheza gave 2 214 paper stars to Hadia. Now Hadia had twice as many paper stars as Sheza. How many paper stars did Hadia have at first?
14. Mr. Shahid bought 28 200 apples. 5 460 apples were rotten, he packed the remaining apples into a bag of 15 apples each. He then sold each bag of apples for $ 4. How much money did he get from selling the apples?

STEP 3 _ _____

Learning Activities:

Activity 1:

1. Write numbers that are divisible by 7 and 11 (for e.g. 98, 176, 112, and 220) on small pieces of paper and fold them.
2. Put the folded papers in a box.
3. Ask each student to pick one and tell if it is divisible by 7 or 11.

Activity 2:

1. Form a tic-tac-toe using multiplication equations.
2. Make a grid (similar to what is shown below) and write one multiplication equation in each box.
3. Make sure that the answer of all the equations in one direction are the same, while others must be different. These same products can be in horizontal, vertical or diagonal direction.
4. Then, ask the students to identify these products and make a horizontal, vertical or diagonal line.

2 x 5	6 x 3	4 x 2
7 x 12	5 x 2	8 x 10
5 x 9	4 x 3	10 x 1

For example: In the grid given on the right, all products in one of the diagonals are same i.e. 10 hence there is a diagonal line drawn on the grid.

Activity 3:

1. Divide students into small groups and give 20 marbles to each group.
2. Then, ask each group to divide these equally amongst themselves and keep the remaining marbles aside.
3. Hand over a chart paper and ask them to represent the division using the long division method, expressing the quotient and remainder.
4. Tell them to remove one marble (from the 20 marbles) and redistribute the new number of marbles amongst themselves and represent the division on the chart paper.
5. Ask them to keep doing this until the number of marbles left are less than the number of students in the group.

Activity 4:

1. Divide students into small groups and give eight marbles or any other small objects to use as counters, to each group.
2. Then, ask each group to come up with as many word problems as they can that involve eight marbles. For example, one problem might be, “I have 3 marbles and my friend has 5 marbles. How many

marbles do we have in total?" or "There are 4 friends and a total of 8 marbles. How many marbles does each friend get?"

3. Encourage the students to explore different operations.

Activity 5:

4. Solve the problems below and then find the facts in the equation search. One has been done for you.

2	25	50	9	6	96	3	11	14	120	32
4	2	6	18	2	12	24	4	7	4	30
15	48	12	4	80	8	32	16	8	77	3
42	8	96	12	7	8	20	15	18	2	8
3	90	30	3	10	40	2	12 =	108	5	48
25	2	45	5	6	30	10 X	9	5	12	6
160	20	8	9	72	40	12	12	91	22	8
54	8	6	12	6	3	20	4	13	7	6
8	5	40	42	120	40	3	4	7	13	4

□ 9 × 12 = 108	□ 13 × 7 =	□ 15 × 2 =	□ 20 × 8 =
□ 8 × 12 =	□ 5 × 8 =	□ 11 × 7 =	□ 6 × 8 =

□ 3 × 30 =	□ 2 × 25 =	□ 40 × 3 =	□ 12 × 4 =

Domain: Number and Operations
Sub-Domain: Factors and Multiples

STEP 1 _____
Standard 1: Students will be able to Identify and differentiate between 2-digit prime and composite numbers,find H.C.F and L.C.M of two numbers (up to 2-digits) using various methods.
Student Learning Outcomes :Students will be able to ● Identify and differentiate between 2-digit prime and composite numbers up to 100. ● Find HCF and LCM of two numbers (up to 2-digits) using various methods. ● Solve real-world word problems involving HCF and LCM.

Knowledge:
Students will know:
● Prime and composite numbers (up to 2-digits).
● HCF (highest common factor).
● LCM (lowest common multiple).
	Knowledge:
	Students will be able to:
	● Identify and differentiate between prime and composite numbers.
	● Identify prime and composite numbers (up to 2-digit numbers).
	● Calculate the HCF of two numbers (up to 2-digit) using various methods. e.g.
	  ● Prime factorization
	  ● Division Method
	● Calculate the LCM of two numbers (up to 2-digit) using various methods. e.g.
	  ● Prime factorization
	  ● Division Method
	● Solve real-world word problems involving HCF and LCM.
	
	ADDITIONAL/ADVANCED LEVEL:
	● *Calculate the HCF of three numbers (up to 2-digit) using various methods. e.g.*
	  ● *Prime factorization*
	  ● *Division Method*
	● *Calculate the LCM of three numbers (up to 2-digit) using various methods. e.g.*
	  ● *Prime factorization*
	  ● *Division Method*

STEP 2 _____	
Formative Assessments Some of the types of formative assessment teacher may use are: ● Question & Answer(open and closed) ● Quick Quiz ● Learning Walks ● Projects, ● Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.) ● Observation diaries ● Inquiry charts, ● Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on	

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

1. What are prime numbers?
2. What are composite numbers?
3. What is the difference between prime and composite numbers?
4. Ask riddles. For example:
   (i) 'I am the only even prime number, who am I?'
   (ii) 'I am a prime number, and I am greater than 17 and less than 20. Who am I?'
   (iii) 'I am a composite number, and I am greater than 96 and less than 99. Who am I?'
5. What does HCF mean?
6. What makes prime factorization and the division method of finding HCF different?
7. What does LCM mean?
8. What makes prime factorization and the division method of finding LCM different?

Some of the questions that can be used as part of the summative assessments are:

1. Give various 2-digit numbers and ask students to identify prime and composite numbers.
2. Differentiate between prime and composite numbers by giving a few examples of each.
3. Tell the difference between LCM and HCF with an example.
4. Find the HCF of two numbers using prime factorization and division method, for example 24 and 30.
5. Find the LCM of two numbers using prime factorization and division method, for example 60 and 24.
6. Real world word problems related to LCM.
   For example: Saima goes to her Nani's house after every 12 days and her cousin sister goes after every 16 days. If they visited their Nani together today, after how many days will they visit her together again?
7. Real world word problems related to HCF.
   For example: Hamid has two wires one of which is 12 m long and the other is 16 m long. He wants to cut the wires into pieces of equal length. Find the maximum length of each piece that can be cut.
8. Ali has 40 pencils and 35 notebooks. He wants to put these pencils and notebooks in bag such that every bag has an equal number of pencils and notebooks. What will be the maximum number of pencils and notebooks in each bag?

STEP 3 _ _____

Learning Activities

Activity 1:Guess the hidden number:

1. Divide students into small groups.
2. Write any one composite or prime number (for e.g. 22) on a card and keep it hidden from the students.
3. Then, go to one of the groups and tell them a clue, for e.g. “I have a composite number that falls between 14 and 26. Can you guess the number?”
4. Tell the group that they can ask three more questions about the hidden number (for e.g. is it even or odd?) and then make a guess. Repeat the activity with all the groups.

Activity 2: Sit or jump

1. Ask the students to stand in an open space at least an arms-length away from each other.
2. Then call out numbers and ask the students to identify if the number is prime or composite.
3. Inform that if it is prime, they should sit down and if it is composite, they should jump once.
4. After calling out a composite number, ask a student to prime factorize the number.

Activity 3: Factor sticks

1. Give each student 5 craft sticks and a marker.
2. Ask them to write the numbers from 8 to 12, one number per craft stick.
3. Then, ask the students to write the factors of each number on the back of the sticks.

Activity 4: Factoring a Tree

1. Ask the students to draw a tree trunk on a chart paper.
2. Then write a composite number on the trunk (for e.g. 24).
3. Ask the students to draw roots with all the possible factors of the number (for e.g. factors of 24 are: 1, 2, 3, 4, 6, 8, 12 and 24.)

Activity 5: Multiple Petals

1. Divide the students into small groups and give each group a chart paper.
2. Then, ask them to make a circle at the center of the chart paper and write any one number from 6 to 15 in it.
3. Next, ask them to draw 12 petals around it and write the multiples of the chosen number (one multiple in each petal).

Activity 5: Matching Boxes

1. Give students a question similar to the image given below.

2. Ask them to color the pairs of boxes (with the same color) that match. For example, the matching box of '6 and 7' is 'LCM 42 HCF 1'.

6 and 7	LCM 42 HCF 1	5 and 10
LCM 10 HCF 5	15 and 25	LCM 75 HCF 5
8 and 20	LCM 40 HCF 4	12 and 30

Activity 6:

1. Write the numbers from 1 to 9 in the grid given below so that the correct factor goes into the correct box.
2. You can use each number from 1 to 9 only once in the grid.

	Factors of 56	**Factors of 30**	**Factors of 27**
Factors of 35			
Factors of 72			
Factors of 60			

Domain: Numbers and Operations
Sub-Domain: Fractions

STEP 1 _____

Standard: Students will be able to compare, order, add, subtract, multiply and divide fractions and solve related real-world word problems.

Student Learning Outcomes: Students will be able to

- Compare and order whole numbers, proper, improper fractions and mixed numbers in ascending and descending order.
- Add and subtract; two or three unlike fractions and mixed numbers.
- Multiply and divide proper, improper fractions and mixed numbers and express the answer in its simplest form (if applicable).
- Solve real-world word problems involving fractions.

Knowledge: Students will know: ● equivalent fractions. ● addition and subtraction of like fractions. ● addition and subtraction of unlike fractions. ● multiplication and division of fractions. ● Simplification of fractions.	**Skills:** Students will be able to: ● Compare, proper fractions, improper fractions, and mixed numbers. ● Arrange, proper fractions, improper fractions, and mixed numbers in ascending and descending order. ● Add unlike fractions and mixed numbers. (up to three fractions) ● Subtract unlike fractions and mixed numbers. (up to three fractions) ● Multiply proper fractions, improper fractions and mixed numbers and express the answer in its simplest form (wherever applicable). ● Divide proper fractions, improper fractions and mixed numbers and express the answer in its simplest form (wherever applicable). ● Solve real-world word problems involving fractions by identifying appropriate operations.

STEP 2 _____

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the questions that can be used as part of formative assessments are:

1. How can we convert a mixed number into an improper fraction? Explain with the help of an example.
2. How can we convert an improper fraction into a mixed number? Explain with the help of an example.
3. What are equivalent fractions? Give examples
4. How can we find an equivalent fraction of a given fraction?
5. Give examples of like and unlike fractions.
6. How do we compare two like fractions?
7. How do we compare two unlike fractions?
8. How do we compare fractions with mixed numbers? What is the first thing we do to compare them?
9. How do we add or subtract two like fractions? Explain with the help of an example.
10. How do we add or subtract two unlike fractions? Explain with the help of an example.
11. How do we multiply a fraction? Explain with the help of an example.
12. How do we divide a fraction? Explain with the help of an example.
13. How do we find the reciprocal of a fraction?

Some of the questions that can be used as part of summative assessments are:

1. Compare the given fractions using '<', '>' and '='.
   For example, (i) ½ ___ $\frac{3}{4}$ (ii) $4\frac{2}{5}$ _____ $\frac{5}{4}$
2. Arrange the given fractions in ascending and descending order.
   For example, 1/2, 6/7, 2 ½ , $2\frac{3}{8}$
3. Add unlike fractions and mixed numbers.
   For example, $\frac{2}{3} + \frac{7}{4} + 2\frac{4}{5}$
4. Subtract unlike fractions and mixed numbers.
   For example $2\frac{7}{8} - \frac{1}{2} - \frac{1}{5}$
5. Multiply fractions and mixed numbers.
   For example $\frac{2}{3} \times \frac{3}{8}$, $\frac{4}{5} \times \frac{3}{2}$ and $\frac{6}{7} \times 3\frac{1}{2}$
6. Divide fractions and mixed numbers.
   For example $8\frac{3}{4} \div 2\frac{1}{3}$, $5\frac{1}{4} \div \frac{3}{1}$ and $\frac{7}{10} \div \frac{14}{5}$
7. Real world word problems related to fractions (involving addition, subtraction, multiplication and division).
   For example: Asif has a piece of wood that is ¾ of a foot in length. He wants to cut it into pieces that are 1/16 of a foot long. How many pieces can he cut out of this piece of wood?

STEP 3 _ _____

Learning Activities

Activity 1: Fractions in My Name

1. Ask the students to write their full name on a paper, for example Ayesha Hamid.
2. Now ask students to:
   01. Write the fraction of capital letters in your name. (for e.g. 2/11)
   02. Write the fraction of vowels in your name. (for e.g. 5/11)
   03. Write the fraction of lowercase letters/small letters in your name. (for e.g. 9/11)

04. Then ask the students to sit in pairs and write all their answers of part (i) to (iv) together in ascending order.
05. Then ask the students to sit in pairs and write all their answers of part (i) to (iv) and add any three fractions.

Activity 2:

1. Divide students into small groups and ask each group to think of a 'This or That' question, for example 'Which colour do you like better, red or blue?'
2. Then ask any one student from each group to come and ask the question to the class out loud and the group can note the answers in fractions. For example, if 12 out of 25 students raise their hand on red colour and 13 students on blue colour then the group will write down 12/25 and 13/25 on a paper.
3. Then, ask each group to find equivalent fractions of the fractions they wrote.

Domain: Number and Operations
Sub-Domain: Decimal Numbers

STEP 1 _____

Standard: *Students will be able to* students will be able to compare, order, round off, add, subtract, multiply and divide decimal numbers and solve related real-world problems. Students will be able to use the correct order of operations to solve mathematical expressions.

Student Learning Outcomes: Students will be able to

- Convert fractions to decimals and vice versa.
- Compare and order numbers up to three decimal places using signs > , < and = sign and in ascending and descending order.
- Multiply numbers up to two decimal places by up to 2-digit whole numbers 3-digit numbers with up to two decimal places.
- Multiply and divide a number up to two decimal places by 10, 100 and 1000.
- Use appropriate operations to solve real-world word problems including numbers up to two decimal places (including money, quantities and measures).
- Recognize the order of operations and use it to solve mathematical expressions involving whole numbers, decimals and fractions.

Knowledge:

Students will know:

- Representation of decimal numbers in fractions and vice versa.
- place value of each digit in numbers with up to three decimal places.
- rounding off decimal numbers (with up to three decimal places) to the nearest whole number and to tenth and hundredth.
- addition and subtraction of numbers with up to three decimal places.
- Multiplication of numbers with up to three decimal places.
- Division of numbers with up to one decimal place.
- order of operations to solve real-world word problems including numbers up to two decimal places (including money, quantities and measures).

Skills:

Students will be able to:

- Convert fractions to decimals and vice versa.
- Compare up to 3-digit numbers with up to three decimal places using <, > and =.
- Order up to 3-digit numbers with up to three decimal places in ascending and descending order.
- Round off decimal numbers (with up to three decimal places) to the nearest whole number and to tenth and hundredth.
- Add 4-digit numbers with up to three decimal places.
- Subtract 4-digit numbers with up to three decimal places.
- Multiply:
  - 3-digit numbers with up to three decimal places by 2-digit whole numbers
  - 3-digit numbers with up to three decimal places by 3-digit numbers with up to three decimal places
- Divide:
  - 3-digit numbers with up to three decimal places by 2-digit whole numbers
  - 3-digit numbers with up to two decimal places by 2-digit numbers with one decimal place
- Multiply and divide a number up to two decimal places by 10, 100 and 1000.
- Solve real-world word problems involving decimal numbers by identifying appropriate operations.
- Use the correct order of operations to solve mathematical expressions involving whole numbers, decimals and fractions.

STEP 2 _____

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

1. Can we convert a decimal number into a fraction? Explain how.
2. Can we convert a fraction into a decimal number? Explain how.
3. Give an example of a fraction and convert it into a decimal number.
4. Which is greater? For example, 310.035 OR 310.354
5. Round off 521.986 to the nearest whole number, tenth and hundredth.
6. When adding or subtracting decimal numbers vertically, how do we place them?

Some of the sample questions that can be used as part of summative assessments

1. Real world word problems relating to rounding off.
   For example: Midhat runs 12.74 km per week and Sarah runs 147/10 km per week. (i) Who runs more than the other? (ii) What is the distance covered by both of them? Use rounding off and give your answers as whole numbers.
2. Real world word problems relating to addition and subtraction.
   For example: Maha scored 403.25 marks in her final exams and her sister scored 402.75 marks. (i) Who scored more marks? (ii) How much more did one score than the other?
3. Real world word problems relating to multiplication.
   For example: The weight of a box is 1340.535 kg. What will be the weight of 7 such boxes?

4. Real world word problems relating to division.
   For example: A car travels a distance of 367.80 km in 6 hours. How much distance will it travel in 1 hour?

STEP 3

Learning Activities:

Activity 1:

1. Divide students into groups and give different colored markers and a chart paper to each group.
2. Then ask them to write down the rules or strategies of rounding off decimals to the nearest whole numbers, tenths and hundredths.
3. Tell them that they can also write examples. Encourage them to make their work presentable.
4. Then, ask each group to present their work to other groups.

Activity 2:

1. Ask students to think about all the mental strategies that they have learnt in this topic and make a list of them with examples.
2. Then, group the students in pairs and ask the partners to discuss their lists.

Activity 3:

1. Write various solved equations of decimals on cards but do not put the decimal point in the answers, for example 234. 69 x 12.3 = 2886687.
2. Put these cards in a basket and ask each student to pick three cards from the basket without looking.
3. Then, ask each student to put the decimal point in the answers.
4. Group the students in pairs and ask the partners to check each other's work.

Domain: Number and Operations

Sub-Domain: Percentage

STEP 1 _____

Standard: Students will be able to recognize percentages and express them as fractions and decimal numbers and solve related real-world word problems.

Student Learning Outcomes: Students will be able to

- Express percentages as a fraction with denominator 100 and as a decimal number.
- Use equivalences between simple fractions, decimals and percentages in real world contexts.
- Solve real-world word problems involving conversion of percentage, fraction and decimal numbers.
- Solve problems which require knowing percentage and decimal equivalents of ½, ¼, 1/5, 2/5, 4/5 and those fractions with a denominator of a multiple of ten or 25.

Knowledge: Students will be able to know: ● percent symbol (%) and that percent is 'the number of parts per hundred'. ● relationship between percentage, fractions and decimal numbers.	**Skills:** Students will be able to: ● Express percentage as a fraction with denominator 100 and vice versa. ● Express percentage as a decimal number and vice versa. ● Use equivalences between fractions, decimals and percentages in real-world contexts. ● Solve real-world word problems involving conversion of percentage, fractions and decimals. ● Solve problems involving percentage and decimal equivalents to ½, ¼, 1/5, 2/5, 4/5 and fractions with a denominator of a multiple of 10 or 25.

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the questions that can be used as part of formative assessments are:

1. What is the percent symbol?

2. When we convert a percentage into a fraction, what do we write as the denominator and why?
3. Convert 19% to a fraction.
4. Can a fraction be converted into a percentage? Explain how.
5. Convert 1/4 into percentage.
6. Express 12% in decimals.
7. Express 0.64 as a percent.

Some of the questions that can be used as part of the summative assessments are:

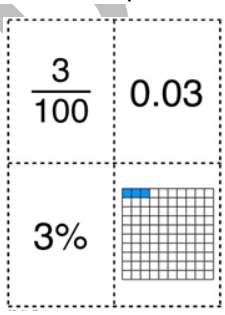
1. Real world word problems relating to percentage.
   For example:
   - Ahmed runs an organization where 40% of his employees are males and 60% are females. Express the number of male and female employees in fraction.
   - There are 1500 students in Mariam's school. 800 of them are in primary and 700 of them are in secondary. What percentage of students are in primary?
   - Maliha wants to buy a pair shoe that costs Rs. 600. When she went to buy it, she found out that she does not have to pay 10% of the price because it is on sale. How much money does Maliha have to pay now?

STEP 3 _ _____

Learning Activities

Activity 1:

1. Give an A4 size paper to each student with an empty hundred square grid (10 x 10 grid) drawn on it.
2. Then, ask them to shade as many squares in it as they want.
3. Once done, ask them to represent the shaded squares in a fraction, decimal number, and percent. Show the given picture as an example.



Activity 2:

1. Team up students in pairs. Then, ask each pair to imagine that they will teach a class.
2. Tell them to make a mark sheet for their students.
3. Give the following guidance and instructions for making the mark sheet.
   - The mark sheet will be for 10 students.
   - First column will be students' names.
   - Second column will be of the marks that each student has obtained out of 100. (Pairs are to give different marks of their own choice in whole numbers or decimals to each student.)

- Third column will be of marks in percentage form.

4. Once the pairs are done making their mark sheets, ask them what percentage of their students scored marks above 60%.

Domain: Number and Operations
Sub-Domain: Unitary Method

STEP 1 _____

Standard: Students will be able to use unitary method to calculate the value of object(s) in different cases and to solve related real-world word problems.

Student Learning Outcomes: Students will be able to

- Use unitary method to calculate the value of many objects of the same kind when the value of one is given, the value of one object when value of many is given and value of many objects when value of some is given (including related real-world problems).

Knowledge:	**Skills:**
Students will know: ● unitary method to calculate the value of object(s).	Students will be able to: ● identify the given values and the quantity to be found. ● Calculate the value of many objects of the same kind when the value of one object is given. ● Calculate the value of one object when the value of many objects is given. ● Calculate the value of many objects when the value of some objects is given. ● Use unitary methods to solve real-world word problems.

STEP 2 _____

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,

- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that may be used as part of the formative assessments are:

1. What operation do we use to find the value of many objects of the same kind when the value of one object is given? Give an example
2. What will be the price of 3 books if the price of 1 book is Rs. 150?
3. What operation do we use to find the value of one object when the value of many objects is given?
4. What will be the price of 1 pencil if the price of 10 pencils is Rs. 50?
5. Which operations are required to find the value of many objects when the value of some objects is given?
6. What will be the price of 12 water bottles if the price of 3 water bottles is Rs. 60?

Some of the sample questions that may be used as part of the summative assessments

1. Real world word problems related to Unitary Method.
    - Usman types 320 words in half an hour. How many words would he type in 4 hours?
    - A worker is paid Rs.1050 for 5 days of work. How much does he earn each day?
    - The weight of 56 books is 8 kg. What is the weight of 120 such books?
    - A car travels 228 km in 3 hours. How far can it travel in 8 hours?

STEP 3 _ _____

Learning Activities

Activity 1:

1. Tell the students that the unitary method has several uses in our daily life.
2. Ask them to come up with at least four situations where a unitary method can be used. For example, we use it while buying and selling.
3. Divide students into small groups.
4. Then, ask each group to develop five questions that can be solved with a unitary method and write each on a piece of paper.
5. Collect all the papers, fold them and put them in a box.
6. Prepare some questions yourself as well and put those in the box too.

7. Then, ask each group to pick five questions and solve them.

DOMAIN: Algebra

STEP 1 _____

Standard: Students will be able to recognise and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}),identify pattern rules and use them to describe a pattern, extend it and determine its missing elements.

Student Learning Outcomes: Students will be able to

- Recognize and use square numbers and cube numbers, and the notation for squared (^{2}) and cubed (^{3}).
- Using a pattern rule, describe the pattern found in a given table or chart.
- Identify and apply the pattern rule of a given increasing and decreasing pattern to:
  -extend the pattern for the next three terms
  -determine missing elements in a given pattern.

Knowledge:

Students will be able to know:

- square numbers and cube numbers.
- increasing and decreasing number patterns.
- pattern rules in different number patterns.

ADDITIONAL/ADVANCE LEVEL:

Students will be able to:

- Know about variables for unknown quantities and their notation.

Skills:

Students will be able to:

- Recognize and use square numbers, cube numbers and their notations.
- Recognize increasing and decreasing number patterns.
- Recognize pattern rules in different number patterns.
- Use a pattern rule to describe a pattern given in a table or a chart.
- Identify a pattern rule of an increasing or decreasing pattern and use it to:
  - Extend the pattern for next terms.
  - Determine missing elements in the pattern.

ADDITIONAL/ADVANCE LEVEL:

- Use variables to write simple algebraic sentences.

STEP 2 _____

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. What is the square of 2 and how is it represented?
2. What is the cube of 4 and how is it represented?
3. What is the square and cube of 0?
4. What is the square and cube of 1?
5. What will be the next five terms if we start from 6 and add 9?
6. What will be the next five terms if we start from 28 and subtract 3?
7. What will be the next five terms if we start from 8 and multiply by 2?
8. What will be the next five terms if we start from 45, then subtract 1 and add 2?
9. Write the pattern rule for the given patterns: For example: 1, 2, 4, 5, 7, 8 and 98, 93, 89, 86, 84
10. Find the missing numbers of the given patterns: For example: 25, 23, ____, ____ 17, 15 and 6, 13, 20, ___, ____, 41

Some of the questions that can be used as part of the summative assessments are:

1. Write the pattern rule and fill in the blanks accordingly.
   24, 27, 30, ____, ____, ____
   98, 100, 103, 107, ____, _____, _____
   167, 160, 153, ____, ____, ____
   13, 39, 117, ____, ____, ____
2. Fill in the blanks.

0, 4, 8, ____, ____, ____
____, _____, ____, 38, 46, 64, ____
____, ____, ____ 16, ____, 22, 25
____, ____, ____ 39, ____, 59, 69
____, ____ 455, ____, 255, 155

STEP 3 _ _____

Learning Activities

1. Write some increasing, decreasing number patterns and their pattern rules on separate pieces of paper. Mix them all and put them in a box. Ask each student to pick one chit. Then, ask all the students to go around the classroom and find their partner. Students who have picked patterns will look for the students who have their pattern rules.
   Examples of patterns and their pattern rules:
   - 48, 54, 60, 66, 72 = Add 6 each time.
   - 67, 61, 55, 49, 43 = Subtract 6 each time.
   - 2, 3, 5, 8, 12 = Add 1, then 2, then 3, then 4 and so on.
   - 99, 96, 93, 90, 87 = Subtract 3 each time.
   - 45, 48, 44, 47, 43 = Subtract 3, then 4, then 3, then 4 and so on.

DOMAIN: Measurement

STEP 1 _____

Standard: Students will be able to convert, add and subtract measures of length, mass, capacity and time and solve related real-world word problems.

Student Learning Outcomes: Students will be able to:

- Convert units of length from larger to smaller and vice versa.
- Convert, add and subtract lengths, to solve real-world word problems.
- Convert units of mass from larger to smaller and vice versa.
- Convert, add and subtract mass to solve real-world word problems.
- Convert units of capacity from larger to smaller and vice versa.
- Convert, add and subtract capacities to solve real-life word problems.
- Convert larger units to smaller units of time and vice versa.
- Add, subtract and convert measures and intervals of time to solve real-life word problems.

Knowledge:

Students will be able to:

Length:

- Know appropriate units of measurement for length.
- Know the conversion of units of length from Kilometres to metres; metres to centimeters and from centimeters to millimeters:
  - 1 km = 1000 m
  - 1 m = 100 cm
  - 1 cm = 10 mm

ADDITIONAL/ADVANCE LEVEL:

- *Know the conversion of units of length from the largest to the smallest unit:*
  - *1 m = 100 cm = 1000 mm*
  - *1 km = 1000 m = 100,000 cm*
- *Know the expanded form of the measures of length.*

Mass:

- Know appropriate units of measurement for mass.
- Know that units of mass can be converted from one unit to another:
  - 1 kg = 1 000 g
  - 1 g = 1 000 mg

ADDITIONAL/ADVANCE LEVEL:

- *Know that units of mass can be converted:*
  - *1 ton = 1000 kg*
  - *1 kg = 1000 g = 1,000,000 mg*
- *Know the expanded form of measures of mass.*

Capacity:

- Know appropriate units of measurement for capacity.
- Know that units of capacity can be converted:
  - 1ℓ= 1000 mℓ

Skills:

Students will be able to:

Length:

- Identify and choose appropriate units of measurement for length.
- Convert measures given in km to m, m to cm and cm to mm and vice versa.
- Add and subtract measures of length.
- Solve real-world word problems involving conversion, addition, and subtraction of measures of length.

ADDITIONAL/ADVANCE LEVEL:

- *Convert measures of length between km, m, cm and mm. (e.g., 2 km = 200,000 cm)*
- *Express measures of length in expanded form. (e.g., 1400 m = 1 km + 400 m)*

Mass:

- Identify and choose appropriate units of measurement for mass.
- Convert measures given in kilograms to grams, grams to milligrams and vice versa.
- Add and subtract measures of mass.
- Solve real-world word problems involving conversion, addition and subtraction of measures of mass.

ADDITIONAL/ADVANCE LEVEL:

- *Recognize that measures of mass can be expressed in expanded form.*
- *Convert measures of mass between milligrams, grams, kilograms and ton. (e.g., 2 kg = 2,000,000 mg)*
- *Express measures of mass in expanded form. (e.g., 1650 g = 1 kg + 650 g)*

Capacity:

- Identify and choose an appropriate unit of measurement to measure a given capacity.

ADDITIONAL/ADVANCE LEVEL:

- *Know the expanded form of the measures of capacity.*

Time:

- Know that units of time can be converted:
  - 1 year = 12 months
  - 1 month = 28/29/30/31 days
  - 1 week = 7 days
  - 1 day = 24 hours
  - 1 hour = 60 minutes
  - 1 minute = 60 seconds
- Know about a leap year.

ADDITIONAL/ADVANCE LEVEL:

- *Know that units of time can be converted:*
  - *1 hour = 60 minutes = 3600 seconds*
- *Know the expanded form of measures of time.*

- Convert measures given in ℓitres to millℓitres and vice versa.
- Add and subtract measures of capacity.
- Solve real-world word problems involving conversion, addition and subtraction of measures of capacity.

ADDITIONAL/ADVANCE LEVEL:

- *Recognize that measures of capacity can be expressed in expanded form.*
- *Express measures of capacity in expanded form. (e.g. 4320 milliℓitres = 4 ℓitres + 320 milliℓitres)*

Time:

- Identify and choose an appropriate unit to measure time (calendar and analogue clock).
- Convert measures of time given in years to months, months to days, weeks to days, days to hours, hours to minutes, minutes to seconds and vice versa.
- Add and subtract measures of time.
- Solve real-world word problems involving conversion, addition and subtraction of measures of time.

ADDITIONAL/ADVANCE LEVEL:

- *Recognize that measures of time can be expressed in expanded form.*
- *Convert measures of time between hours, minutes and seconds. (e.g. 2 hours = 7200 seconds)*
- *Express measures of time in expanded form. (205 minutes = 3 hours + 25 minutes)*

STEP 2 _____

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,

- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that may be used as part of formative assessment are:

1. Which operation do we use when converting a small unit to a bigger unit?
2. Which operation do we use when converting a big unit to a smaller unit?
3. How many meters are there in a kilometre?
4. How many centimeters are there in a metre?
5. How many millimeters are there in a centimetre?
6. How many grams are there in a kilogram?
7. How many milligrams are there in a gram?
8. How many milliliters are there in a litre?
9. Ask questions about units of time. For example, how many hours are there in a day?
10. What is a leap year?
11. How many grams is equal to 23,645 mg?
12. Daniyal has 0.5 liters of water. How many milliliters (mL) of water does Daniyal have?
13. Add measures of length, mass and capacity. For example: Add 35 kg 250 g and 4 kg 150 g
14. Subtract measures of length, mass and capacity. For example: Subtract 19 kg 600 g from 23 kg 900 g
15. Mariam has a string which is 1 m 15 cm long and her friend Sarah has a string which is 130 cm long. Whose string is longer and by how much?

Some of the sample questions that may be used as part of the summative assessments are:

1. Convert the measures.
   (i) 26 kg _____ g (ii) 30 ℓ _____ mℓ (iii) 8 m 23 cm _____ cm (iv) 17 hours = _____ minutes
   (v) 7000 g _____ kg (vi) 1100 cm _____ m (vii) 8892 mℓ _____ ℓ (vii)3600 seconds = _____ minutes
2. Solve the following.

(i) 4 km + 3 km 700 m (ii) 19 km 100 m + 2 km 500 m (iii) 90 kg 8 g + 44 kg 80 g
(iv) 9 ℓ 320 mℓ + 2 ℓ 18 mℓ (v) 46 km - 2 km 200 m (vi) 99 kg 100 g - 55 kg 50 g
(vii) 21 ℓ 620 mℓ - 21 ℓ (viii) 12 ℓ 630 mℓ - 5 ℓ 300 mℓ

3. Real world word problems related to measurement.
    - Aliya bought 975 cm of cloth and she used 230 cm from it. How much cloth is she left with?
    - Can A contains 2.5 ℓ of juice and Can B contains 3250 mℓ of juice. If the juice from both can is mixed then what will be the total volume of juice? Give your answer in ml.

STEP 3 _ _____

Learning Activities:

Activity 1:

1. Inform students that a year has 365 days except when it is a leap year, which has 366 days.
2. Ask students do they know why it is called a leap year and how many days does a leap year have?
3. After taking their responses, inform them that a leap year February has 29 days.
4. Now ask them to identify leap years of the past 10 - 15 years.
5. You may also ask them to inform you of the leap years of the next 20 years.

Activity 2:

1. Give students a measuring tape and ask them to measure any one side of the classroom's door, chair, table and board.
2. Then, ask the students to write the lengths in centimeters and meters.

Activity 3:

1. Make pairs of students and provide a handout of the table given below.
2. Inform them that the table shows the matching units of measure and time.
3. Tell them that each square in the table has another matching square, for example the matching square of '2 km' is '2000 m.
4. Use a different colour to shade the matching squares. For instance you may choose a colour square showing '2 km' and the square showing ' 2000 m' with yellow.
5. Let students find the matching pairs of units of measures and time.

2 km	30 cm	4 g	48 hours
2 weeks	5 kg	12 L	2000 m
2 days	3 days	14 days	72 hours
0.3 m	12000 mL	4000 mg	5000 g

Activity 4:

1. Hand over the handout of the table given below.
2. Group students into pairs and give them the following directions:

- Place your markers on the start and play rock, paper and scissor.

3. Tell them that the winner of the match will move the marker up (one step) and solve the problem.
4. Keep repeating this until one of the players has reached the finish line and wins!

Finish	Finish
___ seconds = 19 minutes	____ cm = 80 m
____ cm = 89 m	_____ L is 5000 mL
____ m = 5 km	____ m = 8 km
_____ days = 4 weeks	_____ mm is 20 cm
_____ mm is 13 cm	___ seconds = 15 minutes
_____ L is 3000 mL	_____ days = 3 weeks
_____ mg = 2 g	_____ mg = 3 g
Start - Player 1	**Start -Player 2**

Domain: Measurement
Sub-Domain: Area and Perimeter

STEP 1 _____

Standard: Students will be able to differentiate between and find the area and perimeter of square and rectangular regions and solve related real-world problems

Student Learning Outcomes: Students will be able to

- Recognise that the shapes with the same area can have different perimeters and vice versa.
- Calculate the area of parallelograms and triangles.
- Solve real life word problems involving perimeter and area of square and rectangular regions.

Knowledge:
Students will be able to know:

- perimeter and area of a square, rectangle and rectilinear shapes.
- the unit of measurement for perimeter (e.g., m, cm or mm).
- the unit of measurement for area (e.g., m^2 and cm^2).
- Understand and state the formula for perimeter of a rectangle i.e., 2l + 2w
- Understand and state the formula for perimeter of a square i.e., 4l
- Understand and state the formula for area of a rectangle i.e., l x w
- Understand and state the formula for area of a square i.e., l ⍰ l.

ADDITIONAL/ADVANCED LEVEL:
Students will be able to know about the perimeter and area of a composite shape (made up of squares and rectangles.

Skills:
Students will be able to:

- Recall the perimeter of a 2-D shape.
- Recall area of a 2-D shape.
- Recognize the unit of measurement for perimeter (e.g., m, cm or mm).
- Recognize the unit of measurement for area (e.g., m^2 and cm^2).
- Differentiate between area and perimeter of square and rectangular regions.
- Apply the formula to find the perimeter of a rectangular region.
- Apply the formula to find the:
  - perimeter of a square region.
  - area of a rectangular region.
  - area of a square region.
- Calculate the area of parallelograms and triangles.
- Solve real-world word problems involving area and perimeter of square and rectangular regions.

ADDITIONAL/ADVANCED LEVEL:

- *Find perimeter and area of composite shapes (made up of squares and rectangles only)*

STEP 2 _____

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. What does area mean?
2. What is the unit of measurement for area? Give an example.
3. What does perimeter mean?
4. What is the unit of measurement for Perimeter? Give an example.
5. What is the formula for finding the area of a square?
6. What is the formula for finding the area of a rectangle?
7. What is the formula for finding the perimeter of a square?
8. What is the formula for finding the perimeter of a rectangle?
9. What will be the area of a square of sides 4 cm each?
10. What will be the perimeter of a square of sides 7 cm each?
11. What will be the area and perimeter of a rectangle whose length is 6 cm and width is 3 cm?

Some of the sample questions that may be used as part of summative assessments are:

1. Find the area and perimeter of a few given squares (or you may ask them to find the area and perimeter of their table top).
2. Find the area and perimeter of the given rectangle. For example:
3. Real world word problems involving area and perimeter. For example:
    - A rectangular playground is 58 m wide and 90 m long. What is its perimeter?
    - A square shaped tile is 12 inches long. What is the area of the tile?
    - A bedroom wall is 3 m wide and 4 m long. If a tub of paint can cover an area $10m^2$ then how many cans will be required to paint the wall?

STEP 3 _ _____

Learning Activities:

Activity 1:

1. Give three square shaped cut outs to students, of different sizes.
2. Ask them to find the area of any one cut out and estimate the area of the remaining cut outs.
3. Ask them to find out the actual area of the remaining cut outs and see how close or far their estimated answers were.

Activity 2:

1. Ask the students to find the area and perimeter of any one face of their book.

Activity 3:

4. Divide students into small groups and take them to the school ground.

5. Then, ask each group to draw a big square or rectangle on the ground (they can either make it on sand using wooden sticks or on the floor using chalks).
6. Then, give measuring tapes to each group and ask them to find the area and perimeter of their drawn shapes.

Domain: Geometry
Sub-Domain: Prisms

STEP 1 _____	
Standard: Students will be able to recognize and classify quadrilaterals and their characteristics, prisms, pyramids and their nets.	
Student Learning Outcomes: Students will be able to ● Recognize, compare and classify types of quadrilaterals and their characteristics (parallel sides, equal sides, equal angles, right angles, lines of symmetry etc),(Square, rectangle, parallelogram, rhombus, trapezium and kite). ● Recognize and draw nets of prisms and pyramids.	
Knowledge: Students will be able to: ● Know that quadrilaterals are polygons with 4 sides and 4 vertices. ● Know the following types of quadrilaterals: ● Square ● Rectangle ● Parallelogram ● Rhombus ● Trapezium ● Kite ● Know the characteristics of the quadrilaterals such as: ● Equal angles ● Equal sides ● Parallel sides ● Right angles ● Lines of symmetry	**Skills:** Students will be able to: ● Recall that quadrilaterals are polygons with 4 sides and 4 vertices. ● Recognize and identify the following types of quadrilaterals: ● Square ● Rectangle ● Parallelogram ● Rhombus ● Trapezium ● Kite ● Identify the characteristics of the quadrilaterals such as: ● Equal angles ● Equal sides ● Parallel sides ● Right angles ● Lines of symmetry

• Know nets of prisms such as square-based, triangular based and rectangular based pyramids.	• Recognize nets of prisms such as square based, triangular based and rectangular based pyramids. • Compare and classify quadrilaterals based on their characteristics. • Draw nets of prisms such as square based, triangular based and rectangular based pyramids.

STEP 2 _____

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of the formative assessments are:

1. A quadrilateral has _____ sides.
2. A quadrilateral has _____ angles.
3. A quadrilateral has _____ vertices.
4. Ask Riddles such as:
    - I am a quadrilateral with four equal sides and four right angles. Who am I?
    - I am a quadrilateral with two pairs of parallel lines and all congruent sides. Who am I?'

5. Draw different quadrilaterals on the board or show pictures to the students and ask them to identify them.
6. Make a table (like the one shown below) on the board and elicit answers for each square in the table.

Name of the Shape	Number of Equal Angles	Number of Equal Sides	Number of Parallel Sides	Number of Right Angles	Number of Lines of symmetry
Square					
Rectangle					
Parallelogram					
Rhombus					
Trapezium					
Kite					

7. Draw nets of prisms and pyramids on the board and ask the students to identify the shape.

Some of the sample questions that can be used as part of the summative assessments are:

1. List three ways a rectangle and a square are alike.
2. Tell one difference between a parallelogram and a rhombus.
3. Draw a picture of a house using any 4 types of quadrilaterals.
4. Draw nets of prisms and pyramids.

STEP 3 _ _____

Learning Activities:

Activity 1 - Guess the shape::

1. Write the name of all the quadrilaterals on separate pieces of paper and put them in a box.
2. Ask a student to pick a chit and then describe its properties to the class so that the rest of the students in the class can guess the shape.

Activity 2: Unfolding 3D shape

1. Get a net of a square based, triangular based and a rectangular based pyramid (made out of paper)with fold lines drawn on it.
2. Show the net to the students.
3. Ask them to fold the net from the fold lines to explore the shape and know how these square, triangular and rectangular based objects are formed.

Domain: Geometry

Sub-Domain: Angles

STEP 1 _____

Standard: Students will be able to identify, measure, construct (using a protractor) different types of angles and calculate supplementary and complementary angles.

Student Learning Outcomes:Students will be able to

- Identify angles at a point on a straight line and half a turn (180 degrees).
  angles at a point and 1 whole turn (360 degrees).
- Describe and calculate complementary and supplementary angles.

Knowledge:

Students will be able to know:

- standard unit for measuring angles i.e.,1˚, which is defined as 1/360 of a complete rotation.
- the types of angles:
  - Acute angle
  - Obtuse angle
  - Right angle
  - Straight angle
  - Reflex angle
- Construction of angles using protractor and a scale..
- complementary and supplementary angles.

Skills:

Students will be able to:

- Recall angles.
- Recall the standard unit for measuring angles i.e.,1˚, which is defined as 1/360 of a complete rotation.
- Identify the types of angles:
  - Acute angle
  - Obtuse angle
  - Right angle
  - Straight angle
  - Reflex angle
- Recall using a protractor to measure angles.
- Classify angles as acute, obtuse, right, straight and reflex angle.
- Measure angles using a protractor.
- Construct angles using a scale and a protractor.
- Identify complementary and supplementary angles.
- Calculate the unknown angle in a pair of complementary and supplementary angles.

STEP 2 _____

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,

- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. Draw analogue clocks on the board, without the hour and minute hand. Then, ask the students to draw the hands of the clock and show different types of angles i.e. acute, obtuse, right, straight and reflex.
2. Draw different angles on the board and ask the students to identify the types of angles.
3. Show a protractor to the students and ask them to identify the two different scales.
4. Give few examples of acute angles. (For e.g., 30^o)
5. Give few examples of obtuse angles (for e.g., 125^o)
6. Give few examples of reflex angles. (For e.g., 215^o)
7. What are complementary angles?
8. What are supplementary angles?
9. Use the protractor and scale to draw angles of the given measures. (For e.g., 65^o)

Some of the sample questions that can be used as part of summative assessments are:

1. Classify the given angles into acute, obtuse, right and reflex angles, for example: 35°**,** 145°**,** 90°**,** 72° and 260°
2. Measure the given angles in a given illustration with unknown angles mentioned.
3. Draw angles of the given measures for example: 23°**,** 245°**,** 90°**,** 105° and 180°
4. Find the complement of each of the following angles, for example: (i) 40° (ii) 27° (iii) 35°
5. Find the supplement of each of the following angles: such as (i) 100° (ii) 90° (iii) 110° (iv) 107°
6. Draw a pair of supplementary angles such that one of them measures: (i) 120° (ii) 90°

STEP 3 _ _____

Learning Activities:

Activity 1:

1. Ask the students to identify right angles around them in the classroom. For example, the hands of the clock make a right angle at 3:00 pm, the corner of their notebook is a right angle etc.
2. Take their responses.

Activity 2:

1. Draw an image of a protractor on the floor (with chalk) around the classroom door.
2. Then move the door, making different angles and ask the students to measure the angle using the protractor on the floor.

Activity 3:

1. Make angles using your arms.
2. Ask the students to identify the types of angles.

Activity 4:

1. Give the students a grid paper and ask them to write their names using straight lines (do not use curved lines or curved edges).
2. Then, ask them toIdentify and describe different types of triangles; with respect to sides and angles.
3. Calculate and measure unknown angles in a triangle. identify as many angles in their name as they can.
4. Ask them to measure the angles and identify their type.

Domain: Geometry
Sub-Domain: Types of Triangles

STEP 1 _____	
Standard: Students will be able to identify and describe different types of triangles and measure and calculate unknown angles in a triangle.	
Student Learning Outcomes:Students will be able to ● Identify and describe different types of triangles. with respect to sides and angles.	

Knowledge:
Students will be able to:
● Know the following types of triangles based on their sides and angles:
  ● Acute-angled triangle
  ● Obtuse-angled triangle
  ● Right-angled triangle
  ● Equilateral triangle
  ● Isosceles triangle
  ● Scalene triangle
● Know that the sum of angles in a triangle is equal to 180^{o}.
	Skills:
	Students will be able to:
	● Identify and describe different types of triangles based on their sides and angles:
	  ● Acute-angled triangle
	  ● Obtuse-angled triangle
	  ● Right-angled triangle
	  ● Equilateral triangle
	  ● Isosceles triangle
	  ● Scalene triangle
	● Calculate the measure of an unknown angle in a triangle.

STEP 2 _____

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of the formative assessments are:

1. Draw different types of triangles and ask the students to recognise and identify the type of triangle.
2. Ask Riddles. For example:
   - I am a triangle with sides of 4 cm, 4 cm and 7 cm. Which triangle am I?
   - I am a triangle with angles of 90°, 60° and 30°. Which triangle am I?
   - I am a triangle with angles of 110°, 40° and 30°.Which triangle am I?
   - I am a triangle with sides of 5 cm, 13 cm and 12cm. Which triangle am I?
   - I am a triangle with angles of 60°, 60° and 60°.Which triangle am I?
3. If the measures of two angles of a triangle are 65° and 40°. What is the measure of the third angle?

Some of the sample questions that can be a part of the summative assessments are:

1. Identify the type of triangle based on its properties. For example:
   - Identify the triangle whose angles are 35°, 40° and 105°.
   - Identify the type of triangle whose angles are 55°, 65°and 60°.
   - Identify the type of triangle whose angles are 50°, 40°and 90°.
   - Identify the type of triangle where each side is 7 cm long.
   - Identify the type of triangle which has two equal sides.
   - Identify the type of triangle where all sides are of different lengths.
2. Fill in the blanks. For example:

- The triangle with equal sides is _____.
- A _____triangle has all sides of different lengths.
- Each angle of an equilateral triangle is _____.
- An _____ triangle has two equal sides.
- In an obtuse angled triangle one angle is _____90°.
- Each angle of an acute angled triangle is _____90°.

3. Find the measure of the unknown angle ∠C of a triangle. For example:
   ∠A = 60°, ∠B = 60°
   ∠A = 75°, ∠B = 87°
   ∠A = 95°, ∠B = 10°
   ∠A = 96°, ∠B = 25°

STEP 3 _ _____

Learning Activities:

Activity 1:

1. Give some toothpicks, glue and a paper to the students and ask them to draw the following types of triangles:
   - Right angled triangle
   - Equilateral triangle
   - Isosceles triangle

DOMAIN: STATISTICS AND PROBABILITY

STEP 1 _____

Standard.: Students will be able to draw, read and interpret bar graphs and line graphs; and interpret data represented in pie charts.

Student Learning Outcomes:Students will be able to

- Draw, read and interpret bar and line graphs.
- Interpret pie charts.(including real-world problems)

Knowledge:

Students will be able to:

- Know line graphs as a method of representing data.
- Know interpret line graphs, represent data on a line graph.
- Know pie charts
- Interpret pie charts.

Skills:

Students will be able to:

- Recall representation of a data using horizontal and vertical bar graphs.
- Recall representation of a data using horizontal and vertical bar graphs.
- Recognize line graphs as a method of representing data.
- Represent the given data using horizontal and vertical bar graphs.
- Read and interpret data from a bar graph.
- Read and interpret data from a given line graph.
- Represent the given data using line graphs.
- Read and interpret data from a given pie chart.
- Solve real-world word problems using data presented in bar graphs, line graphs and pie charts.

STEP 2 _____

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

1. Ask the favorite color/fruit/city of the students in your class and write the data gathered on the board in a table. Then, ask the students to make a bar graph to represent the data on an A4 paper. Ask the whole class to show their graph on your clap. You can do the same for a line graph.
2. Show pictures of different bar graphs to students and ask them to identify which is horizontal and which is vertical.
3. Show/Draw a table on the board containing some data and ask the students to draw a horizontal/vertical bar graph (in their notebooks) to represent the data.
4. Show/Draw a pie chart on the board and ask the students questions about the data being represented. For instance if the pie chart represents the data about balanced dietary preferences. You could ask questions such as:
   (i)Which balanced diet is consumed by the highest number of people?
   (ii)Which balanced diet is consumed by the least number of people?
   (iii)If this pie chart represents the preferred balanced type of 200 people, how many people have dairy products as their preferred balanced diet.

Some of the sample questions that can be used as part of summative assessments are:

Ask the students to solve the following types of questions:

1. Reading, interpreting and drawing a bar graph. For example: a bar graph is shown which represents data collected from a class showing favourite fruit in a class. Each student voted once. The relevant questions could be:.
   - How many different fruits are represented on the graph?
   - Which fruit has the most number of votes?)
   - Which fruit has the least number of votes?
   - How many students voted for Bananas?
   - Which fruits were liked by the same number of students?
   - How many more votes did Oranges get than Grapes?
   - Find out the favorite fruit of 8-10 of your classmates and represent the data using a bar graph.
2. Reading, interpreting and drawing a line graph, For example: a line graph is shown that represents the annual food production from 1992 to 1997.
   - What was the food production in the year 1994?
   - How much did the food production increase from 1992 to 1993. Express your answer in percentage also.
   - Which year has the highest food production?
   - How much did the food production decrease from 1995 to 1996? Express your answer in percentage also.
3. Reading and interpreting a pie chart.
   For example: 32 people were asked which season was their favorite.
   - How many people chose winter?
   - How many people chose summer?
   - How many people chose spring?
   - How many people chose autumn?

STEP 3 _ _____

Learning Activities

Activity 1:

1. Give students buttons of 5 different colors.
2. Ask them to draw a vertical and horizontal bar graph to represent the number of buttons of different colors.

Activity 2:

1. Give students buttons of 5 different colors and a chart paper.
2. Tell them that a survey was conducted on a group of 25 people about their favorite color. 7 choose red, 5 choose blue, 9 chose yellow and 4 chose green.
3. Then, ask the students to make a bar graph on the chart paper and stick the buttons to represent the data.

Activity 3:

3. Give students matchsticks and ask them to draw a line graph using them, to represent the data given below.

Activity 4:

1. Show a balance diet chart to the students and asks the following questions:
   - Which food group should be consumed more for balanced diet?
   - Which food group should be consumed less?
   - Which food groups cover ¼ of our diet?

Domain: Statistics and Probability

Sub-Domain: Averages

STEP 1 _____

Standard.: Students will be able to calculate the average of given quantities and solve related real-world word problems.

Student Learning Outcomes: Students will be able to

- Find the average of given quantities, measures and numbers in a data.
- Solve real world word problems related to averages involving quantities, measures and numbers.

Knowledge: Students will be able to: ● Know and understand averages. ● Understand and state the formula for calculating average of various quantities. (i.e. sum of all items/total number of items)	**Skills:** Students will be able to: ● Calculate the average of given quantities. ● Solve real-world word problems related to average.

STEP 2 _____

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of the formative assessments are:

1. How do we calculate the average?
2. If I want to find the average marks of a class of 20 students, what will I divide the total marks of all students with?
3. Find the average of the first ten odd numbers.
4. Ask the students in your class the number of siblings they have and then calculate with them the average number of siblings of the students in the class.
5. Find the average of 65, 85, 70, 90, and 105 and choose the correct answer. (i)80 (ii)83 (iii)85 (iv)90
6. The total sales of a coffee shop for a week are Rs. 42,700. What is the average sale per day?
7. The goals scored by a team in a total of six matches are 1, 2, 5, 3, 4, 0. Find the average score of the team.

Some of the sample questions that can be used as part of summative assessments are:

1. What is the average of the first three 3-digit numbers? Choose the correct answer: (i) 99 (ii) 100 (iii) 101 (iv) 102
2. What is the average of the first four even numbers? Choose the correct answer: (i) 5 (ii) 7 (iii) 8 (iv) 9
3. The average of 20 numbers is 75. One of the numbers i.e. 86 was incorrectly read as 68 while calculating the average. Find the correct average.
4. The ages of five men are 45, 42, 40, 53 and 50. What is their average age? Choose the correct answer: (i) 42 (ii) 43 (iii) 45 (iv) 46
5. Real world word problems related to average. For example:
    - Aslam took 1 hour 25 minutes to finish his homework, Farah took 2 hours 40 minutes and Nabeel took 3 hours 35 minutes to finish his homework. How long did they take on average to finish their homework?
    - Rayan covered a distance of 42 km in 3 hours and a further distance of 44 km in 4 hours. Find his average speed.
    - In a series of four cricket matches, the runs scored by India and Australia were as follows (show a table containing number of matches and scores scored by teams):
        - What is the average score of India?
        - What is the average score of Australia?
        - Which team performed better?
    - The weight of four children is given below:
        - Arshad = 34.2 kg
        - Sohail = 36.8 kg
        - Fatima = 41.3 kg
        - Sana = 40.5 kg

    a). Find the average weight?

    b). How many children weigh less than the average weight?

    c). Name the children whose weights are above the average weight.

STEP 3 _ _____

Learning Activities:

Activity 1:

1. Ask the students to write the marks of their monthly test for all the subjects.
2. Calculate their average marks.

Activity 2:

1. Ask the students to find the ages of 10 to 12 of their classmates.
2. Then find their average age

Domain: Statistics and Probability

Sub-Domain: Probability

STEP 1 _____

Standard: Students will be able to explain experiments and outcomes; and represent the probability (using a fraction) that an event will occur, in simple games and probability experiments (including real-world word problems)

Student Learning Outcomes: Students will be able to

- Explain experiments and outcomes; and represent the probability (using a fraction) that an event will occur, in simple games and probability experiments (including real-world word problems).

Knowledge:

Students will be able to:

- know experiments and outcomes.
- Understand and state the formula for probability. (i.e., number of favorable outcomes/ total number of possible outcomes)

ADDITIONAL/ADVANCE LEVEL:

Students will be able to:

- Know the language of probability.

Skills:

Students will be able to:

- Identify experiments and outcomes.
- Represent the probability (using a fraction) of an event in simple games and probability experiments. (For e.g., a spinner has four equal sections and one of those sections is colored red. The probability that the arm will land on red is 1/4).
- Solve real-world word problems involving simple games and probability experiments.

ADDITIONAL/ADVANCE LEVEL:

Students will be able to:

- Carry out probability experiments.

STEP 2 _____

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

1. Give a few examples to students and ask them to identify which are of experiments and which are not.
2. Give an example of an experiment and ask the students to list its outcomes.
3. Write each of the letters of the word MISSISSIPPI on a separate piece of paper, then fold all of them and put them in a box and mix them thoroughly. Tell the students what the box contains and then ask them if a piece of paper is chosen (without looking) from the hat. What is the probability that it will say 'I'?
4. In a class of 20 students, 8 are in the drama club and 12 are in the art club. If a student is selected at random, what is the probability that the selected student is in the: (i) drama club (ii) art club
5. A bag contains 50 marbles out of which 28 are red and 22 are blue. If a marble is picked at random from the bag. What is the probability that it will be: (i) a red marble (ii) a blue marble.

Some of the sample questions that can be used as part of summative assessments are:

1. Real world word problems related to probability. For example:
   - Out of 300 students in a school, 95 play cricket, 120 play football, 80 play volleyball and 5 don't play any games. If one student is chosen at random, find the probability that
     - he/she plays volleyball
     - he/she plays cricket
     - he/she plays football
   - The blood group of 60 students of a class is shown in a table. A student of the class is selected at random.
     - What is the probability that the selected student has blood group O?
     - What is the probability that the selected student has the blood group B?
2. Choose the correct answer. For example:
   - What is the probability of getting odd numbers if a dice is thrown? (i)1/2 (ii) 2 (iii)4/2 (iv) 5/2
   - What is the probability of getting an even number when a dice is thrown? (i)1/6 (ii)1/2 (iii)1/3 (iv) ¼
   - What is the probability of getting 2 when a dice is thrown? (i) 1 (ii)3/6 (iii)4/6 (iv)1/6

STEP 3 _ _____

Learning Activities

Activity 1:

1. Bring a dice to the classroom and allow the students to play with it. Then ask the following questions:

- What is the probability of rolling a 3?
- What is the probability of rolling more than 4?
- What is the probability of rolling less than 5?
- What is the probability of rolling an even number?
- What is the probability of rolling an odd number?
- What is the probability of rolling a prime number?
- What is the probability of rolling an even prime number?
- What is the probability of rolling a composite number?

2. Bring a spinner to the classroom and allow the students to play with it. Then ask the following quesstions:
   - What is the probability that the spinner will stop at red?
   - What is the probability that the spinner will stop at yellow?
   - What is the probability that the spinner will stop at blue?
   - What is the probability that the spinner will stop at green?

DRAFT

Mathematics - Class 6
Suggested Guidelines

DOMAIN: Numbers and Operations
Sub-Domain: Multiples and Factors

STEP 1 _____

Standard : Students will be able to recognize factors, multiples, HCF and LCM

Student Learning Outcomes: Students will be able to

- Recognize factors of numbers up to 3-digit
- Multiples of numbers up 2-digit.
- HCF and LCM.

Knowledge:
Students will be able to know:

- Factors of numbers up to 3-digit
- Multiples of numbers up to 2-digit
- Highest Common Factor (HCF)
- Least Common Multiple (LCM)

Skills:
Students will

- Find factors of up to 3-digit numbers
- Find multiples of up to 2-digit numbers
- Find prime factors of a given number up to 4-digit express its factors in the index notation (base and exponent)
- Find HCF of three numbers upto3-digits by
  - prime factorization
  - division method
- Find LCM of up to four numbers of 3-digits by
  - prime factorization
    - division method
- Apply HCF and LCM in real life situations
- Recognize and calculate squares of up to 2-digit numbers.

Additional/Advanced:
Students will be able to:

- Find relation between HCF and LCM

STEP 2 _____

Assessments:

Formative Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessment are:

3. Write any 3-digit number and do prime factorization. Peer checking can be done for this task.
4. Write first five multiples of numbers 10– 15 in 2 minutes.
5. Find the lowest number which is exactly divisible by 18 and 24.
6. Find the greatest number that divides 90 and 126 exactly.

Some of the sample questions that can be used as part of summative assessments are:

7. Write the multiples of 6 which are greater than 20 and less than 50.
8. Write all the prime numbers between 1 and 15.
9. Write all the composite numbers between 1 and 30.
10. Write all the prime numbers between the following:

    31 and 50 50 and 90 61 and 80

- Write all the composite numbers between the following:

  40 and 50 75 and 90 25 and 35

11. Find the highest common factor of the given numbers by long division method.

    18 and 30 75 and 180

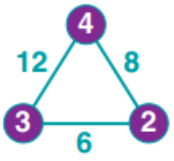
- Two ropes are 64 cm and 80 cm long. What maximum length of pieces can be cut equally from the given ropes?

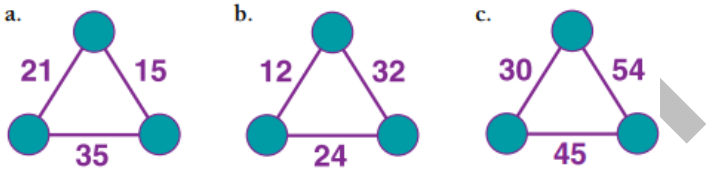
- A shopkeeper sells candles in packets of 12 and candle stands in packet of 8. What is the least number of candles and candle stands Nita should buy so that there will be one candle for each candle stand.
- A florist wants to arrange 24 bouquets of flowers in different rows. Find out in how many ways he can arrange the bouquets with same number in each row.

STEP 3 _ _____

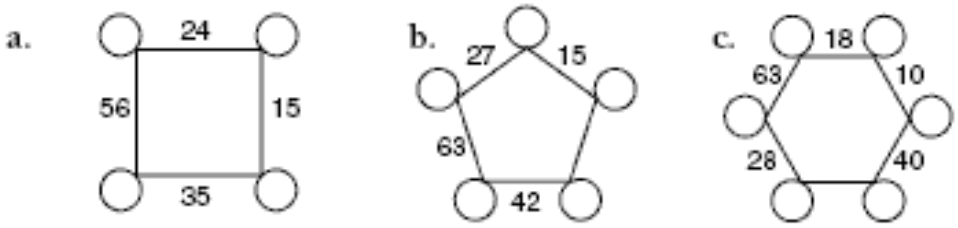
Learning Activities

1. Teacher can explain the concept of factors by making a combination table.
2. Teachers can also use a puzzle of different polygons to make learning fun. For example in the following polygon, the number beside each line segment is the product of the factors in the circles at each end of the line segment.





3. Teachers can ask students to make different polygons and exchange with other classmates as a challenge.



4. Teachers can play a bingo game with 2 dice and provide students with a number grid. 1-dice will be used with original numbers i.e. 1-6 and others will be used as 4-9. This game will be played in pairs:
   - Take turns to roll the dice.
   - On your turn, multiply the two numbers showing on the dice and mark square on the board that shows the product.
   - The first player to cover three squares in a row (vertically, horizontally, or diagonally) wins.
   - If neither player ends up with three counters next to each other, the game is a draw.

36	45	54	63	72	81
35	40	42	48	56	20
24	28	32	16	63	30
40	48	25	28	45	36
54	72	35	42	56	24
32	64	49	20	30	72

5. Teachers can use an interesting activity for introducing factorization by continuing the roots to their prime factors. On a sheet of brown construction paper, have students draw a tree trunk. On the trunk write the number 24. Below

the trunk, have students draw roots with all the possible factors of 24: 1, 2, 3, 4, 6, 8, 12 and 24. Have students complete this activity with other numbers.

6. Teachers can play Two –Minute Multiple games with students by asking students to write numbers 2 - 10 in a column on their mini white boards. Teacher will set the timer of 2 minutes and will read aloud the first 10 multiples of 2 - 10. Students will be required to write the multiple corresponding to the correct number. When time is up, each player counts the multiples written next to the numbers. The player with the most correct multiples wins!
7. Teacher can use following activity to do practice of prime factorization:
    - Ask students to stand in an open space at least an arms-length away from each other.
    - Tell them that you will be calling out numbers (such as 13, 21 or 101) and they will need to decide if the number is prime or composite.
    - If prime, they should sit down. If composite, they should stand up.
    - After calling out a composite number, choose a standing student to give the prime factorization of the number
8. Teacher can share following online game with students to practice prime factorization https://www.mathplayground.com/factortrees.html
9. Teachers can make cards to play treasure hunt with students. Each card will contain the answer of any other card and a question. Students will solve the questions to solve the treasure hunt.

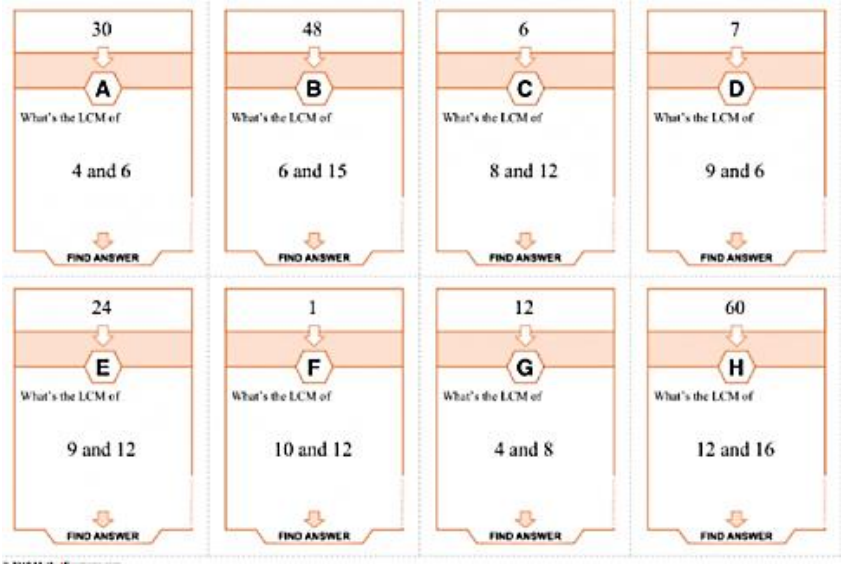


Figure 1 [Treasure Hunt Cards] [tes]

10. Teacher can share following online game with students to practice Highest Common Factor (HCF) and Least Common Multiple (LCM)
    https://www.transum.org/software/SW/Starter_of_the_day/Students/HCF_LCM.asp
    https://www.transum.org/software/SW/Starter_of_the_day/Students/HCF_LCM.asp?Level=2

11. Following coloring activity sheet can be provided to students to match the square numbers by coloring the block with same color.

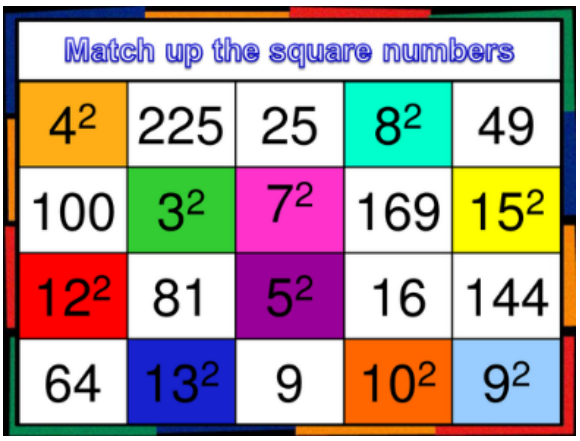


Figure 2 [Square Numbers] [tes]

12. Following type of maze game can be used as a fun learning activity by teachers to practice square numbers.

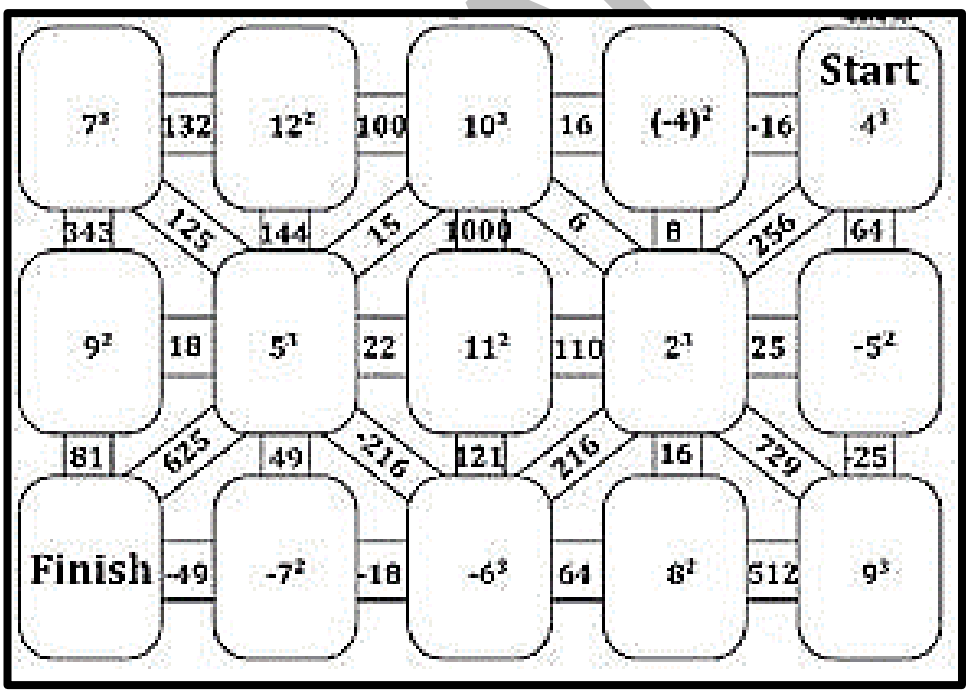


Figure 3 [Square Numbers] [tes]

Reference:

TES (2021) Retrieved from: https://www.tes.com/teaching-resource/lcm-and-hcf-treasure-hunt-11743277

TES (2021) Retrieved from: https://www.tes.com/teaching-resource/square-numbers-matchup-game-11059444

Teachers Pay Teachers (2021) Retrieved from: https://www.teacherspayteachers.com/Product/Squared-and-Cubed-Numbers-Maze-4790446

Domain: Number and Operations
Sub-Domain: Integers

STEP 1

Standard: Students will be to recognize and identify integers, their absolute values and compare and arrange in different order.

Student Learning Outcomes: Students will be able to

- Recognize and identify integers (positive integers, negative integers and neutral integers).
- Calculate absolute or numerical value of an integer.
- Using a number line,compare and arrange a given list of integers and their absolute values in ascending and descending order

Knowledge:
Students will be able to know:

- Integers
- Negative integers
- Positive integers
- Zero (0) as a neutral integer
- Absolute or numerical value of an integer
- Integers on number line

Skills:
Students will

- Represent integers on number line
- Identify integers on number line as:
  - positive integer
  - negative integer
  - neutral integer
- Arrange a given list of integers in ascending and descending order
- Arrange the absolute or numerical values of the given integers in ascending and descending order
- Apply integers to solve real life situations

STEP 2

Assessments:
Formative Assessments.

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be sued as part of the formative assessment are:

Ask students the following type of questions:

1. Note down temperatures of their five favorite countries and represent them on the number line.
2. Write any five negative numbers and any 5 positive numbers and find their absolute values.
3. Students can be asked a riddle: A special integer exists in mathematics that shows a special property. If you subtract any number from that integer, the result will always be divisible by the successor of that number completely.

Some of the sample questions that can be used as part of the summative assessments are:

Ask students the following type of questions:

1. In each case, arrange the given integers in ascending order:
   -8, 0, -5, 5, 4, -1
   3, -3, 4, -7, 0, -6, 2
   -1, -7, 8, -3, 0, 3, 17
2. In each case, arrange the given integers in descending order:
   -5, -3, 8, 15, 0, -2
   12, 23, -11, 0, 7, 6
   -1, -21, -31, 12, 5, 11
3. Find the mod of:
   |14 - 6| = |8| = 8 - |- 10| = - 10 15 - |- 6| = 15 - 6 = 9
   7 + |- 7| = 7 + 7 = 14

4. When Steve woke up. His temperature was 102º F. Two hours later it was 3º lower. What was his temperature then?
5. An elevator is on the twentieth floor. It goes down 11 floors and then up 5 floors. What floor is the elevator on now?
6. Josie has $47 left on her checking account. If she writes a check for $55, what will Josie's balance be?
7. It will be – 12º tonight. The weatherman predicts it will be 25º warmer by noon tomorrow. What will the temperature be by noon tomorrow?
8. The elevation of Mt. Everest is 29,028 feet. The elevation of the Dead Sea is –485 feet. What is the difference in the elevation between Mt. Everest and the Dead Sea?

STEP 3 _ _____

Learning Activities

1. Teacher will ask students to give real life scenarios where they have seen negative numbers.
2. Teacher can show the following video to discuss real life examples of integers. https://www.youtube.com/watch?v=9w7gwFA1HNI
3. Number cards will be made by teacher and students will be asked to add negative or positive signs and then arrange them in ascending or descending order.
4. Different temperature cards will be displayed to students and they will be asked to arrange them in order from coldest to warmest.
5. Number line will be displayed on board and students will be asked to point out the position of different integers on number line.
6. Teacher can prepare a short worksheet of filling the missing spaces on number line.
7. Students can play a game with dice in pairs to compare integers.
    - Teacher will provide a handout with some blank spaces for 2-digit or 3-digit numbers with positive and negative signs and an empty box in between number blanks for comparison of integers.
    - Player 1 will role dice and fill one blank of question and then player 2 will role dice and fill the other blank then according to positive and negative signs, players will determine which sign goes between numbers(< , > or =).
    - The player with greater number gets 1 point.
8. Following Online game link can be shared with students for practice of arranging integers. https://www.mathplayground.com/mobile/numberballs_fullscreen.htm
9. Teacher can show the following video to explain concept of absolute value. Video can be paused at several intervals to ask questions from students. https://www.youtube.com/watch?v=zxaT8ArCKjQ
10. Following Online game link can be shared with students for practice of finding absolute value of integer. https://www.math-play.com/Millionaire-Game-Absolute-Value/Millionaire-Game-Absolute-Value_html5.html

Domain: Number and Operations
Sub-Domain: Laws of Integers

STEP 1 _____

Standard*:* Students will be able to apply four operations (+, - , x, ÷ BODMAS), commutative, associative and distributive laws on integers.

Student Learning Outcomes: Students will be able to

- Add upto-2-digit like and unlike integers.
- Verify commutative and associative laws.
- Subtract up to 2-digit like and unlike integers.
- Multiply up to 2-digit like and unlike integers.
- Verify commutative, associative and distributive laws.
- Divide like and unlike integers up to 2-digit.

Knowledge:

Students will be able to know:

- Commutative, associative and distributive laws.
- "0"as an additive identity
- Additive inverse of an integer
- "1"as a multiplicative identity
- Order of mathematical operations by applying the BODMAS rule.

Skills:

Students will

- Add two integers up to 2-digit with the same and opposite signs and represent it on a number line
- Verify commutative and associative law of addition for integers up to 2-digit numbers
- Subtract two integers up to 2-digit with same and opposite signs.
- Multiply two integers up to 2-digit with the same and opposite signs
- Verify commutative and associative law of multiplication for integers up to 2-digit numbers
- Verify Distributive law of multiplication over addition up to 2-digit integers
- Verify Distributive law of multiplication over subtraction up to 2-digit integers
- Divide Two Integers With Same And Opposite Signs.
- Explain the order of mathematical operations by applying the BODMAS rule.
- Simplify Mathematical Expressions Involving integers, fractions and decimals.

STEP 2 _____

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make a poster of Addition and subtraction rules of integers with examples.
2. Make mathematical expressions and exchange it with other students to take it as a challenging question.
3. Maze hand out can be given to students to assess mathematical expressions.

Some of the sample assessments that can be used as part of the summative assessments are:

Ask students the following type of questions:

1. Simplify :
   12-[20÷{8-2(9-5-2)}]
   25− [4 + {16 − (12 − 2)}]
   36 − [18 − {14 − (15 − 4 ÷2 ×2)}]
   13-[20 ÷{8-2(9-5-2)}]

2. Challenge Activity for students

Use each of the digits 1,2 ,3 and 4. Place appropriate operation symbol and brackets to derive the given answer.

Example: (4 + 3 – 1) x 2 = 12

	= 11
(4 + 3 – 1) x 2	= 12
	= 13
	= 14
	= 15
	= 16
	= 17
	= 18
	= 19
	= 20

Figure 4 [Challenge Activity] [liveworksheets]

STEP 3 _ _____

Learning Activities

1. Teachers can use the following links to explain the concept of adding and subtracting integers.
   https://www.youtube.com/watch?v=CfkaifC7tGY
   https://www.youtube.com/watch?v=1DKWG5CBeek
2. Teachers can use playing cards to practice adding, subtracting and multiplying integers.
   - Red cards are negative and black cards are positive
   - Deck will be placed in the center of the table upside down and each student will be asked to take out 2 cards.
   - Students will be asked to add, subtract or multiply the value of their card
   - To get a 2-digit number students will take out 2 cards to create 1 value.
   - On giving each right answer, Students will get 1 point.
3. Following Online game link can be shared with students for practice of adding integers.
   https://www.mathplayground.com/ASB_SpiderMatchIntegers.html
4. Teachers can explain the commutative property by following activity.
   - Write this problem on the board. For example, 9 + 2 = ___
   - Have nine children stand to the left of the board and two children to the right. Have the children count all the students for the answer of 11.
   - Shift, write 2 + 9 = on the board and discuss that it doesn't matter in addition, the ORDER of the problem, just the total amount of items, the sum.
   - KEEP the same students in the two groups but have them shift to the left or right so the nine students are now on the right and the SAME two students are on the left.
   - Discuss how the total number of students have not changed, and that we call this the Commutative Property of Addition.
5. Teachers can use 3 dice to practice associative property. Teacher will provide a handout of associative property with blanks. Students will roll all 3 dice at once and will write the numbers

in the same sequence on both sides and then they will solve both sides to find out both sides give the same answer.

6. Teachers can explain the concept of distributive property by using a real-life scenario. For example,
    - Imagine one student and her two friends each have seven strawberries and four apples. How many pieces of fruit do all three students have in total?
    - In their lunch bags — or, the parentheses — they each have 7 strawberries and 4 apples. To know the total number of pieces of fruit, they need to multiply the whole thing by 3.
    - When you break it down, you're multiplying 7 strawberries and 4 apples by 3 students. So, you end up with 21 strawberries and 12 apples, for a total of 33 pieces of fruit.
7. Following Online game links can be shared with students for practice of Commutative, Associative and Distributive property.
   https://www.mathgames.com/skill/3.37-properties-of-addition
   https://www.mathgames.com/skill/3.38-solve-using-properties-of-addition
   https://www.mathgames.com/skill/7.96-properties-of-addition-and-multiplication
8. Teacher can make a concept map of BODMAS on board to explain the order of operations.

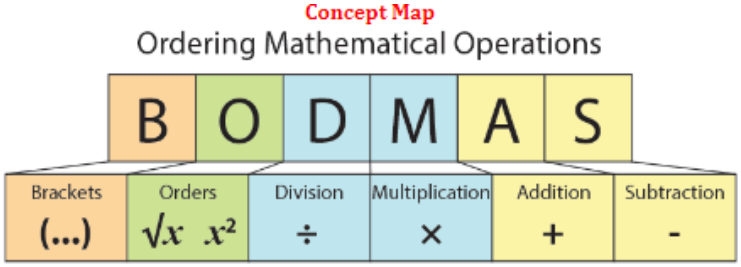


Figure 5 [BODMAS CONCEPT RULE] [liveworksheets]

9. Teachers can take a box in class containing mathematical expressions written on folded paper chits. Students will be asked to take out one paper chit and solve it. First student solving the mathematical expression correctly will be announced "Math Genius" of class.

Reference:

Liveworkseets (2021) Retrieved from:
https://www.liveworksheets.com/bp935523uz

Domain: Number and Operations

Sub-Domain: Rate, Ratio and Percentage

STEP 1 _____

Standard*:* Students will be able to define and calculate ratio, rate, and percentage and apply these in real life context.

Student Learning Outcomes: Students will be able to

- Define and calculate ratio, equivalent ratio, rate and percentage.
- Solve real life problems involving ratio, rate and percentage.

Knowledge:

Students will be able to know:

- Ratio, equivalent ratio, rate.
- Difference between ratio and rate.
- Ratio has no unit but the rate has a unit.
- Meaning of percentage.
- The amount, the base, and the percent in a percent problem.

Additional:

Students will be able to know relation between distance, time and speed

Skills:

Students will

- Express ratio as comparison of two quantities that are measured in same units
- Calculate ratio of two numbers/ quantities up to3-digit
- Simplify given ratio into lowest(equivalent)form
- Describe the relationship between ratio and fraction
- Explain continued ratio.
- Explain rate as comparison of two quantities that are measured in different units.
- Express one quantity as percentage of another
- Compare two quantities by percentage
- Increase or decrease a quantity by a given percentage
- Solve Real Life Situations involving percentage
- Solve Real Life Situations Involving Ratio, Rate and Percentage.

Additional:

Students will be able to:

- convert 12-hr clock time to 24-hr clock time (calculating journey time)
- solve real-life problems involving distance, time and speed

STEP 2 _____

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz

- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Use their favorite recipe and find out the quantity of each ingredient to make 15 servings.
2. Make a discount poster of their favorite clothing shop. And make a list of 5 articles with original price and 25% discounted price.

Some sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. The length of the ribbon was originally 30 cm. It was reduced in the ratio 5: 3. What is its length now?
2. Mother divided the money among Ron, Sam and Maria in the ratio 2: 3: 5. If Maria got $150, find the total amount and the money received by Ron and Sam.
3. The ratio of the number of boys and girls is 4:3. If there are 18 girls in a class, find the number of boys in the class and the total number of students in the class.
4. Jason is driving across the country. For the first 3 hours, he travels 60 mph. For the next 2 hours he travels 72 mph. Assuming that he has not stopped, what is his average traveling speed in miles per hour?
5. Tom runs a 100m race in a certain amount of time. If John runs the same race, he takes 2 seconds longer. If John ran at 8m/s, approximately how fast did Tom run?
6. In an election, candidate A got 75% of the total valid votes. If 15% of the total votes were declared invalid and the total number of votes is 560000, find the number of valid votes polled in favor of the candidate.
4. A shopkeeper bought 600 oranges and 400 bananas. He found 15% of oranges and 8% of bananas were rotten. Find the percentage of fruits in good condition.

5. Aaron had $ 2100 left after spending 30 % of the money he took for shopping. How much money did he take along with him?

STEP 3 _____ _____

Learning Activities

1. Teachers can demonstrate the concept of ratio by M&M Activity. Each student will get a pack of M&Ms of assorted colors. Teacher will lead students through how they will fill out the activity sheet. Students will count the total M&Ms and will calculate the ratio of each color to total M&Ms.

	Red	Orange	Yellow	Green	Blue	Brown
Total of each color						
Ratio of color to total M&Ms						

2. Teacher can explain the concept of equivalent ratios by using kid's favourite recipe to make several servings.
3. Following Online game links can be shared with students for practice of unit rate: https://www.brainpop.com/games/unitrates/?topic_id=
4. Teacher can Challenge students to use their knowledge about percentages in this fun game. Just roll the dice and race to calculate the percentage. Whoever gives the correct answer first earns a point and the first person to reach 15 points wins!!
    - In order to determine the percentage, students will pick a card from the deck and whatever number they'll draw they will have to add zero at its end. For example, if student draws an 8 the percentage need to calculate will be 80
    - 2 dice will be rolled to get a number of which percentage has to be calculated.
    - The first player should turn over a card and roll the dice.
    - Players race to see who can get the correct percentage of the number rolled on the dice. For example, if the total of the 2 dice was 11 and the percent was 20%, players try to determine what 20% of 11 is. 4. The first player to get the correct answer wins that round and gets a point. Play continues until one player reaches 15 points.
5. Following Online game links can be shared with students for practice of percentage increase or decrease.
   https://www.quia.com/rr/230204.html

Domain: Number and Operation

Sub-Domain: Sets

STEP 1 _____

Standard: Students will be able to use language notation and Venn diagrams to represent sets.

Student Learning Outcomes: Students will be able to

- Use language, notation and Venn diagrams to represent different types of sets and their elements (empty, singleton , subsets , proper, improper subsets and universal set , finite and infinite sets).

Knowledge:

Students will be able to know:

- Set, an element of a set, empty set.
- Singleton set and universal set.
- Types of sets.
- Sets using Venn diagrams.

Additional:

Students will be able to know about subsets of a given set

Skills:

Students will be able to

- Name the sets using capital letters A, B, C etc. And use symbol for empty set (Φ).
- Differentiate between elements of a set, finite & infinite sets and universal sets.
- Identify and find the subsets (proper and improper) of a set, finite and infinite sets.
- represent sets using Venn diagrams

STEP 2 _____

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests

- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make sets of first ten multiples of 6 and 8 and find union and intersection of sets using Venn diagram.
2. Students can be asked to do a short activity in pairs. In each pair, students will make a set of his/her favorite food items, after making a set, each pair of students will find the union and intersection of their favorite colors.

Summative Assessments

Ask students the following type of questions:

1. If A = {1, 3, 7, 9, 10}, B = {2, 5, 7, 8, 9, 10}, C = {0, 1, 3, 10}, D = {2, 4, 6, 8, 10}, E = {negative natural numbers} and F = {0}
   Find:
   (i) A ∪ B (ii) E ∪ D (iii) C ∪ F (iv) C ∪ D (v) B ∪ F (vi) A ∩ B
   (vii) C ∩ D (viii) E ∩ D
2. If P = {multiples of 3 between 1 and 20} and Q = {even natural numbers upto 15}. Find the intersection of the two given sets P and set Q.

STEP 3 _ _____

Learning Activities:

1. Teachers can use the following online game link for practice of symbols used in set.
   https://www.transum.org/software/SW/Starter_of_the_day/Students/Set_Notation/Default.asp
2. Teachers can use the following online video link to explain types of sets.
   https://www.youtube.com/watch?v=8dup8yGwBhM
3. Teacher can explain the concept of representing sets using the Venn diagram by the following activity: Teacher will make three sets of hobbies. Sports, Reading and Computer games.
   - Set A is for pupils who like sport.
   - Set B is the pupils who like reading.
   - Set C is for pupils who like computer games.
   - Teacher will write the names of students in each set. And then construct the Venn diagram on board.
4. Teacher can use following online video link to explain union and intersection of two set
   https://www.youtube.com/watch?v=YEsBbAGqkZw
5. Teacher can use following activity to do practice of set:
   - These activities will require students to be grouped prior to the beginning of the activity.
   - Divide students into groups of 5-7
   - Give one set of numbers to each group

- Teacher will write a few sets on the b board. A - D
- Call out a problem such as ''The union of A and E''.
- The first group to raise the correct number cards reflecting the answer to your question gets a point.
- Continue for as long as desired. The team with the most points at the end of the game wins

6. Teachers can use the following online puzzle link for practice of Venn diagram used in set. https://www.univie.ac.at/future.media/moe/tests/mengen/duv.html

DOMAIN: Algebra
Sub-Domain: Algebraic Expression

STEP 1 _____

Standard: Students will be able to recognize simple number patterns, use letters to represent numbers, evaluate, add, subtract and simplify linear expressions.

Student Learning Outcomes: Students will be able to

- Recognize simple patterns from various number sequences.
- Use letters to represent numbers, express basic arithmetical processes algebraically.
- Evaluate algebraic expressions, add and subtract linear expressions.
- Simplify linear expressions.
- fhgdfjkhgjhgk

Knowledge:
Students will be able to know:

- Simple patterns from various number sequences.
- Term Algebra as an extension of arithmetic, where letters, numbers and symbols are used for construction of algebraic expressions
- Basic arithmetic operation using Algebra
- Algebraic sentence as combination of algebraic expressions using symbols =, ≠.

Skills:
Students will

- Continue a given number sequence and find a term to term rule.
- Solve real life problems involving number sequences and patterns
- Evaluate an algebraic expression or algebraic formula
- Differentiate a statement as open, true and false
- Manipulate simple algebraic expressions using addition and subtraction
- Simplify Algebraic Expressions

STEP 2

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on.

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

12. Write a sequence of even numbers between 60 and 90.
13. Make a poster of polygons in sequence according to the number of sides.
14. Teacher can also ask tricky riddle to students:

Riddle: What do u think are the last two numbers in this sequence: 8, 5, 4, 9, 1, 7, _? (Hint: use numbers less than 10)

Answer: 6, 3. the number names in words are in Alphabetical order. (eight, five, four etc.)

1

Some of the sample questions that can be used as part of the summative assessments are:

Ask students the following type of questions:

1. Determine the nth term of the sequence (Give questions involving simple numbers, fraction numbers ranging from simple to more complex):
2. Find the terms a_2, a_5 and a_7 of the arithmetic sequence if you know :
   a) $a_1 = 4$, $d = 3$ *b)* $a_1 = -5$, $d = -2$ *c)* $a_1 = 0$, $d = -1$.

STEP 3

Learning Activities

1. Teacher can use manipulatives like math manipulatives, decimal manipulatives, or place value manipulatives to create activities: For example, dominoes come with dotted patterns, Teacher can ask students to arrange in an increasing or decreasing order to give practice on sequences. Teachers can also use any type of snacks or cereal to make a sequence of any pattern.

2. Teachers can use a classic deck, which can also offer a very entertaining way of learning number sequences. There is a game called Parliament, the game goes something like this:
   - The equal number of cards are dealt to each player.
   - Teachers can decide a middle number to start the game, say 7.
   - All the players carrying number seven keep it on the table
   - The other players start making a series in increasing and decreasing order, which means the left side of number 7 is expanded by placing numbers 6, 5, 4 and so on. Similarly, on the right side, the players have to put the numbers 8,9,10 till King
3. Teachers can provide a hundred square grid (by browsing on net for a copy of it) or can display it on board to ask students to color squares to explore different number patterns like odd numbers, even numbers, counting in multiples from times tables and ten more and ten less.
4. Teachers can use the following online game link for practice of sequence. https://mathsframe.co.uk/en/resources/resource/42/sequences
5. Teacher can use following online game link for practice of sequence. https://www.topmarks.co.uk/ordering-and-sequencing/chinese-dragon-ordering
6. Teachers can take a simple example like 2x + 4y - 9 to explain coefficients, variables and constants. He/She can begin by asking students to identify the terms in the expression and then use the expression to draw attention to coefficients, variables and constants.
7. Teacher can share following online game links to identify term, coefficient and constant in algebraic expressions https://www.mathgames.com/skill/6.6-identify-terms-coefficients-and-monomials
8. Teachers can use hexagon calculation games to do practice of algebraic expressions. Hexagon puzzle is an algebra challenge that can be played by multiple players. It involves rolling a dice to work out the value of an algebraic expression. Students take turns rolling the dice and the number rolled becomes the value of 'n'. The player then gets one chance to choose a hexagon and solve the equation using the assigned value of 'n'. At the end of the game, the student with the most number of solved hexagons wins.

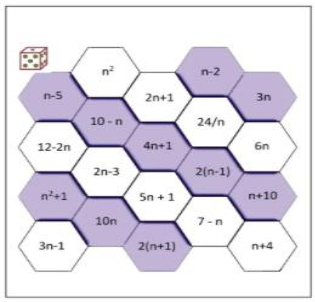


Figure 7 [Hexagon Calculation Game] [prodigygame]

9. Teacher can share following online game links to practice algebraic expressions https://www.mathgames.com/skill/4.94-write-variable-expressions

https://www.mathgames.com/skill/6.9-evaluate-multi-variable-expressions

Reference:
Help Teachers (2021) Retrieved from: https://www.helpteaching.com/questions/157258/expand-96x7
Prodigy Game (2021) Retrieved from: https://prodigy-website.cdn.prismic.io/prodigy-website/eb0ad3f4-7f29-4860-84dc-57932df3f9a6_hexagon.pdf

Domain: Algebra
Sub-Domain: Linear Expressions & Equations

STEP 1 _____

Standard: Students will be able to identify and differentiate between linear expressions and linear equations, solve linear equations and apply them in real life context.

Student Learning Outcomes: Students will be able to

- Recognize algebraic equations.
- Differentiate between linear algebraic equations and linear algebraic expressions in one variable,
- Solve linear equations and apply them in real life situations.

Knowledge:
Students will be able to know:

- Concept of equations.
- Linear equations in one variable.

Skills:
Students will

- Construct linear equations in one variable
- Solve simple linear equations involving integers, fractions and decimal coefficients.
- Solve linear equations of the type: $ax + b = c$, $a \neq 0$
- Solve real life situations involving linear equations

STEP 2 _____

Assessments:
Formative Assessments:
Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,

- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Convert word statements to algebraic equations. For example: Sum of price of 3 shirts and 2 pants is Rs. 13,000
2. Develop an equation with one variable and exchange it with the student sitting beside and solve it as a challenge.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Solve simple linear equations (give questions involving simple linear equations, linear equations in fractions etc)
2. Translate the sentence into an algebraic equation and solve

- Twice the difference of x and 3 gives 18.
- 4 times the difference of x and 8 gives 22
- Seven more than x is equal to 21
- Product of 4 and y is equal to the sum of 2y and 8.

STEP 3 _ _____

Learning Activities

1. Teachers can use the following activity to explain the concept of balancing equations.

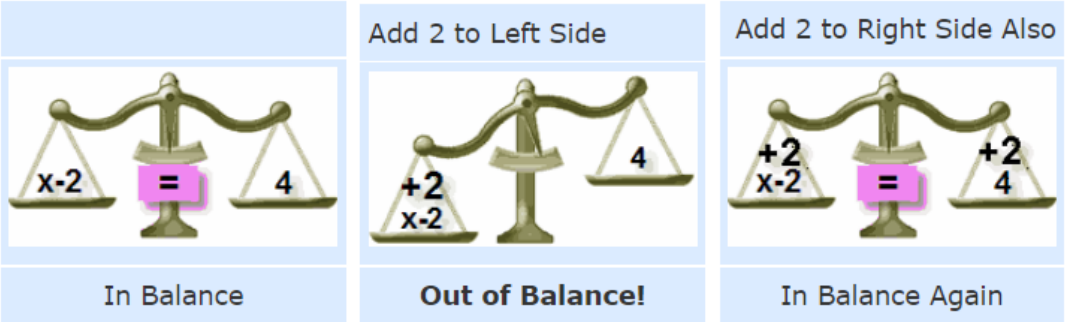


Figure 8 [Balancing Equation] [mathisfun]

2. Teachers can use Balance Math activity to do practice of algebraic equations. Students need to find out the missing number to balance the pan. When both sides weigh the same, the pan stays balanced. Working on these pan balance problems is a great way to improve logical reasoning skills.

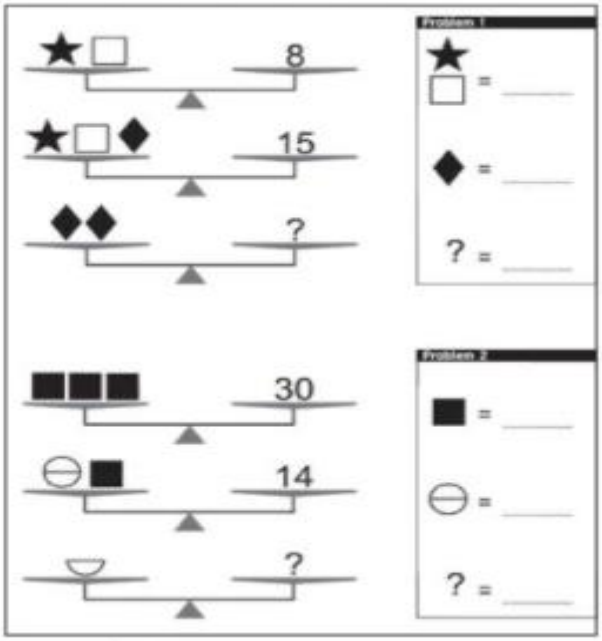


Figure 9 [Balancing Activity] [prodigygame]

3. Teachers can use riddle activity to do practice of linear equations. 'Riddle Me' is a fun classroom activity for students. The game can be made easy or hard depending on the equations but essentially the motive is to solve the value of each algebraic equation and find the answer to the riddle. The student who manages to solve all the equations and find the answer to the riddle wins the game!

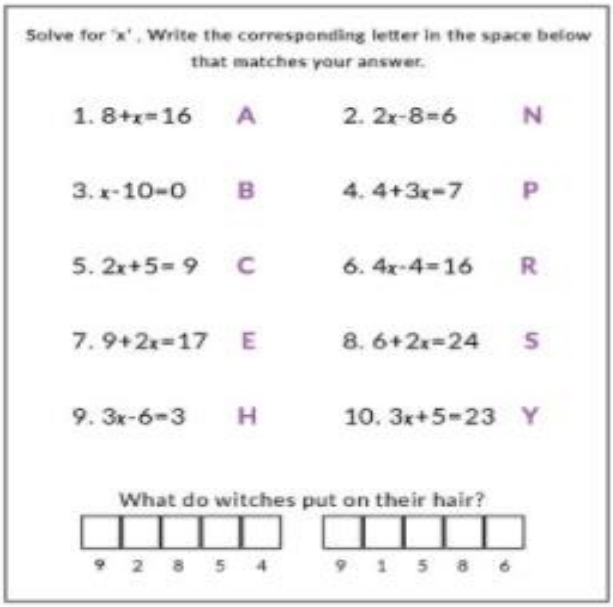


Figure 10 [Riddle Me This] [prodigygame]

4. Teachers can share the following online game links to practice algebraic equations.
   https://www.mathgames.com/skill/3.75-solve-for-the-variable-with-addition-and-subtraction
   https://www.mathgames.com/skill/3.76-solve-for-the-variable-with-multiplication-and-division

References:

Prodigy Game (2021) Retrieved from:
https://prodigy-website.cdn.prismic.io/prodigy-website/eb0ad3f4-7f29-4860-84dc-57932df3f9a6_hexagon.pdf

Maths is Fun (2021) Retrieved from:
https://www.mathsisfun.com/algebra/add-subtract-balance.html

Prodigy Game (2021) Retrieved from:
https://prodigy-website.cdn.prismic.io/prodigy-website/5cfc7227-ab10-448c-a1ce-583d70366ddb_balance.pdf

DOMAIN: Measurements

Sub-Domain: Surface Area and Volume

STEP 1 _____

Standard: Students will be able to calculate area and perimeter, surface area, volume of different 2D and 3D shapes by applying suitable formulae and units.

Student Learning Outcomes: Students will be able to

- State and differentiate between area and perimeter and their units.

- Recognize the formulae to calculate the area and perimeter, surface area, volume of different 2D and 3D shapes.

Knowledge: Students will be able to know: ● Difference between area and perimeter. ● Formulae to calculate the area and perimeter of different shapes.	**Skills:** Students will ● Calculate the area and perimeter of a rectangle, square, parallelogram, triangle and trapezium. ● Calculate the surface area and volume of cube and cuboids. ● Solve real life word problems involving perimeter, area, the surface area and volume of cubes and cuboids.

STEP 2 _____

Assessments:

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

15. Find the area and perimeter of their lunch boxes.
16. Make the layout of their house on a grid sheet and find Area and perimeter of each room.
17. Count the tiles of the room and estimate the area and perimeter of the classroom.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Adriel ran 5 rounds of a square ground of side 70 m. Find the total distance he ran.
2. Mrs. Rao gives one rectangular card of sides 18 cm by 14 cm to each of her 7 pupils. She wants her pupils to glue a ribbon around the border of their own card. Find the length of the ribbon they will need altogether.
3. Mrs. Bell cuts a 25 cm by 6 cm cloth into 5 equal pieces. What is the area of each piece?
4. Adler purchases a new house, but the main gate of the house looks ugly because of color. He measures the gate 8 feet by 10 feet. He wants to paint the main gate with white color at a cost of $20 per square foot. How much will it cost for Adler to add color to his main gate?
5. What is the height of a rectangular stone with a perimeter of 260.2 mm and a base length of 75.4 mm?
6. Luca has a keyboard. The length of the keyboard is 18 inches and the width is 10 inches. Find the area of the keyboard.
6. A rectangular park is 54 yards wide and 110 yards long. What is its perimeter?
7. Lisa wanted to paint her ugly brown flower box red. Using the given dimensions, how many square inches will she have to paint?
8. David and Karen are building a tree house in the shape of a rectangular prism for their daughter. If the tree house is going to be 5 feet tall, 8 feet wide, and 7.5 feet long how much space will there be inside? How much space will they have to paint on the outside?

STEP 3 _ _____

Learning Activities

1. Teachers can start the concept by asking students to make an anchor chart. This smart option lays out the differences and similarities between area and perimeter measurements.

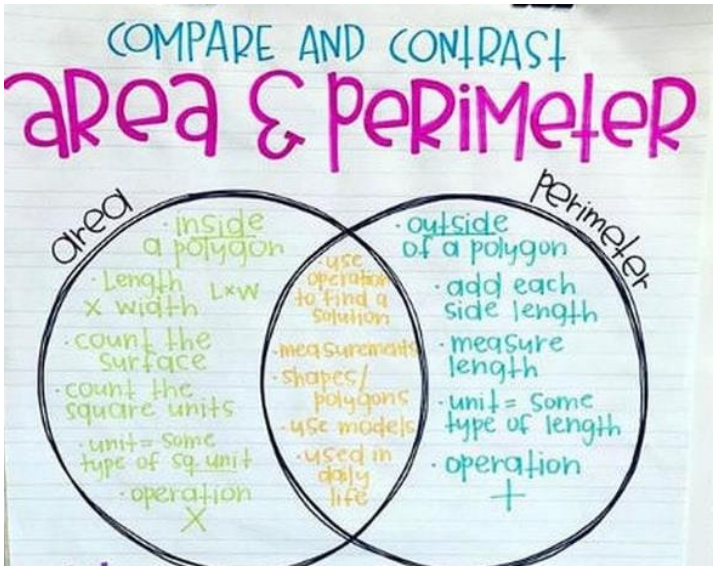


Figure 11 [Area & Perimeter] [weareteachers]

2. Students can be provided a grid sheet and asked to draw themselves and find area and perimeter.

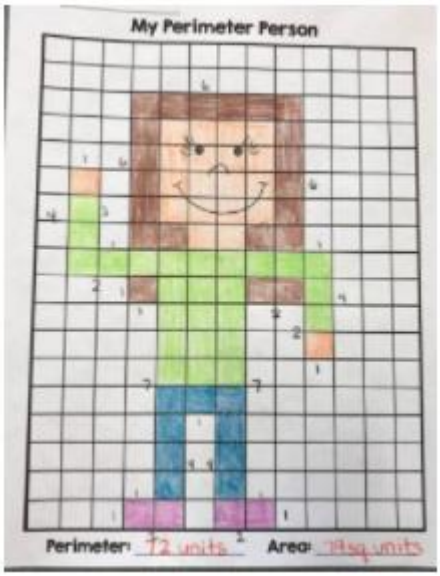


Figure 12 [Perimeter Person] [qwordfromthird]

3. Teachers can also do a pair activity and can use square floor tiles to make different shapes by painter's blue tape and can ask students to find area and perimeter.

4. Teachers can share the following online game links to practice areas and perimeter.
https://www.splashlearn.com/s/math-games/find-the-perimeter-of-the-shapes-using-grids
https://www.splashlearn.com/s/math-games/find-the-perimeter-of-polygons
https://www.splashlearn.com/s/math-games/find-the-area-by-multiplying-the-side-lengths

5. Teachers can ask students one day before to bring empty boxes of cube or cuboid shape in class then next day students will find the volume of those boxes.

6. Teachers can share the following online game links to practice volume of cube and cuboid.

https://www.splashlearn.com/s/math-games/find-volume-using-the-formula
https://www.splashlearn.com/s/math-games/solve-the-word-problems-related-to-volume

References:

Prodigy Game (2021) Retrieved from: https://prodigy-website.cdn.prismic.io/prodigy-website/c1c3b0cf-b7f0-4161-814a-0e9783d55f9c_riddle.pdf

DOMAIN: Geometry

Sub-Domain: Symmetry

STEP 1 _____

Standard: Students will be able to identify 2D, 3D shapes, parallel lines and related angles and rotational symmetry.

Student Learning Outcomes: Students will be able to

- Identify 2-D, 3-D shapes with respect to their characteristics.
- Differentiate between parallel and intersecting lines.
- Identify transversal angles related to them and recognize rotational symmetry.

Knowledge:

Students will be able to know:

- 2-D shapes (cube, cuboid, cone, cylinder, sphere, hemisphere and cone) with respect to their characteristics.
- Difference between parallel lines, perpendicular lines and transversal.
- Adjacent angles and unknown angles related to parallel lines and transversals. (corresponding, alternate and vertically opposite angles)
- Rotational symmetry.

Skills:

Students will

- Reflect an object using grid paper and compass and find the line of reflection by construction.
- Solve problems involving angles formed by two parallel lines and a transversal (corresponding, alternate, vertically opposite angles).
- Find the point of rotation and order of rotational symmetry.

Additional:

- Calculate unknown angle using the concept of angles at a point.

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make an assignment of animal pictures with a line of reflection.
2. Write their name in all capital letters and draw line of symmetry on each letter.
3. Find order of rotational symmetry of 5 objects.

Summative Assessments

Ask students the following type of questions:

1. Draw all the lines of symmetry in the shapes below (give different objects pictures which can have line of symmetry):
2. Fill in the blanks:
    - A square has …… lines of symmetry.
    - An equilateral triangle has …….. lines of symmetry.
    - A line of symmetry divides an image into …… equal halves.
    - A scalene triangle has …….. lines of symmetry.
    - A circle has …….. lines of symmetry.
    - Letter H has …….. lines of symmetry.
3. Give questions that asks for drawing lines of symmetry such as:

- Draw a shape with exactly 2 lines of symmetry. Include the lines of symmetry on your drawing.
- Draw a shape with exactly 5 lines of symmetry. Include the lines of symmetry on your drawing.
- Draw a shape with exactly 3 orders of rotation.
- Draw a shape with exactly 6 orders of rotation.

4. Give questions that asks for order of rotational symmetry such as:
   - What is the order of rotational symmetry of an equilateral triangle?
   - What is the order of rotational symmetry of a regular pentagon?
   - What is the order of rotational symmetry of a parallelogram?
   - What is the order of rotational symmetry of a kite?
5. Find the order of rotational symmetry of following shapes

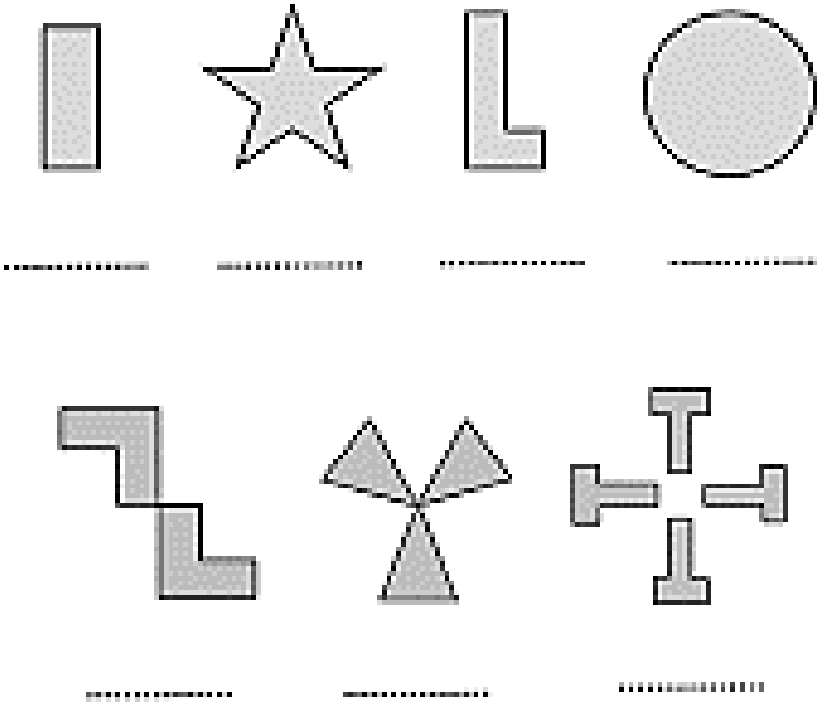


Figure 13 [Rotational Symmetry] [studylib]

STEP 3 _ _____

Learning Activities

1. Students can be given a short activity to take color paper and fold it in half and cut any shape on its edge and observe symmetry by unfolding paper.
2. Teachers can assign students to write A to Z in Capital letters and find lines of reflection in each alphabet.
3. Teachers can make a worksheet with the following type of questions.

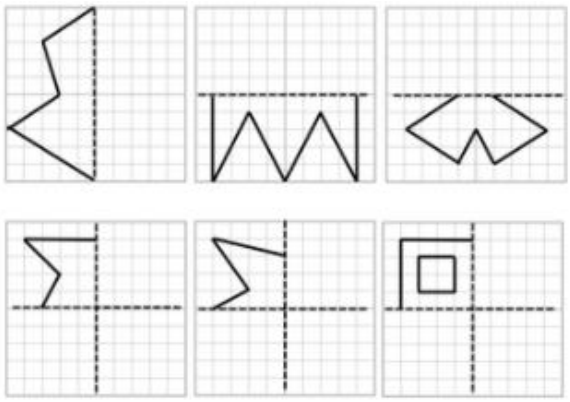


Figure 14 [line of Symmetry] [fiveways]

4. Teachers can share the following online game links to practice algebraic equations.
   https://www.topmarks.co.uk/symmetry/symmetry-matching
   https://www.mathgames.com/skill/8.73-reflections-graph-the-image
5. Teacher can use following method to explain the concept of rotational symmetry
   - Students will be asked to each pick a couple of different cut out shapes and trace them on a piece of paper.
   - After tracing the shapes, the students will be asked to use their pen or pencil to hold down the center of the shape and rotate the shapes and count how many times the cut out shape lined up perfectly with the traced shape (until they got to a full turn around).
   - The number of times cut out will be lined to sketch in one complete rotation will be the rotational symmetry order.
6. Teacher can use following link to explain the concept of rotational symmetry and point of rotation
   https://www.mathsisfun.com/geometry/symmetry-rotational.html
7. Teacher can share following link with students to solve a quick quiz
   https://www.mathopolis.com/questions/q.html?id=849&t=mif&qs=849_850_2137_2138_3360_3361_3362_3363_5033_5034&site=1&ref=2f67656f6d657472792f73796d6d657472792d726f746174696f6e616c2e68746d6c&title=526f746174696f6e616c2053796d6d65747279#
8. Teachers can ask students to write down everything they know about lines and angles. Allow a few volunteers to write one piece of information each on the board.
9. Teachers can do a poster activity in which students will make columns with all the types of angles along with sketches.

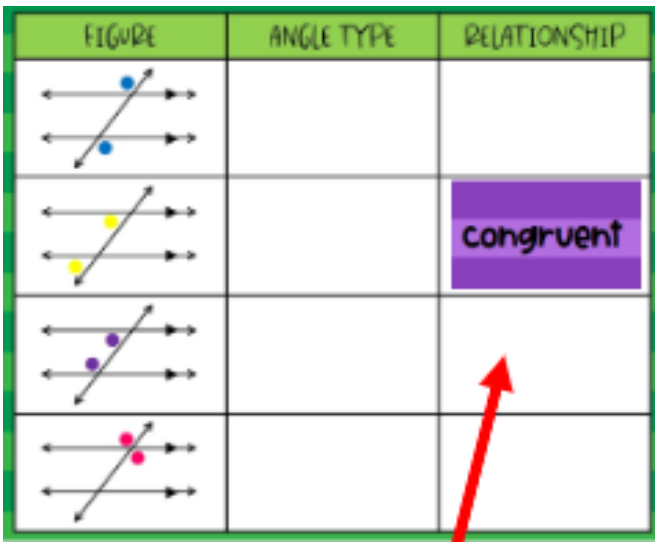


Figure 16 [Types of Angle][mrblairmaths]

10. Teachers can share the following online game links to practice of angles formed by two parallel lines and a transversal.
    https://www.mathgames.com/skill/8.46-transversal-of-parallel-lines
    https://www.transum.org/software/SW/Starter_of_the_day/Students/AngleParallel.asp

References:

Five Ways (2021) Retrieved from:
https://www.fiveways-primary-school.org.uk/admin/ckfinder/userfiles/files/Symmetry%202.pdf

Pinterest (2021) Retrieved from:
https://www.pinterest.com/pin/283375001524974344/

Mr. Blair's Maths (2021) Retrieved from:
https://sites.google.com/a/vusd.us/mr-blair-s-math-class/home/integrated-math-2/unit-2---lines-and-angles

DOMAIN: Geometry

Sub-Domain: Geometrical Constructions

STEP 1 _____

Standard: Students will be able to construct angles of different measure (with compass), bisectors of angles and bisector and perpendicular bisectors of line segments.

Student Learning Outcomes: Students will be able to

- Construct angles of different measures.
- Define bisectors of an angle, bisector and perpendicular bisector of a line segment.

Knowledge:

Students will be able to know:

- Difference between line and line segment.
- Bisector of an angle, perpendicular bisector of a line segment.
- Difference between bisector and perpendicular bisector of a line segment.

Skills:

Students will

- Construct angles of specific measures (30, 45, 60, 75, 90, 105 and 120) and bisect angles using a compass.
- Construct a perpendicular (from a point on the line and outside the line) and a perpendicular bisector.

Additional:

- find unknown angles (straight line and at a point)
- find unknown angles in a triangle (interior and exterior angles)

STEP 2

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make an acute angle, an obtuse angle and a right angle and draw their angle bisectors.
2. Draw 5 line segments of any measurements and draw a perpendicular bisector on each.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Find the size of each missing angle.(give images of different angles drawn on 180 or 360 degrees)
2. Use your protractor to draw these angles:
   40° 125° 25° 268°
3. Identify which of the following pairs of angles are complementary or supplementary?
   (i) 70°, 20° (ii) 20°, 170° (iii) 50°, 145° (iv) 125°, 55° (v) 105°, 75°
4. Construct angle bisector of following angles. (provide images of different angles)
5. Construct line bisector of following line segments:
   67.8 cm 45 cm 122 cm

STEP 3 _ _____

Learning Activities

1. Teacher can explain the concept of angle bisector by using the following activity.
   - Divide the class into small groups, and provide each group with a large piece of paper, a protractor, a ruler, a pencil, and some art supplies.
   - Instruct each group to make a large X on the paper by connecting the corners of the paper using two diagonal lines.
   - Point out the four angles that have formed, and tell students to find and draw the angle bisector of each angle.
   - Tell students that this will form additional angles, which will have their own bisectors, and so on.
   - Students should continue finding bisectors until they have a given number of sections. They can then use the art supplies to color in each section for a piece of "angle bisector artwork" that looks a bit like an explosion.
2. Teachers can use the following web link to show construction of angle and line bisection. https://www.mathspad.co.uk/i2/construct.php
3. Teachers can explain the concept of perpendicular bisectors by asking students to stand and make T using their arms. Teacher will explain how the body is acting as a perpendicular to their arms and the distance from their nose to tip of the finger on each side is equal.
4. Teachers can share the following online quiz link of line and angle bisector. https://www.mathgames.com/skill/8.111-measures-of-bisected-lines-and-angles

DOMAIN: Statistics and Probability

Sub-Domain: Data Management

STEP 1 _____

Standard: Students will be able to recognize graphs, grouped, ungrouped data continuous and discrete variables. Calculate mean, median and mode.

Student Learning Outcomes: Students will be able to

- Recognize different types of graphs.
- Differentiate between grouped and ungrouped data, continuous and discrete variables.
- Calculate mean median and mode.

Knowledge:

Students will be able to know:

- Types of graphs.
- Difference between grouped and ungrouped data, continuous and discrete variables.
- Types of formulae to calculate means.

Skills:

Students will

- Draw, read and interpret horizontal and vertical multiple bar graphs and pie charts.(including real-world problems)
- Identify and organize different types of data (i.e. discrete, continuous, grouped and ungrouped).
- Calculate the mean, median and mode for ungrouped data and solve related real-world problems.

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests

- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be used as part of formative assessments are:

Ask students the following type of questions:

1. Make a pie chart of time they spend out of 24 hours in following activities: Studying, Playing, Eating, Sleeping and Other Activities.
2. Collect data of ages of 10 people and find the mean of that data.
3. Find the median of the first 12 prime numbers.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. Find the mean of the following data.
   (a) 9, 7, 11, 13, 2, 4, 5, 5
   (b) 16, 18, 19, 21, 23, 23, 27, 29, 29, 35
   (c) 2.2, 10.2, 14.7, 5.9, 4.9, 11.1, 10.5 (d) 11/4, 21/2, 51/2, 31/4, 21/2
2. Find the mean of the first ten whole numbers.
3. Find the mean of the first 5 prime numbers.
4. The mean of 8, 11, 6, 14, x and 13 is 66. Find the value of the observation x.
5. The weights in kg of 10 students are given below:
   39, 43, 36, 38, 46, 51, 33, 44, 44, 43
   Find the mode of this data. Is there more than 1 mode? If yes, why?
6. Find the median of the following data.
   27, 39, 49, 20, 21, 28, 38
   10, 19, 54, 80, 15, 16
   47, 41, 52, 43, 56, 35, 49, 55, 42
   12, 17, 3, 14, 5, 8, 7, 15
7. The number of bed-sheets manufactured by a factory during five consecutive weeks is given below. Represent the data using the bar graph. (provide a table with weeks and number of bedsheets provided in it)
8. The number of students in 7 different classes is given below. Represent this data on the bar graph. (provide a data in a table with class and number of students given in it)
9. The population of a particular state in different years is given below. Represent this data on the bar graph. (Provide a data in a table with years and population figures provided in it)
10. The following table shows the mode of transport used by 400 students of a school. Represent the following information on the pie chart. (Provide a data in a table with mode of transport and number of students mentioned in ti)
11. The percentage of expenditure of a company under different heads is as follows. Represent the following information on the pie chart. (Provide a data with heads of expenditure being salary, electricity, conveyance and machines and percentages given as 45%, 20%, 10% and 25% respectively)

STEP 3 _ _____

Learning Activities

1. Teachers can use skittles to explain the concept of bar graph in the following way. Teachers can ask several questions through which students will learn the interpretation of bar graphs. For example: which color skittle do you have the most? Which color skittles do you have in the same number? Etc.
2. Teachers can share the following online game link of interpreting and constructing bar graphs.
    - https://www.splashlearn.com/s/math-games/answer-how-many-more-or-less-using-bar-graphs
    - https://www.splashlearn.com/s/math-games/create-bar-graphs
    - https://www.splashlearn.com/s/math-games/analyze-and-represent-data-using-bar-graph
3. Teachers can explain the method of constructing a pie chart by gathering data from students. Data can be gathered by asking students how many students like to read Comic books, Poem books, Story books and Puzzle books.
4. Teachers can assign students to make a pie chart of the favourite flavors of ice-cream for the children in a locality. Draw the pie chart to represent the given information. (Provide a dat in a table with ice cream flavours and percentages of students who like them mentioned in it.
5. Teacher can share following online game link of interpreting and constructing pie chart https://www.transum.org/software/SW/Starter_of_the_day/Students/Pie_Charts.asp
6. Teacher can ask students to find mean and median of following data sets:
    - First 10 even numbers
    - Odd numbers between 50 and 70
    - Multiples of 15 below 100.
7. Teachers can share the following online quiz link of finding mean, median and mode. https://www.mathgames.com/skill/7.90-interpret-charts-to-find-mean-median-mode-and-range

References:
Pinterest (2021) Retrieved from:
https://www.pinterest.com/pin/124763852166566344/

Domain: Statistics and Probability
Sub-Domain: Probability

STEP 1 _ _____

Standard: Students will be able to understand the concepts relating to probability.

Student Learning Outcomes: Students will be able to

- Explain experiments, outcomes, sample space, events, equally likely events and probability of a single event.
- Differentiate the outcomes that are equally likely and not equally likely to occur.(including real-world word problems).

Knowledge: Students will be able to know: ● Experiments, outcomes, sample space, events, equally likely events and probability of a single event. ● Difference between the outcomes that are equally likely and not equally likely to occur.	**Skills:** Students will ● Explain experiments, outcomes, sample space, events, equally likely events and probability of a single event. ● Differentiate the outcomes that are equally likely and not equally likely to occur. ● Apply the probability concepts to real life situations.

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teacher may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the blanks, etc.)
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe are the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests.
- External Exams

Some of the sample questions that can be a part of formative assessments are:

Ask students the following type of questions:

1. Write five things which they are likely to do in a day and 5 things they are unlikely to do in their complete day.
2. Write 7 events which will have zero chances to happen.

Some of the sample questions that can be used as part of summative assessments are:

Ask students the following type of questions:

1. If the spinner is spun once, determine whether it is certain, likely, unlikely, or impossible that the pointer stops on a number that is a multiple of 3.
- Which outcome is least likely when spinning the arrow on this spinner?
2. A spinner is divided into 10 equal sectors numbered 1 through 10. If the spinner is spun, is it certain, likely, unlikely, or impossible that it lands on a number less than 4?
3. What is the probability of rolling a number which is greater than 6 on a fair die?
4. There are 15 letter tiles in a bag: six tiles are labeled S, eight tiles are labeled R, and one is labeled M. Which of the following describes how likely it is to choose the letter M?

STEP 3 _ _____

Learning Activities

1. Teachers can give the concept of probability by making a concept map and by using real life events.

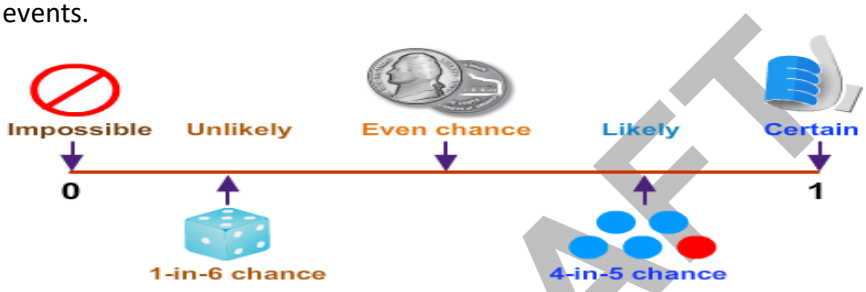


Figure 18 [Probability Line] [mathsisfun]

2. Teachers can make a maze handout of probability for students to practice probability.

Teachers can share the following online quiz link of probability.
https://www.ixl.com/math/grade-3/certain-probable-unlikely-and-impossible
http://www.scootle.edu.au/ec/viewing/L118/index.html#

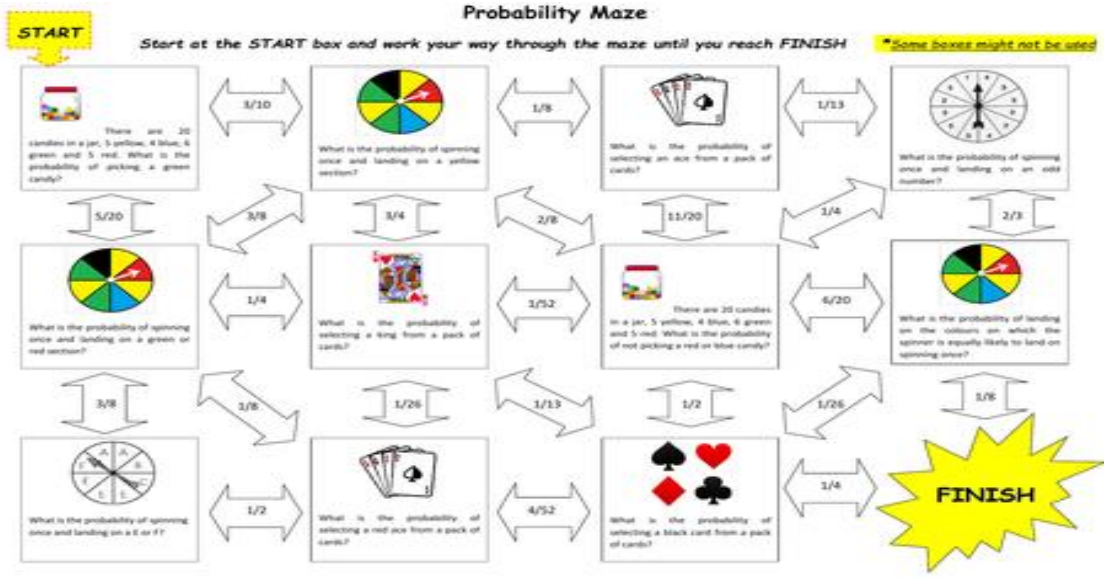


Figure - SEQ Figure * ARABIC 10 [Probability Maze] [tes]

References:

Math is Fun (2021) Retrieved from:
https://www.mathsisfun.com/data/probability.html

TES (2020) Retrieved from:
https://www.tes.com/teaching-resource/probability-maze-activity-11787241

DRAFT

Mathematics - Class 7
Suggested Guidelines

Note:

Key for Core and Advanced/Additional SLOs

- Normal font = Core
- Italics = Advanced/Additional Concepts

Domain: Numbers and Operations

Sub-Domain: Rational Numbers

STEP 1 _____	
Standard: Identify, recognize, compare, arrange and round Integers, whole numbers, rational numbers and decimal numbers	
• **Student Learning Outcomes**: Identify, arrange and round integers, whole numbers, rational numbers and decimal numbers. Represent these using a number line. Develop an understanding of place-value for these different types of numbers, and the concept of significant figures	
Knowledge: Students will be able to know: : • rational number as a number that can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$ Students will know: • Different types of sets (including natural, whole, integers and rational number sets)	**Skills:** Students will be able to: • Identify a rational number as a number that can be expressed in the form of $\frac{p}{q}$, where *p* and *q* are integers and $q \neq 0$ • Represent rational numbers and decimal numbers on a number line • Use symbols <, >, =, ≤ and ≥ to compare rational numbers and decimal numbers • use the concept of place value for rational numbers and decimal numbers

	of any size ● Arrange whole numbers, integers, rational numbers and decimal numbers in ascending or descending order ● Round any whole numbers, integers, rational numbers and decimal numbers to a required degree of accuracy, significance or decimal places (up to 3 decimal places)

STEP 2 _____

Assessments

Formative Assessments

- Basketball approach (Through a question about numbers and sort them) to encourage silent learners in discussion.
- In-class presentations on rules of significant figures.
- Cut & Paste – Mixed Numbers Practice Page (Can be used for number line)
- Exit Ticket

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3 _ _____

Learning Activities

- Generate a discussion with students on: why and how man first felt the need to have numbers in his life and what type of numbers do they see around them, and the numbers they see in

Mathematics that they cannot see in real life (e.g. negative numbers), and to be able to categorize different kinds of numbers.

- Comparing Numbers: Number Whisper – Have partners think of a secret number. They write it down (keeping it hidden). Then, give clues. For example, mine is greater than one, but less than 10. They keep giving clues until the number is guessed correctly. Students then switch roles.
- Group discussion on the pros and cons of rounding off money amounts. For instance, while shopping, to figure out if they have enough money to buy something or when trying to divide a large amount of items among a few people. These mental math problems usually start with rounding, and you can practice this at home. Some other good places to practice rounding numbers is the grocery store, restaurants, or shopping mall or planning a party.
- Use number line for ordering and comparing different types of numbers

Domain: Number and Operations

Sub-Domain: Laws of Operation (rethink)

STEP 1 _____
Standard: Use vocabulary and symbols related to addition, subtraction, multiplication and division for integers, whole numbers, rational numbers and decimal numbers.
● **Student Learning Outcomes**: Perform mental calculations on increasingly large numbers. Use Commutative, Associative and Distributive Laws, and the concept of Order of Operations to solve problems involving addition, subtraction, multiplication and division

Knowledge:	**Skills:**
Students will understand: ● Associative property of whole numbers, integers and rational numbers ● Commutative property of whole numbers, integers and rational numbers ● Distributive property of rational numbers with respect to multiplication over addition and subtraction Students will know: ● "0" as additive identity ● "1" as multiplicative identity	Students will be able to: ● Identify additive inverse of a rational number ● Identify the multiplicative inverse of a non-zero rational number ● Perform mental calculations, including mixed operations on large numbers <100 ● Use commutative, associative and distributive laws of the four operations (addition, subtraction, multiplication and division) in whole numbers ● Use the concept of Order of Operations

	to solve numerical expressions involving integers, whole numbers, rational numbers and decimal numbers ● Solve word problems that involve addition, subtraction, multiplication and/or division of integers, whole numbers, rational numbers and decimal numbers in real-life contexts ● Use knowledge of rounding to give an estimate to a calculation - to check the reasonableness of the solution.

STEP 2 _____

Assessments

Formative Assessments:

- Think-pair-share activity (related to the concept of Order of Operations)
- Online math games on integer and decimal addition, subtraction, multiplication and division
- Ask the students to create addition, subtraction, multiplication and division word problems, each with an answer of 5.7
- Two stars and a wish (Break the class into pairs and have them review each other's work - application of number properties)

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3 _ _____

Learning Activities

- Pick up any object on your desk. It could be a pen, a cup, a computer mouse, or anything else. By holding what you picked up in your hand, you can tell it has certain properties, like size, shape, and weight. Similarly, the numbers we use in math problems also have properties of their own.
- Here, we are going to go over number properties: the commutative property, the associative property, distributive property, multiplicative inverse and additive inverse. These properties show us how the numbers in math problems can be rearranged or tackled in different orders without changing the final answer. This is important because sometimes a problem is easier to

solve if it can be written in a different order. We use these properties when working out both basic math and algebra problems.

- Quick mental tests on mixed operation (e.g. 22 ÷ 11 x 10, 50 + 60 x 5, 50 ÷ 5 + 4 x 3 etc.)
- Provide students with a variety of division questions that result in a remainder and have them investigate and discuss the meaning of the remainders
- A way to remember the order of the operations is PEMDAS or BODMAS, where in each letter stands for a mathematical operation.
- The PEMDAS rule that state the order in which the operations in an expression should be solved, is:

  1. **P**arentheses - They take precedence over all other operators. The first step is to solve all the operations within the parentheses. Work out all groupings from inside to out. (Whatever is in parentheses is a grouping)

  2. **E**xponents - Work out all the exponential expressions.

  3. **M**ultiplication and **D**ivision - Next, moving from left to right, multiply and/or divide whichever comes first.

  4. **A**ddition and **S**ubtraction - Lastly, moving from left to right, add and/or subtract whichever comes first.

Domain: Number and Operations

Sub-Domain: Square and Square Root

STEP 1 _____
Standard: Use prime factorization to calculate square root of perfect square numbers.
• **Student Learning Outcomes**: Recognize prime and composite numbers less than 500. Calculate square and square root of different types of numbers. Recall the concepts of HCF and LCM and use them to solve word problems

Knowledge:	**Skills:**
Students will Know : • the following properties of perfect square of a number:	Students will be able to: • Recognize prime and composite numbers <500

- the square of a proper fraction is less than itself
- the square of a decimal less than 1, is less than itself

- Square root is the inverse process of squaring a number

Students will know:

- Square of a number as multiplication of a number with itself

- Calculate square of an integer, whole number, rational number or decimal number (up to 3-digits)
- Calculate square roots of perfect squares using prime factorization of:
  - Integers (up to 3 digits)
  - Fractions
  - Decimal numbers (up to 2 decimal places)
- Solve word problems with real-life context involving squares and square roots
-

Advanced/Additional:

Students will be able to:

- *Use approximation to the nearest perfect square numbers to find square roots of non-square numbers (e.g. √1000)*

STEP 2 _____

Assessments

Formative Assessments

- White Board technique (Every student will need a small whiteboard at their desk - they will do prime factorization on their white-board and show it to the class)
- Basketball technique (To recognize composite and prime numbers)
- Think-pair-share (Students will find out square roots)

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- Ask students to use factor trees to identify prime and composite numbers.
- Ask students to square various numbers including integers, decimals and fractions.
- Online games on square and square roots.
- Use LCM and HCF in real life application problems.

- *Use estimation for finding square roots of non-square numbers by recalling all square numbers from 1 to 20 by group activity*.

Domain: Number and Operations

Sub-Domain: Rate, Ratio and Percentage

STEP 1 _____
Standard: Perform appropriate operations on fractions and percentages in various problem-solving contexts.
● **Student Learning Outcomes**: Identify and convert between different types of fractions, percentages and decimals. Calculate simple percentage, percentage increase and percentage decrease. Solve word problems with real-life contexts involving Zakat, Ushr, Inheritance, Commission and Taxes

Knowledge:	**Skills:**

Students will understand:
● The concept of income tax, property tax, general sales taxes and value-added tax
 	
Students will know:
● The method of calculating Zakat, Inheritance and Ushr in different circumstances (in accordance with Islamic principles)
	Students will be able to:
	● Identify and convert between various types of fractions
	● Express one quantity as the percentage of another quantity
	● Increase and decrease quantities by a given percentage
	● Differentiate between:
	  ○ selling price and cost price
	  ○ profit, loss and discount
	  ○ profit percentage and loss percentage
	● Solve word problems related to real-life situations involving profit, loss and discount
	● Calculate Zakat, Inheritance and Ushr
	● Solve word problems related to real-life situations involving Zakat, Inheritance, Ushr, Commission, Income tax, Property

	tax, general sales tax (GST) and value-added tax (VAT) ● Convert and use equivalences between simple fractions, decimals, ratios and percentages in various contexts ● Solve problems involving fractions - expressing the answers in simplest form

STEP 2 _____

Assessments

Formative Assessments

- Think-pair-share (for the concept of Types of fractions)
- Presentations: Word problems on Zakat, Ushr, Inheritance, profit, loss and discount will be solved/discussed by group presentations.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3 _ _____

Learning Activities

- Concept of Zakat will be explained (Zakat is one of the five pillars of Islam. It is the amount, which wealthy Muslims (Sahib-e-Nisaab) pay to needy Muslims. The rate of Zakat is 2.5% of the total value of the Gold & Silver & cash amount.
- Know the rate of Ushr levied on land-owner in respect of produce of the land
- Know the ratio of shares among legal inheritors of a property (in accordance with Islamic principles).
- Calculate amount of share of each legal inheritor of a property (in accordance with Islamic principles).
- Discuss real world applications with students in which a percentage greater than 100% is used.
- Online games on percentage increase and decrease, discount, VAT and GST.

Domain: Number and Operations

Sub-Domain: Financial Mathematics

STEP 1 _____

Standard: Use the concept of rate, ratio and proportion in various problem-solving contexts.

- **Student Learning Outcomes**: Calculate increase and decrease in ratios, rates, average rates, direct and inverse proportion. Solve word problems pertaining to all of these concepts

Knowledge:	**Skills:**
Students will understand: ● Proportion as equality of two ratios Students will know: ● Common units of rate	Students will be able to: ● Calculate Increase and decrease in a ratio based on change in quantities and vice versa ● Calculate rate and average rate of quantities ● Calculate direct proportion ● Calculate inverse proportion ● Solve word problems related to real-life situations involving direct and inverse proportions, rates and ratios

STEP 2 _____

Assessments

Formative Assessments

- Basketball activity (for increase and decrease in ratios)
- Four corners of room technique (Students can go in four corners of the room according to their understanding, for example if a student doesn't get the concept he can go to that corner where all students are standing who are confused about concept, and so on.)
- White board technique (can be used for direct and inverse proportion questions given by teacher)
- Assessment Reflection

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____
Learning Activities ● Give students examples from daily life on increase and decrease in ratios (e.g. the total number of teachers in school has increased from 50 to 60, hence the ratio of new vs old number of teachers is 6:5) ● Explain to the students how they can figure out based on the given ratio whether they have to calculate the increase or decrease in a quantity. ● Give students examples from daily life to understand how different quantities can be used together to form a rate (e.g.100 km/h, 70 beats/min, $1.69/100 g, $9.50/kg) ● Sometimes a change in the proportions of one quantity means a change in the proportions of the other! For example, when you buy more apples, you will have to pay more money. Similarly, if we increase the speed of a vehicle, the time that it takes to cover some distance goes down.

Domain: Number and Operations

Sub-Domain: Sets

STEP 1 _____	
Standard: Use language, notation (tabular and descriptive form) and Venn diagrams to describe sets and their elements, and solve word problems.	
● **Student Learning Outcomes**: Describe and differentiate different types of sets. Show different set operations using Venn diagrams	
Knowledge: Students will understand: ● Commutative and associative properties of union and intersection on two sets ● Operations on sets: ○ union of two sets ○ intersection of two sets ○ difference of two sets ○ Complement of a set	**Skills:** Students will be able to: ● Describe and list down the elements of a descriptive set in numerical form and vice versa ● Describe the following sets: ○ natural numbers (N) ○ whole numbers (W) ○ even numbers (E) ○ odd numbers (O) ○ prime numbers (P)

Students will know: ● The meaning of and enumerate complement, union, intersection and difference of two sets mathematically	○ integers (Z) ● Differentiate the following: ○ subsets and supersets ○ proper and improper subsets ○ *equal and equivalent sets* ○ disjoint and overlapping sets ● Show complements, union and intersection and difference of two sets by shading in Venn diagram using one universal sets and two subsets ● Identify and describe mathematically different sets shaded in the Venn diagram using one universal set with two subsets ● Solve simple word problems involving set theory ***Advanced/Additional:*** *Students will be able to:* ● Differentiate the following: ○ *equal and equivalent sets* ● *Verify the following:* ○ $A \cap \emptyset = \emptyset$ ○ $A \cup \emptyset = U$ ○ $(\emptyset \cup \emptyset)' = \emptyset' \cap \emptyset'$ ○ $(\emptyset \cap \emptyset)' = \emptyset' \cup \emptyset')$

STEP 2 _____

Assessments

Formative Assessments

- Entrance Tickets (Students' prior knowledge will be checked related to different sets and notations)
- The white board technique - can be used to solve union, intersection and complements of sets.
- Venn Diagram - classroom group activities.

- 3-2-1 strategy – students are asked to mention 3 takeaways, 2 questions and 1 thing they enjoyed about a particular topic. This provides an easy way for teachers to check student understanding and to gauge student interest in a particular topic

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- Sets can be found all around us. People like to group things according to common properties because it makes it easier to find things and easier to use. Use the example of collective nouns (e.g. a flock of birds, a fish of school, a pack of wolves, a hive of bees) to develop the basic understanding of a set (i.e. it is a collection/group of like items)
- Use 4 different colored counters (red, blue, green and yellow) and three baskets to explain union, intersection and difference of two sets. Basket A contains (red, blue and yellow counters) and basket B contains (red, blue and green counters). Use basket C to explain concepts of union, intersection and difference between two sets. Let students explore the ideas on their own in groups.
- Standard symbols and particular writing forms are used in sets to help save time and writing space.
- Explain to students about the complement of sets. The complement of a set is the set that includes all the elements of the universal set that are not present in the given set. Let us say A is a set of all coins which is a subset of a universal set that contains all coins and notes, so the complement of set A is a set of notes, which does not include coins.
- Teach students to choose a random universal set and two subsets and find intersections and complements, to be able to identify the area to be shaded in Venn diagram in general cases
- Online games on set theory and Venn diagram

- Following link can be used to put numbers in correct sets: https://www.transum.org/Maths/Activity/Number_systems/

- Numbers can be arranged in Even, prime and square numbers by using following link: https://www.transum.org/software/SW/Starter_of_the_day/Students/Venn_Diagram.asp

- https://www.transum.org/software/SW/Starter_of_the_day/Students/Venn_Diagram_Matching.asp - Match the sets statement with the equivalent Venn diagram.

Domain: **Algebra**

Sub-Domain: Algebraic Expressions

STEP 1 _____	
Standard: Manipulate algebraic expressions	
● **Student Learning Outcomes**: Recognize Muhammad bin Musa Al-Khwarizmi as the father of Algebra. Develop an understanding of algebraic terms, monomial, trinomial and polynomial. Add, subtract, multiply, simplify and factorize algebraic expressions	
Knowledge: Students will understand: ● The algebraic terms including; open and close sentences, like and unlike terms, variable, constant, expression, equation and inequality ● Variable as a quantity which can take various numerical values Students will know: ● Muhammad bin Musa Al-Khwarizmi as the founding father of Algebra	**Skills:** Students will be able to: ● Recognize polynomial as an algebraic expression in which the powers of variable are whole numbers ● Identify a monomial, a binomial and a trinomial as a polynomial ● Add two or more polynomials ● Subtract a polynomial from another polynomial ● Multiply: ○ monomial with monomial ○ monomial with binomial/trinomial ○ binomial with binomial/trinomial ● 3 basic identities (a+b)2 , (a-b)2, a2 - b2 ● Simplify algebraic expressions involving addition, subtraction and multiplication ● Simplify by expanding products of algebraic expressions (by a number, a variable or an algebraic expression) ● Factorize algebraic expressions (by taking out common terms and by regrouping) ● Factorize quadratic expressions (by middle term breaking method)

Advanced/Additional:

Students will be able to:

- *Multiply and divide algebraic fractions and express the answers in the simplest form.*

STEP 2 _____

Assessments

Formative Assessments

1. Play Math Baseball

Divide your class into two teams to play math baseball - an activity that gives full control to the teacher of the questions students answer. Firstly, a teacher will compile the questions related to a distinct skill and assign them equal marks. One team will start 'at bat', scoring runs by giving correct answers. Jot down the marks of team on board. After 5 questions, switch the team.

2. Peer checking

Assign some questions to the students by writing them on board or write them on chart paper and paste it on the board. Mention 10-15 minutes time for students to solve the questions. After the time finishes, ask the students to exchange their notebooks. Teacher will explain the checking criteria - write down the correct answers on the board and it will help the students to identify the mistakes.

3. Factoring Comic activity

Students love comics and graphic novels, this activity brings this interest into conversation with Math. To start with, assign each student a polynomial. Ask them to imagine that each variable within the polynomial is a character. Their task is to create a comic strip that shows how they would factor the polynomial. They can create images personifying their factors.

When a teacher will put their comics together, he will have an illustrated guide to factorize polynomials.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- Give an introduction of Muhammad Ibn Musa Al Khwarizmi as he was the first person to treat Algebra as an independent discipline and introduced the methods of reduction and balancing the equation. The term algebra itself comes from the title of his book; he has been described as the "father of algebra".
- Explain the new vocabulary terms monomial, binomial and trinomial to the students and let them write it in their notebooks. A **monomial** is the product of non-negative powers of variables. A monomial has no variables in its denominator and will have only one term. A **binomial** is the sum of two monomials and thus will have two unlike terms. A **trinomial** is the sum of three monomials meaning it will be the sum of three unlike terms.
- Recall the concept of factors of a numeral to make students understand the concept of factorization in linear algebra.
- Also, take factorization as the inverse process of multiplication of an algebraic expression with a number or a variable or both.
- Introduce the general form of quadratic expression as $ax^2 + bx + c$, where a, b, c are constants.
- Use algebra tiles to explain the concept of factorization in quadratic expressions.
- Online games on algebraic expressions and factorization

Suggested Online Resources:

https://www.khanacademy.org/math/algebra-basics/alg-basics-algebraic-expressions?t=practice

(Factorization of algebraic expressions)

https://www.theproblemsite.com/games/quadratic-rush

(Online game for quadratic expressions)

Domain: Algebra

Sub-Domain: Algebraic Equations and Inequalities

STEP 1 _____

Standard: Manipulate Algebraic Equations and Inequalities.

- **Student Learning Outcomes**: Solve linear equations and basic linear inequalities. Plot graphs for linear equations in two variables. Solve basic simultaneous equations and inequalities. Recognize the pattern in number sequences and determine the nth term

Knowledge:	**Skills:**
Students will understand: ● The use of number lines to represent intervals/inequalities Students will know: ● Explanation of the solution of linear equations in one variable	Students will be able to: ● Solve linear equations (including those involving algebraic fractions) in mathematical and practical situations ● With increasing level of challenge, change the subject of a formula and use substitution method to calculate values of unknown variables ● Construct linear equation in two variables such as; □□ + □□ = □, where □ and □ are not zero ● Solve basic simultaneous linear equations in two variables using elimination, substitution and graphical methods. ● Solve basic single and simultaneous linear inequalities in one variable and use number line to illustrate the answers ● Recognize the pattern in number sequences and find out the missing next terms (including the nth term) ***Advanced/Additional:*** *Students will be able to:* ● *Show, by shading the region on the graph, the solution to Inequalities in one variable.*

STEP 2 _____

Assessments

Formative Assessments

1. Think-Pair- Share exercises

Pair the students together to think individually about a specific question, discuss their results and findings. Finally have each pair share their ideas with the rest of the class and open the floor for further discussion. It allows our students to process content individually, in a small group and in a large group.

2. Gallery walk [for simultaneous equations]

Depending on the strength of a class, divide the students in 4-6 groups. Each group of students will select one group leader who will write down the steps of working. Provide them a flip chart/A4 paper for the solution. Assign them a question to be solved within the given period. They will paste it on the wall of the classroom. All of the groups will take a round of the class and observe the strategies used by other groups.

3. Task cards for writing, solving and Graphing Inequalities

A teacher will combine all 3 skills into one activity by writing tasks from each skill on the cards.

Step 1: On the 1st 4 cards, students have to answer yes or no.

Step 2: The next 4 cards have students answer yes or no to 4 different options in an inequality. Students then have to graph an inequality on the following 4 cards.

Step 3: Another 4 cards have scenarios written where students have to write an inequality based on the situation. The last 4 cards require students to solve an inequality and then graph it on a number line.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- **Starter activity for Equations**
  'Riddle me this' is a fun classroom activity for students. The game can be made easy or hard depending on the equations you select but essentially the motive is to solve the value of each algebraic equation and find the answer to the riddle. The student who manages to solve all the equations and find the answer to the riddle wins the game!
- **Starter activity for Inequalities**

For making our students master of one-step inequalities, challenge them with a maze that requires them to pick an inequality based on a sentence. Students will read a sentence and pick the correct inequality and continue this process until they get to the end of the maze. Use it for group work.

- Have students understand that two variables in an equation will require two equations for solution
- Ask students to solve linear equations using substitution or elimination methods, plot their graphs, compare them and share their observations.
- Generate a discussion on the drawbacks of the graphical method with the students.
- Have students check their answers by substituting in the given equations
- Use the knowledge of number lines to represent intervals/inequalities.
- Show, by shading the region on the graph, the solution to Inequalities in one variable.
- Related Inequalities in real life problem solving skills such as speed limit on the highway, minimum payments on the credit card bills, number of text messages you can send each month from your cell phone and the amount of time it will take to get from home to school. All of these can be represented as mathematical inequalities.
- Ask students to share patterns they have seen, or present them with samples of patterns. Ask them to describe the patterns. Ask whether there are other ways to represent the same pattern. Review pattern-related vocabulary as opportunity arises during the discussion.
- Give students different number sequences (increasing and decreasing), pictorial patterns and tables and generate a discussion on the possible nth term
- Ask students to make their own number sequences and derive their nth terms and vice versa

- **Suggested Online resources:**
- www.mathgames.com/skill/8.67-solve-a-asystem **(substitution method)**
- http://www.onlinemathlearning.com/algebra-math-games.html **(Basic algebra)**
- http://www.transum.org/Software/SW/Starter_of_the_day/Similar.asp?ID_Topic=36 **(Sequences)**

Domain: Algebra

Sub-Domain: Coordinate Geometry

STEP 1 _____

Standard: Use the concept of Linear functions to solve problems pertaining to Coordinate Geometry.

- **Student Learning Outcomes**: Develop an understanding of the Cartesian coordinate system. Plot graphs of linear equations – Find values of *x* and *y*, gradient and y-intercept from straight line equations
- Solve basic simultaneous linear equations in two variables using graphical methods.

Knowledge:

Students will understand:

- the meaning and effect of negative, positive and zero gradients of straight lines on the graph

Students will know:

- Cartesian coordinate system
- The equation of horizontal and vertical lines
- Relationships between gradients of parallel and perpendicular lines

Skills:

Students will be able to:

- Plot graphs of linear equations in two variables
- Calculate gradients and y-intercepts from a given straight line equation of the form $y = mx + c$, as well as from the graph
- Find the values of *x* and *y* from the graph

STEP 2

Assessments

Formative Assessments

1. **Play Math Baseball** (Finding the values of x and y from the graph)

Divide your class into two teams to play math baseball- an activity that gives full control to the teacher of the questions students answer. First, a teacher will compile the questions related to a distinct skill and assign them equal marks. One team will start 'at bat', scoring runs by giving correct answers. Jot down the marks of the team on board. After 5 questions, switch the team.

2. **Peer checking** (Finding the gradient and y-intercept from a set of given linear equations)

Assign some questions to the students by writing them on board or write them on chart paper and paste it on board. Mention 10-15minutes time also. After the time finishes, ask the students to exchange their notebooks. Teacher will explain the checking criteria - write down the correct answers on the board and it will help the students to identify the mistakes.

3.**Presentations** (Students will complete the table of coordinates and will represent them on graph and will find the gradient and y-intercept)

4.**Think-pair-share**

5.**Visualization**

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams**.**

STEP 3 _ _____

Learning Activities

- Provide students with graphs of discrete data arranged horizontally and vertically. Students should create a table of values from the graph, write an equation by recognizing the pattern in the data and be able to describe a situation to represent each graph.
- Have students write equations from pre-drawn graphs of straight lines
- Provide students with various graphs and linear relations and ask them to match the graph with the equation based on their knowledge of gradient and y-intercept. Students could also be asked to describe the pattern within the graphs.
- Have students calculate the gradients of parallel and perpendicular lines and share their observations about them.
- Use online resources to draw lines and describe their gradients. https://www.youtube.com/watch?v=rgvysb9emcQ

Domain: Geometry

Sub-Domain: Quadrilaterals

STEP 1 _____

Standard: Develop an understanding of the properties of Quadrilaterals, polygons and circles.

- **Student Learning Outcomes**: Develop an understanding of properties of circles and

quadrilaterals. Calculate interior and exterior angles of a polygon

Knowledge:	**Skills:**
Students will understand: ● *The meaning of concentric and eccentric circles* Students will know: ● Properties of quadrilaterals (square, rectangle, parallelogram, rhombus, trapezium and kite) ● A circle; its center, radius, diameter, chord, arc, major and minor arcs, semicircle and segment of the circle.	Students will be able to: ● Calculate the interior and exterior angles of a polygon ● Calculate the sum of interior angles of a polygon ● Differentiate between Convex and Concave polygons **Advanced/Additional** ● *Identify and differentiate between similar and congruent 2D shapes and 3D objects – recognition only*

STEP 2 _____

Assessments

Formative Assessments

1. **Think-pair-share** (Calculate the interior and exterior angles of a polygon)

2. **Play Math Baseball** (Calculate the sum of interior angles of a polygon)
Divide your class into two teams to play math baseball- an activity that gives full control to the teacher of the questions students answer. First a teacher will compile the questions related to a distinct skill and assign them equal marks. One team will start 'at bat', scoring runs by giving correct answers. Jot down the marks of the team on board. After 5 questions, switch the team.

3. **Peer checking**

Assign some questions to the students by writing them on board or write them on chart paper and paste it on board. Mention 10-15 minutes time also. After the time finishes, ask the students to exchange their notebooks. Teacher will explain the checking criteria - write down the correct answers on the board and it will help the students to identify the mistakes.

Summative Assessments

- Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams.

STEP 3 _ _____

Learning Activities

- Draw a rectangle and find its area. Divide it into two equal triangles and find their areas. Now add these areas and share your results with the whole class.
- Have students construct area formulas of parallelogram and trapezium by applying their knowledge of the area of rectangles. Have them cut a right-angled triangle from one end of a rectangle and join it on the other end to have a parallelogram. Have them investigate and explore that the area remains the same when shapes are re-arranged to make new shapes.
- Give your students different pairs of parallelograms and equilateral triangles of equal heights and join them to form a trapezium. Have them investigate and explore and derive area formula of a trapezium. Use the same strategy to explore perimeter of these shapes.
- Have students join different 3D objects to explore volume and surface areas of compound objects.
- Use online games on calculation of perimeters, areas and volumes.
- Apply angle properties of triangles and quadrilaterals to find missing angle(s) in triangles and quadrilaterals
- **Online videos**
  https://www.youtube.com/watch?v=5CeBlu260Rw
  https://www.youtube.com/watch?v=NlHqdwTtcCY

Domain: Geometry

Sub-Domain: Polygons

STEP 1 _____

Standard: Construct lines, angles and various polygons

- **Student Learning Outcomes**: Recognize the way to name polygons and angles. Construct angles, triangles, quadrilaterals, angle bisectors and line bisectors

Knowledge:

Students will understand:

- The relationship between interior and exterior angles of polygons, and understand the relationship between opposite interior and exterior angles in a triangle

Students will know:

- The way to name polygons and their angles mathematically (e.g. using different notations such as ∠ABC or ∠A etc.)
- The perpendicular distance from a point to a line is the shortest distance to the line.

Skills:

Students will be able to:

- Recognize and construct acute, obtuse and reflex angles using a protractor
- Construct equilateral, isosceles and scalene triangles
- Construct acute angled, obtuse angled and right- angled triangles
- Construct the following:
  - Square
  - Rectangle
  - Parallelogram
  - Trapezium
  - Rhombus
  - Kite
- Draw angle and line bisectors to divide angles and sides of triangles and quadrilaterals.

STEP 2 _____

Assessments

Formative Assessments

1.**Think-pair-share**

- Construct acute angled, obtuse angled and right-angled triangles
- Draw angle and line bisectors to divide angles and sides of triangles and quadrilateral. Pair the students together to think individually about a specific question, discuss their results and findings. Finally have each pair share their ideas with the rest of the class and open the floor for further discussion. It allows our students to process content individually, in a small group and in a large group.

2. **Using worksheets**

To assess them on; how to construct angles, triangles, quadrilaterals, angle bisectors and line bisectors. Let them solve independently. Check it later and identify the weak areas of students.

3. **Gallery walk**

Depending on the strength of a class, divide the students in 4-6 groups. Each group of students will select one group leader who will write down the steps of working. Provide them a flip chart/A4 paper for the solution. Assign them a question to be solved within the given time period. They will paste it on the wall of the classroom. All of the groups will take a round of the class and observe the strategies used by other groups.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- Have students identify angles in a variety of real life contexts (e.g., angles formed by the two hands of a clock, by the intersection of two roads, and by the blades of scissors or hedge clippers etc.)
- Have students arrange two straws, or two toothpicks:
    - parallel to one another;
    - intersecting;
    - perpendicular at an end point of one straw;
    - perpendicular at endpoints of each straw;
    - one straw perpendicular to the other straw and bisecting;
    - one straw perpendicular to the other straw, but not at its end points and not bisecting;
    - one straw bisecting the other straw but not perpendicular;
    - each straw bisecting the other straw but not perpendicular;
    - one straw bisected by the other straw and perpendicular;
    - Each straw bisecting the other straw and perpendicular.
- Draw angle and line bisectors to divide angles and sides of triangles and quadrilaterals.
- **Online videos**
    - https://www.youtube.com/watch?v=lIwvSzfUkOY
    - https://www.youtube.com/watch?v=5bvjnleMn5A
    - https://www.youtube.com/watch?v=XBgwGROzzzk

Domain: Geometry

Sub-Domain: Properties of lines, angles and polygons.

STEP 1 _____

Standard: Solve various problems related to properties of lines, angles and polygons.

- **Student Learning Outcomes**: Identify and manipulate 2D shapes with respect to symmetry and translation. Calculate unknown angles and lines using properties of triangles and quadrilaterals

Knowledge:

Students will understand:

- Symmetry and translation.

Students will know:

- Angle properties:
  - adjacent angles on a line
  - vertically opposite angles
  - angles on a point
  - alternate angles
  - corresponding angles and interior angles between parallel lines
  - sum of complementary angles
  - sum of supplementary angles

Skills:

Students will be able to:

- Identify and illustrate all lines of symmetry in a wide range of 2D shapes
- Rotate objects using rotational symmetry and describe the order of rotational symmetry for a wide range of 2D shapes
- Translate an object
- Calculate unknown angles in triangles and quadrilaterals, using the properties of angles in triangles and quadrilaterals (square, rectangle, parallelogram, rhombus, trapezium, and kite)

Advanced/Additional:

Students will be able to:

- *Identify and give precise description of transformation connecting given figures.*

STEP 2 _____

Assessments

Formative Assessments

1. Think-pair-share

2. White Board technique

3. Worksheets

4. To assess them on how to solve various problems related to properties of lines, angles and polygons, provide them worksheets. Let them solve independently. Check it later and identify the weak areas of students.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams**.**

STEP 3 _ _____

Learning Activities

- Provide students with or have them bring in a multitude of 2-D shapes and classify them according to the number of lines of symmetry, and rotational symmetry with the angle and order of rotation.
- Develop the concept of equal corresponding angles and sides in case of congruent and equal corresponding angles and proportional corresponding sides in case of similar shapes
- Apply angle properties of triangles and quadrilaterals to find missing angle(s) in triangles and quadrilaterals
- **Online Videos:**
  https://www.youtube.com/watch?v=qTD_z47egHs
  https://www.youtube.com/watch?v=EZ6dOlRQDBo

Domain: **Measurement**

Sub-Domain: Surface Area and Volume

STEP 1 _____

Standard: Use the concepts of Perimeter, Circumference, Area, Volume and Surface Area in problem solving

- **Student Learning Outcomes**: Using appropriate formulae, calculate the circumference and area of circles, area and perimeter of 2D shapes and volume and surface area of 3D shapes. Convert between standard units of mass, length, area and volume

Knowledge:

Students will understand:

- Standard units of length, mass and capacity for estimation and calculation

Students will know:

- Chord, arc and sector in a circle
- Formulae for the following:
  - Circumference of a circle
  - Area of a circle
  - Areas of various quadrilaterals
  - Area of triangle
  - Surface areas of right prism and cylinders
  - Areas of right prism and cylinders

Skills:

Students will be able to:

- Calculate the circumference of a circle
- Calculate the area of a circular region
- Calculate the area and perimeter of composite shapes (shaded and unshaded regions)
- Calculate the surface area and volume of right prisms
- Calculate the surface area and volume of a cylinder
- Calculate the surface area and volume of any simple and compound 3D objects (including right prisms and pipes)
- Calculate the missing dimension from the given area/perimeter/surface area/volume of all 2D shapes, right prisms and cylinders
- Solve word problem with real-life contexts, involving circles, quadrilaterals, right prisms and cylinders
- Convert between standard units of area (converting between m^2, cm^2, mm^2 and vice versa) and volumes (converting between m^3, cm^3 and mm^3 and vice versa)

STEP 2 _____

Assessments

Formative Assessments

At the beginning, make sure that all students must bring the cut outs of different basic shapes [triangle, circle, rectangle and square] with measurements written on it. Any medium can be used [colored sheets, chart papers, foamy sheets]. It will help them in better understanding of the area and perimeter of basic shapes.

<u>Model presentations [Assessing the calculation of volume]</u>

Divide the students in groups of 3-4 students each. Ask them to bring different 3D shapes which are used in daily life. Next, they will calculate the volume of that object. Once all the groups have completed this task, they will present their object and its parameters to the rest of the class. Teacher will evaluate their calculations.

Assessing the skills of units of measurement and its conversion

For this research-based project, guide them to search world's famous buildings, places and monuments [either using the internet or books available in the library]. The students are to note down its dimensions in the notebook along with the picture of that place as well.

Once this task is checked by the teacher, ask the students to convert the mentioned units of measurements as well. e.gIf a student has researched the area of Badshahi Masjid in hectares, ask him/her to convert it into square kilometers as well.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- Preparing a resource sheet of formulae of all 2D and 3D shapes

  Right from the beginning of this topic; guide the students to prepare colored sheets to note down all the formulae of the shapes under study. At the end of topic, paste these resource sheets in their notebook.

- Celebrate Pi(π) day on 14th March

  Have fun filled events on this day to mark the celebrations. Every year on 14 March, the world celebrates Pi day to recognize the mathematical constant Pi. It defines as the ratio of a circle's circumference to its diameter and its value is **22/7**. The numbers in the date [3/14] match the first three digits of the mathematical constant pi.

- Provide pictures of many regular triangles, squares and rectangles, with the measure of one side provided for each. Have students explore to find the most efficient method for finding the perimeters of each. Lead students to discover that "side + side + side + side…" is inefficient when multiplication can be used instead. Repeat the activity with rectangles and squares.

- Use exploratory activities to find the value of perimeter of a circle. Give students circles of different sizes and thread/string to calculate the perimeter. Compare the answer with the answers calculated by the formula and discuss the error in the answer
- Provide paper copies of nets for students who are having difficulty visualizing the parts of a 3-D object, for them to cut and fold.
- Use a variety of different shapes of boxes and containers for cutting and calculating surface area.
- Generate discussions on volume, using informal measurement methods, such as linking cubes. Show and discuss the centimeter cube. Explain that just as square units are used to measure area and surface area, cubic units are used to measure volume. Have students bring in small boxes of various shapes and sizes and use centimeter cubes to determine the volume of each box and provide students with relevant contexts for determining volume

- Provide students with or have them bring in a multitude of 2-D shapes and classify them

- **Suggested online resources:**
  https://www.studyladder.com/games/activity/converting-between-units-of-mass-grams-and-kilograms-27995 (Problems & Activities)

  http://www.onlinemathlearning.com/parts-of-circle.html (Parts of a circle)

  http://www.hoodamath.com/mobile/games/tronix.html (Online Games & Activities)

  https://www.ixl.com/math/grade-7/compare-and-convert-metric-units (Converting units)

  http://nlvm.usu.edu/en/nav/frames_asid_284_g_3_t_4.html?open=activities&from=topic_t_4.html (Virtual manipulatives – requires Java Player)

  http://www.onlinemathlearning.com/measurement-games.html (Different measurements)

Domain: Measurement

STEP 1 _____
Standard: Solve problems pertaining to Distance, Time and Speed.
Student Learning Outcomes: Convert between different units of time, distance and speed. Calculate the arrival, departure and journey times in real-life contexts. Recognize the relationship between speed, distance and time, and solve the associated word problems

Knowledge:

Students will understand:

- Relationship between speed, distance and time

Students will know:

- Difference between uniform and average speeds

Skills:

Students will be able to:

- Convert between 12 hour clock and 24 hour clock and vice versa
- Calculate the difference between two times, and find start or end times for a given time interval (on the previous day and the next day)
- Calculate arrival time, departure time and journey time in a given situation (on the previous day and the next day)
- Convert between different units of speed, time and distance
- Solve word problems with real-life contexts, involving, distance, time and average speed.

Advanced/Additional:

Students will be able to:

- *Draw and interpret simple distance – time and Speed-time graphs (Travel Graphs) in real life contexts.*

STEP 2 _____

Assessments

Formative Assessments

Design a worksheet for the students comprising the questions of basic time calculations of 12 hour and 24-hour clock notation. It will help the teacher to assess their prior knowledge and then designing the next steps to approach.

Assessing time calculation

Guide the students to search the timetable of a specific bus company/freight train/airplane moving from one destination to another. Once the students have the timetable, guide them to find the time differences between different destinations.

Assessing the skills of calculating speed and its conversion

For this research-based project, guide them to search the speed of different models of vehicles, animals, means of transportation, world's fastest athlete, fastest animal, fastest car etc. [either using internet or books available in library]. Note down its speed along with the given units in the notebook (along with the picture of that object as well).

Once the task is checked by the teacher, tell them to convert the mentioned units of speed as well. e.g. if a student has researched the speed of a tiger in km/hr, tell him to convert it in meters/seconds and vice versa.

Worksheets

Use worksheets for illustrations of travel graphs, finding the missing distance and time conversions especially for time from hours in hours and minutes.

Drawing travel graphs

Let the students observe their daily life routine and draw travel graph accordingly. E.g., ask the students to observe their daily routine of coming to school from home, note down the arrival time, departure time, and number of times they stop during the journey. After recording all of these values, draw its travel graph.

Different students can observe different journeys to draw their travel graphs.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams **.**

STEP 3 _ _____

Learning Activities

- Provide the students with geared clocks or tell them to make it for themselves to help them work out the differences between time manually with a visual and tactile aid
- Using knowledge of calculating time intervals to read or understand train or bus timetables.
- Activity for the relation between speed and time
- The purpose of this activity is for students to recognize that speeds can be ranked by comparing time, if the distance travelled is the same. Students will appreciate the fact that the shortest time means the greatest average speed.

  Material required:

  A simple race track-curtain trail or the space between 2 meter rods, table tennis balls, straws, meter rod and stopwatch

  Steps:

  Students blow the ball along the race track as quickly as possible; they will compete in groups of 4. 1 student should blow the marble while the others record the time taken to complete a

200 cm course and then calculate the speed. The ball with the greatest average speed wins. The winner from each group enters the final stages of the competition.

- Use real life situations to calculate arrival time, journey time and departure time and plot graphs from that data

- **Suggested Online Resources:**
  http://nlvm.usu.edu/en/nav/frames_asid_272_g_4_t_4.html?open=instructions&from=topic_t_4.html (Converting units - Requires Java)

  https://www.ixl.com/math/grade-7/compare-and-convert-metric-units (Converting units)

  http://www.onlinemathlearning.com/average-speed-problems.html (average speed word problems)

Domain: **Statistics and Probability**

STEP 1 _____	
Standard: Use the concepts of Data Handling, Frequency Distribution and Statistical graphs in problem solving	
Student Learning Outcomes: Recognize and differentiate between discrete and continuous data. Construct and interpret frequency tables, histograms, bar charts, pie charts and line graphs	

Knowledge:
 	
Students will understand:
• The Difference between a histogram and a bar chart
 	
Students will know:
• The following concepts:
  ○ Frequency
  ○ Tally marks
  ○ Range
	Skills:
	
	Students will be able to:
	• Differentiate between discrete and continuous data
	• Construct and interpret grouped frequency tables for discrete data and continuous data choosing appropriate intervals over a sensible range
	• Recall the construction and interpretation of different types of bar graphs, line graphs, pictograms and pie

○ Lower class limit ○ Upper class limit ○ Class interval ○ Mid-point	charts ● Interpret a pie chart and derive original frequencies from the sector angles of given pie chart ● Construct and compare histograms for both discrete and continuous data with equal interval range ***Advanced/Additional:*** ● *Select and justify most appropriate graph(s) for a given data set and draw simple conclusions based on the shape of graphs.*

STEP 2 _____

Assessments

Formative Assessments

- Entrance Tickets (To check students' prior knowledge about discrete and Continuous data)
- White board strategy can be used to write examples of discrete and continuous data (Students concepts will be assessed by examples written on their respective boards)
- Class presentations/projects in groups to draw line graphs, pictograms and pie charts
- Think-pair-share activity can be used to compare histograms for both continuous and discrete data
- 3-2-1 strategy to check students' understanding in construction and interpretation of charts.

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams **.**

STEP 3 _ _____

Learning Activities

- Have a class discussion about Primary and secondary data, the differences between continuous and discrete data and which type is appropriate in different situations.
- Generate a discussion on the advantages and disadvantages of different graphs, including pie charts, line graphs, bar graphs, double bar graphs, pictograms and histograms, in representing a specific given set of data.

- Set up groups that collect, arrange and display different kinds of data through different methods including questionnaires, experiments, databases and electronic media. Ask students to construct frequency tables from that data and choose the most appropriate graph to represent it. The groups may give a presentation at the end of their data collection.
- Link the concept of percentages, fraction and ratio with the calculation of area of sectors for a pie charts and vice versa

Domain: Statistics and Probability

STEP 1 _____

Standard: Calculate and interpret Measures of Central tendency in various problem-solving contexts

Student Learning Outcomes: Recognize the difference between grouped and un-grouped data. Calculate mean, median and mode for ungrouped data. Compare and justify the appropriate measure of central tendency for a given data-set

Knowledge:

Students will understand:

- The difference between grouped and ungrouped data

Students will know:

- The formulae for the following:
  - Mean of ungrouped data
  - Mean of grouped data
  - Interquartile range

Skills:

Students will be able to:

- Calculate the mean, median and mode for ungrouped data
- Solve problems with real life contexts, involving mean, median and mode
- Compare, choose and justify the appropriate measures of central tendency (mean, mode, median) for a given set of data

Advanced/Additional:

Students will be able to:

- *Calculate the mean, median and mode for grouped data*
- *Calculate the three quartiles and Interquartile range for ungrouped data.*

STEP 2 _____

Assessments

Formative Assessments

- Think-pair-share: Ungrouped data will be given and students will find mean, median, mode and range of the data in groups. Each group will then share their work with other groups. They can compare and justify the most suitable measure of central tendency.
- Classroom presentations on real life applications of measures of central tendency.
- Exit ticket

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams .

STEP 3 _ _____

Learning Activities

- Generate a discussion on Data, the word data is used to refer to any kind of information that you collect and record. It can include words, numbers, measurements, and more. Suppose you decided to record the temperature outside your house every day for a month. Is this data? What if you asked each of your friends what their favorite ice cream flavor was and then wrote down their answers? Would that information be data? Both of these would give you data.
- Generate a discussion on grouped and ungrouped data - grouped data is the type of data which is classified into groups after collection. The raw data is categorized into various groups and a table is created. When a test is done, the result is data this can be grouped in many ways like the number of students that scored above and less average.
- Generate a discussion on situations where mean, median or mode is most appropriate choice of average
- For quantitative data collected in the previous unit, ask students to choose and calculate appropriate measures of central tendency and explain why it is the most suitable average for the given data.
- Ask students to find the range and interquartile range (for ungrouped data) of the above data and discuss with the whole class the spread of the values and its effect on mean and median

Domain: Statistics and Probability

STEP 1 _____

Standard: Solve problems using various concepts pertaining to Probability.

Student Learning Outcomes: Develop an understanding of terms related to probability. Differentiate between mutually exclusive and equally likely events. Determine the complement of an event and probabilities of events involving less than, greater than, at most, at least a particular number

Knowledge:

Students will understand:

- The meaning of the terms experiment, outcome, event, sample space, mutually exclusive events, equally likely events, possible outcomes, favorable outcomes

Students will know:

- The probability of a certain event and of an impossible event
- The formula for finding the probability of the complement of an event

Skills:

Students will be able to:

- Determine the complement of an event by examining the sample space for that event
- Differentiate between mutually exclusive and equally likely events
- Find the probabilities of events involving less than, greater than, at most, at least a particular number - for single event experiments only
- Use the knowledge of probability for solving simple problem (with real-life contexts)

Advanced/Additional:

Students will be able to:

- *List elements of sample space and its subsets for simple and combined events experiments (2 dice, 2 coins, 1 coin and a dice) using possibility diagrams and tree diagrams*

STEP 2 _____

Assessments

Formative Assessments

- White board technique: (Used to find the probabilities of events involving less than, greater than, at most, at least a particular number - for single event experiments only).This technique is very useful to assess student's individual learning.
- Think-pair-share (for tree diagrams of various single and combined events)

Summative Assessments

Tests at the end of each unit, Monthly tests, Mid-year exams, End-of-Year exams

STEP 3 _ _____

Learning Activities

- Ask students to use their prior knowledge and list down all possible outcomes of sample space set for rolling a dice and tossing a coin
- Generate a discussion on mutually exclusive and equally likely events by giving examples. For example, the event of a person being an adult. The person is either an adult or not an adult, not in between. Therefore, these two events are mutually exclusive. Getting an even number on the toss of a dice and getting an odd number on the toss of a dice are equally likely events, since the probabilities of each event are equal.
- Generate a discussion to clear the concepts of events such as less than, greater than, at most and at least of a number for single events.
- Give examples to explain complements of events such as mutually exclusive pair of events are complements to each other. For example, if the desired outcome is heads on a flipped coin, the complement is tails. The Complement Rule states that the sum of the probabilities of an event and its complement must equal 1
- Use table and probability tree/possibility tree methods to list down elements of sample space for single and combined events experiments (2 coins, 2 dice, one coin and a dice)
- Give students the opportunity to explore decision-making based on probability. They should use a sample to determine the probability of an event, use the results and subjective judgment to make predictions and explain the reasonableness of the predictions, based on any assumptions that they made.

DRAFT

Mathematics - Class 8
Suggested Guidelines

DOMAIN: Numbers and Operations

Sub-Domain: Real Numbers

STEP 1 _____
Standard: Students will be able to demonstrate understanding of real numbers, operate with real numbers (with and without number line) and identify the absolute value of real numbers.
Student Learning Outcomes: Students will be able to ● demonstrate decimal fractions as terminating, non-terminating, recurring and non-recurring ● Differentiate rational and irrational numbers**.** ● Recognize real numbers as a union of rational and irrational numbers. ● Recognize the absolute value of a real number. ● Demonstrate the properties of real numbers and their subsets with respect to addition and multiplication.

Knowledge:	**Skills:**
Students will be able to know about : ● calculation with decimals and fractions in real-life situations/word problems ● terminating, non-terminating and recurring and non-recurring ● rational and irrational numbers ● real numbers on a number line ● the absolute value of a real number ● the properties of real numbers	Students will be able to ● solve real-life situations/word problems involving calculation with decimals and fractions ● demonstrate decimal fractions as terminating, non-terminating and recurring and non-recurring ● differentiate rational and irrational numbers ● represent real numbers on a number line ● identify the absolute value of a real number ● demonstrate the properties of real numbers and their subsets with respect to addition and multiplication: ▪ closure property

	▪ associative property ▪ existence of identity element ▪ existence of inverses ▪ commutative property ▪ distributive property of multiplication over addition/ subtraction

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

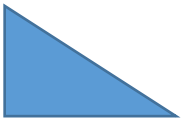
STEP 3 _ _____

Learning Activities

1. Ask the students to construct circles (with different radii) and measure the circumference of each by using thread.
   Find the ratio of circumference to its radius, of each circle up to 5-decimal places and

approximate it to the nearest tenths. What have they observed?

- The exact ratio of circumference of a circle to its diameter is the irrational number π (pi), which is 3.1416 rounded to 4-deciml places.
- Numbers that are not rational can be discovered by using a right-angled triangle whose two sides each of length 1 units as shown in the figure:

1 

- The 1 gth of hypotenuse $\sqrt{2}$ is an irrational number.
- The square root of a prime number is always an irrational number.

2. Number Sorting

This game is perhaps the most straightforward. Have students sort through a set of numbers, and separate them into two groups: rational and irrational numbers. You can structure this in many different ways. You can create a set of index cards with various numbers written on them, and have students sort them in pairs or groups.

However perhaps a more fun approach is to have students grab a card from a box on one side of the classroom, and run to the whiteboard at the opposite side to place it in the correct group. You can draw two large circles on the whiteboard, one labeled rational numbers and the other labeled irrational numbers. Then, provide students with tack that they can use to stick each card to the board in the correct place. This makes the sorting process a game where students compete to complete as many numbers as possible. For every correctly placed number, award a point to that group. For every incorrectly placed number, subtract a point. The group with the most points wins.

3. Rational & Irrational Rules Posters

Since there are lots of rules for students to know about what makes a number rational or irrational, we need to find ways to make it easier for students to remember them. One possible way to do this is to have students work in groups to create a poster summarizing those rules in an understandable and clear way. Students should be encouraged to be as creative as possible in designing their posters, making them attractive, and easy to understand.

- By having students think carefully about the best way to present the rules, they'll be reinforcing them in their own minds at the same time. You can even use one of their posters to introduce the topic to next year's students.

DOMAIN: Numbers and Operations

Sub-Domain: Estimation and Approximation

STEP 1 _____

Standard: Students will be able to round numbers and measures to an appropriate/required degree of accuracy and use approximation through rounding to estimate answers.

Student Learning Outcomes: Students will be able to:

- round off and estimate numbers and quantities
- approximate numbers and quantities to a specified number of decimal places and significant figures.

Knowledge:

Students will be able to know about :

- mathematical vocabulary related to estimation and approximation
- rounding off up to the specified number of decimal places
- significant figures
- rounding off up the to specified number of significant figures

Skills:

Students will be able to:

- round off whole numbers, integers, rational numbers and decimal numbers to a required degree of accuracy, significance (up to 5 significant figures) or decimal places (up to 3 decimal places).
- analyze approximation error when numbers or quantities are rounded off
- Sole real-life situations involving approximation

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Use fraction and decimal data from real-life situations, for example, areas of cities, distances between towns, atomic masses of elements, metric units, areas, volumes, and surface areas of objects, to round off to a given number of decimal places
2. Give the approximate height of the school building, walls of the classrooms, the height of the flag pole, the distance between your home and school
3. The teacher will request learners to share a 5- digit number for rounding off. Ask learners to round off the number to the nearest 10 individually on the book. Ask learners to explain the procedure. Now round off the number to the nearest 100 and 1000
4. Ask students to form any four 7-digit numbers using their date of birth. For example, if my date of birth is 04/09/1996, I can form any four 7-digit numbers using the numbers in it. For example:
   4,009,961; 1,996,094; 6,090,914; 4,916,900
5. Then, ask the students to round off any to the various number of significant figures.
   Work in pairs. Write down a 6-digit or a 7-digit number. Give clues for your partner to guess your number. (For example, if you wrote down 347100, you could say: My number has six digits. The digit 4 is next to the digit 3. The number is rounded off to the nearest 100s. The number is divisible by 3. The digit 7 is in the thousands' place. The value of the digit in the hundreds place is 100. There are two zeros in my number. What is my number) Take turns to guess each other's numbers.

DOMAIN: Numbers and Operations

Sub-Domain: Factors and Multiples

STEP 1 _____

Standard: Students will be able to evaluate square roots and cube roots and solve problems involving square roots and cube roots.

Student Learning Outcomes: Students will be able to:

- calculate square root and cube roots of perfect squares and perfect cubes given as a whole number, fraction and decimal by prime factorization and division method.

Knowledge:

Students will be able to know about :

- perfect squares
- perfect cubes
- the square root of a natural number, a common fraction and a decimal
- cubes of natural numbers up to 2- digit
- cube roots of numbers up to 5-digit which are perfect cubes

Advanced/Additional

Students will be able to know about:

- calculating square root of natural number by division method up to 5- digit

Skills:

Students will be able to:

- Recall squares and cubes of natural numbers up to 3- digit.

Square Roots

- compute square root of:
  - a natural number
  - a common fraction
  - a decimal,

  given in perfect square form by prime factorization method up to 5- digit
- calculate square root of a number up to 4-digit with maximum 2-decimal places which is not a perfect square
- apply squares and square roots in real life situations

Cubes and Cube roots

- calculate cube roots of a number up to 5-digit which are perfect cubes by prime factorization method
- apply cubes & cube roots in real life situations/word problems

Advanced/Additional

Students will be able to:

- *compute square root of:*
  - *a natural number*
  - *a common fraction*
  - *a decimal,*

  given in perfect square form by division method up to 5- digit.

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Learners investigate and describe patterns in multiples of
   - 3, 6 and 9
   - 2, 4 and 8

   e.g., multiples of 3 have digits that add up to a multiple of 3; all multiples of 6 are also multiples of 3. all multiples of 4 are even numbers
2. Learners can be asked to share a 3-digit number and explore that which numbers is it divisible by? Ask learners to the class to justify their answers
3. LCM is used for adding and subtracting fractions with different denominators.
4. LCM and HCF can be used to:
   - divide group of objects into smaller groups
   - distribute equally any number of sets of objects
   - arrange objects into rows and columns.

DOMAIN: Numbers and Operations

Sub-Domain: Ratio, Rate and Proportion

STEP 1 _____

Standard.: Students will be able to extend and formalize their knowledge of ratio and proportion in working word problems, and in expressing proportional relations algebraically

Student Learning Outcomes: Students will be able to :

- differentiate between direct and inverse proportion
- solve problems involving direct, inverse and compound proportions.

Knowledge:

Students will be able to know about :

- relationship between ratio and fraction
- relationship between ratio and proportion
- difference between direct and inverse proportions
- expressing direct and inverse proportion in algebraic terms
- finding the unknown quantities in direct and inverse proportions
- difference between graphs of direct and inverse proportional quantities
- compound proportion

Skills:

Students will be able to

- recall the difference between direct and inverse proportion
- solve problems involving direct proportion of two quantities using:
  - table
  - equation
  - graph
- solve problems involving inverse proportion of two quantities using:
  - table
  - equation
- solve real life situations/word problems involving compound proportion

Advanced/Additional

Students will be able to:

- *solve problems involving inverse proportion of two quantities using:*
  - *graph*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Explain that a ratio is a relationship between two numbers of the same kind
2. Set up real situations i.e., the ratio of boys to girls in a class, the ratio of teachers to students, the ratio of blue counters to yellow counters in a jar and seek the solution
3. Ask learners to bring one of their utility bills (Electricity, Telephone, Sui Gas etc.) and find out the following:
   - the rate of one unit of quantity,
   - how many units the household consumed in a particular month,
   - has the bill issuing authority calculated the due amount correctly?

DOMAIN: Numbers and Operations

Sub-Domain: Percentage and Financial Arithmetic

STEP 1 _____

Standard: Students will be able to deal with currency conversion and solve problems involving profit, loss, discount, Insurance, Partnership and Inheritance

Student Learning Outcomes: Students will be able to :

- convert currencies
- calculate profit percentage, loss percentage, percentage discount, profit/ markup, the principal amount, the profit/ markup rate and time period
- solve problems containing real life situations involving insurance, partnership and inheritance

Knowledge:

Students will be able to know about :

- currency conversion
- difference between profit percentage and loss percentage
- percentage discount
- insurance
- partnership
- inheritance

Skills:

Students will be able to

Currency Conversion

- convert Pakistani currency to well-known international currencies and vice versa

Profit, Loss and Discount

- calculate profit percentage and loss percentage
- calculate percentage discount
- solve problems from real life situations involving successive transactions

Profit and Markup

- differentiate profit and markup
- calculate:
  - the profit/ markup
  - the principal amount
  - the profit/ markup rate, time period
- solve problems from real life situations involving profit/ markup

Insurance

- solve real life situations involving:
  - Insurance
  - Partnership
  - Inheritance (according to Islamic Principles)

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Write 30% on the board. What is the equivalent decimal? (0.3) Ask: What is the equivalent fraction? (30/100 = 3/10). Ask learners to write down other facts that they can deduce using these facts, e.g., 15% = 0.15 = 15/100 = 3/20
2. Each learner will be given a set of cards with equivalent fractions, decimals or percentages e.g., 3/4 could be on one card and 75% on another). Learners take turns to put a card down on the table, and if two successive cards have the same value the learner will say 'snap' and will be the winner.
3. Learners can be asked to identify the larger quantity and give the reason too.
   75% of PKR 200 or 5% of PKR 2000?

DOMAIN: Numbers and Operations

Sub-Domain: Sets

STEP 1 _____

Standard: Students will be able use language, notation and Venn diagrams to describe sets and their elements, and solve word problems

Student Learning Outcomes: Students will be able to:

- describe sets in nature and numbers using language (tabular, descriptive and set- builder notation) and Venn diagrams
- find power set (i.e. P (A) of a set A, where A has up to four elements
- verify commutative, associative and distributive laws with respect to union and intersection,
- Use Venn diagram to demonstrate union and intersection of two sets (Subsets, overlapping sets and disjoint sets)

Knowledge:

Students will be able to know about :

- sets in nature and numbers.
- set notations
- use of mathematical vocabulary i.e. set, element, equal sets, empty set, universal set, subsets, equivalent, equal sets, universal set, complement of a set, subset, proper subset, intersection of sets, union of sets, power set
- operations on sets
- Venn diagram
- properties of sets

Advanced/Additional

Students will be able to know about:

- *Venn diagram*
- *properties of sets*
- *De Morgan's Laws*

Skills:

Students will be able to:

- discover sets in nature and numbers
- express sets using tabular, descriptive, and set-builder notations
- differentiate equivalent, and equal sets
- write subsets
- write power set P(A) of a set A, where A has up to four elements
- describe operations on sets Tabular form:
  - union of two sets
  - intersection of two sets
  - difference of two sets
  - complement of a set
- apply sets in real life situations

Advanced/Additional

Students will be able to:

- *use Venn diagram to demonstrate union and intersection of two sets (Subsets, overlapping sets and disjoint sets)*

	● *describe operations on sets by using Venn diagram:*
	  ▪ *union of two sets*
	  ▪ *intersection of two sets*
	  ▪ *difference of two sets*
	  ▪ *complement of a set*
	● *use Venn diagram to demonstrate union and intersection of two sets (Subsets, overlapping sets and disjoint sets)*
	● *discover properties of sets*
	● *verify De Morgan's Laws.*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Use concrete, pictorial, and verbal representations to develop an understanding of sets from everyday life. For example, sort and classify data on the basis of different attributes such as a collection of books of grade VIII syllabus, kitchen utensils, geometrical instruments, etc.
2. Categorize elements as metals and non-metals on the basis of physical properties with the help of Venn diagrams
3. Ask students to take any two rational numbers (decimals, fractions) and find rational numbers between them, and observe that there are infinite rational numbers between them.
4. Draw a number line and mark the location of each pair of rational numbers, then find another rational number between them
5. Prepare Index cards with one set notation symbol on each. You will need one card per student so replicas will be necessary, however, try to keep the numbers of each symbol equal. Write the six sets above on the board. Hand out one card to each student. Stand at the board and ask students to stand in a line against the opposite wall of the room.
   Call out instructions for students to move toward you based on their card identification. For example:
   ''Move one step forward if your card means to create a new set out of all the numbers in two other sets.''
   ''Hop forward twice if your card would result in the set {4}.''
   For clues that could have more than one response (like subset or intersection), ask students to explain why they have moved forward.
   The first student to reach you takes your place while the other students return to the starting place.
   Play as long as time allows swapping leaders each time a student reaches the leader.
6. Write the above six sets on the board. Give each student one card. Ask students to write a set of numbers based on a set notation operation (like subset, intersection, or union) stemming from any combination of the original six sets. After everyone has finished creating a new set, instruct them to mingle around the room and group themselves by the operation used to create their sets.
   For example, all students who used unions should join together and all students who wrote subsets should join. Do not allow students to talk during this time! They must arrange themselves by group simply based on similarities between the resulting sets.
7. Sets of number cards showing numbers 0, 1, 2, 3, 4, 5, and 6 (one set per group). Write the six sets on the board. Divide students into groups of 5-7. Give one set of numbers to each group. Referring to the sets on the board, call out a problem such as ''The union of A and E''. The first group to raise the correct number cards reflecting the answer to your question gets a point. Continue for as long as desired. The team with the most points at the end of the game wins. Instead of calling out the problem in words, write the problem on the board in set notation, like 'A U B'. This will require students to practice recognizing the symbols used in set notation.

DOMAIN: Algebra

Sub-Domain: Number Sequence and Pattern

STEP 1 _____

Standard: Students will be able to solve problems involving numbers sequences and patterns.

Student Learning Outcomes: Students will be able to:

- identify pattern from various number sequences
- differentiate arithmetic sequence and geometric sequence
- discover terms of an arithmetic sequence using term to term and position to term rules
- construct the general term
- solve problems from real life situations involving numbers sequence and pattern

Knowledge:

Students will be able to know about :

- identify simple pattern from various number sequences
- difference between arithmetic sequence and geometric sequence
- continuing a given number sequence
- finding term to term rule
- finding position to term rule
- find terms of a sequence when general term (nth term) is given
- constructing the formula for general term

Advanced/Additional

Students will be able to know about:

- *terms of a geometric sequence*
- *formulating general term (nth term) of geometric sequence*

Skills:

Students will be able to:

- differentiate arithmetic sequence and geometric sequence
- discover terms of an arithmetic sequence using:
  - term to term rule
  - position to term rule
- construct the formula for general term (nth term) of an arithmetic sequence
- solve problems from real life situations involving numbers sequence and pattern

Advanced/Additional

Students will be able to:

- *discover terms of a geometric sequence*
- *construct the formula for general term (nth term) of geometric sequence*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

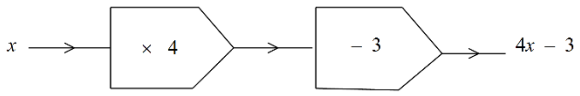
STEP 3 _ _____

Learning Activities

1. Ask learners to think of a number and write it down. They:
   - add 10
   - double the answer
   - subtract 6
   - halve the answer
   - take away the original number

   What do learners notice about their final answers? (Everyone gets 7.)

2. Use algebraic disc for activities
3. Provide learners with real life problems to write as a simple algebraic expression
4. Calculate the number of electrons in a given orbit using the $2n^2$ formula
5. Ask Learners to develop function machines and write their output as a formula.



What sequence does the machine output produce? Generalize it and discover the formula.

6. Describe, extend, and make penalizations about geometric and numeric patterns
7. Make a set of cards as shown

+ 10	- 10	+ 100
+ 10	- 100	+ 100
+ 10	- 1000	+ 100
+ 1000	+ 1000	+ 1000

Each player will start with the number 10 000 written on their paper
The cards will be piled as face down
Players will be instructed to take turns and turn over a card and add or subtract from their starting number as the card shown
Students will keep track of their numbers using their pen and paper
The player with the highest number once all the cards has been turned over will be the winner

DOMAIN: Algebra

Sub-Domain: Expansion and Factorisation

STEP 1 _____
Standard: Students will be able to simplify and factorise algebraic expressions and apply algebraic identities to solve problems.
Student Learning Outcomes: Students will be able to: ● differentiate expression and equation ● use algebraic identities to expand and factorise algebraic expressions ● change the subject of the formula to calculate the unknowns by substituting

Knowledge:	**Skills:**
Students will be able to know about : ● the difference between ▪ open and close sentences ▪ expression and equation ▪ equation and inequality ● addition, subtraction, multiplication and	Students will be able to ● recall the difference between ▪ open and close sentences ▪ expression and equation ▪ equation and inequality

division of polynomials

- algebraic identities and their application
- expand algebraic expressions
- factorise algebraic expressions

Advanced/Additional

Students will be able to know about:

- *base, index/ exponent and its value*
- *scientific notation/standard form*
- *use of positive, negative, fractional and zero indices*
- *application of the laws of exponents/ indices*

- recall addition, subtraction and multiplication of polynomials

Division of Algebraic Expressions

- divide a polynomial of degree up to 3 by
  - a monomial
  - a binomial
- simplify algebraic expressions involving addition, subtraction, multiplication and division

Basic Algebraic Identities

- recognize algebraic identities to expand expressions
  - $(a + b)^2 = a^2 + b^2 + 2ab$
  - $(a - b)^2 = a^2 + b^2 - 2ab$
  - $(a + b)(a - b) = a^2 - b^2$
- apply algebraic identities to solve problems like $(103)^2$, $(99)^2$, 101×99

Factorization

- factorize the following types of expressions:
  - $a^2 - b^2$
  - $a^2 \pm 2ab + b^2$
  - $a^2 \pm 2ab + b^2 - c^2$
  - $a\,x^2 + bxy + cy^2$ (By midterm break)

Advanced/Additional

Students will be able to:

- *identify base, index/ exponent and its value*
- *use scientific notation/standard form to express very large and very small numbers*
- *use positive, negative, fractional and zero indices*
- *apply the laws of exponents/ indices*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Ask learners to explain method of simplification of expression by collecting like terms? 4x + 7 + 3x – 3 – x.
2. Explore the n-degree polynomial in one variable as an algebraic expression of the form $a_0 + a_1x + a_2x^2 + ... + a_nx^n$.
3. Use algebra tiles to explain learners the concept of factorization in quadratic expressions
4. Recognize and generate equivalent form of simple algebraic expressions and solve linear equations
5. Use algebra to explore relationships between symbolic expressions and graphs with emphasis on the meaning of intercept and slope
6. Use algebra to represent real life situations and to solve problems especially those involving linear relationships

7. Use GeoGebra software to plot the graph of the form:
   $y = c, and\ x = a,\ y = mx,$ and $y = mx + c.$

DOMAIN: Algebra

Sub-Domain: Linear Equations and Inequalities

STEP 1 _____
Standard: Students will be able to interpret and plot graphs of linear equations, solve linear and simultaneous linear equations and linear inequalities.
Student Learning Outcomes: Students will be able to: ● plot graphs of linear equations in two variables ● interpret the gradient/ slope and determine the y-intercept of the straight line from the graph ● recall gradient of a straight line, the equation of horizontal and vertical lines ● construct and solve linear and simultaneous linear equations in two variables ● solve simple linear inequalities ● represent the solution of linear inequality on the number line.

Knowledge:	**Skills:**
Students will be able to know about : ● Cartesian plane ● extracting gradient of a straight line from the equation ● extracting intercept of a straight line from the equation ● changing the subject of the formula ● finding the unknown by substitution ● simultaneous linear equations ● solving simultaneous linear equations ● the difference between equation and inequality ● solving simple linear inequalities ***Advanced/Additional*** *Students will be able to know about:*	Students will be able to **Graphs of Linear Equations** ● recall gradient of a straight line ● recall the equation of horizontal and vertical lines i.e., $y = c\ and\ x = a$ ● find the value of 'y' when 'x' is given from the equation and vice versa ● plot graphs of linear equations in two variables i.e., $y = mx$ and $y = mx + c$ ● interpret the gradient/ slope of the straight line ● determine the y-intercept of a straight line **Linear Equations** ● change the subject of the formula

● *representing the solution of linear inequality on the number line*	● calculate the value of unknown in a given formula by substituting the values of suitable unknown **Simultaneous Linear Equations** ● construct simultaneous linear equations in two variables ● solve simultaneous linear equations in two variables using ▪ elimination method ▪ substitution method ▪ graphical method ● solve problems from real life situations involving two simultaneous linear equations in two variables **Linear Inequalities** ● solve simple linear inequalities i.e., ▪ $ax > b \; or \quad cx < d$ ▪ $ax + b < c$ ▪ $ax + b > c$ ***Advanced/Additional*** *Students will be able to:* ● *represent the solution of linear inequality on the number line*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that

represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Re-enforce the idea of an unknown by providing learners with sample equations to solve, for example,

$$2 + \blacksquare = 8$$
$$6 - \blacksquare = 8.$$

2. Establish that some equations can be solved by simple thinking about the answer, e.g., for $x - 3 = 5$, think "what number when you subtract '3' gives '5'.
3. Use short, relatively simple words problems to give students practice in translating problem situation in to mathematical sentences. Write equations for each problem and then find the solution
4. Describe and name the location of the points with simple relations in coordinates system such as maps
5. Describe, name, and interpret relative position in plane
6. Find and name the locations of point in coordinates system, such as maps
7. For graphical method, the teacher may use GeoGebra as teaching tool to improve students' conceptual understanding of linear equations in one or two variables.
8. Design a real-life story involving two linear equations in two variables and ask students to:
9. Understand the problem and the words used in stating the problem. Devise the plan for the solution by translating the situation to an algebraic equation clearly stating what the variables represent. Carry out the plan and solve the problem

DOMAIN: Measurement

Sub-Domain: Mensuration

STEP 1 _____

Standard: Students will be able to recognize various parts of a circle, solve problems involving surface area and volume of 3D shapes and apply the Pythagorean theorem.

Student Learning Outcomes: Students will be able to:

- recognize various parts of a circle
- calculate the surface area and volume of pyramid, sphere, hemisphere and cone
- apply the Pythagorean theorem.

Knowledge:

Students will be able to know about :

- circle and its parts i.e. center, radius, diameter, circumference, chord, arc, major and minor arcs, sector, semicircle, secant, tangent, concentric circles and segment of the circle
- area and perimeter of 2D shapes
- difference between area and perimeter
- volume and surface area of cube, cuboid prisms and
- calculating the surface area and volume of pyramid
- calculating the surface area and volume of sphere and hemisphere
- calculating the surface area and volume of cone
- calculating unknown angles using the properties of quadrilaterals
- polygons e.g. Pentagons, Hexagons etc
- calculating the interior, exterior angles and the sum of interior angles of polygons
- Pythagorean theorem and its application

Advanced/Additional

Students will be able to know about:

- calculating arc length of the circle
- calculating area of the sector of a circle

Skills:

Students will be able to

Circle

- explain the terms related to the circle:
  - arc (major and minor arcs)
  - sector
  - chord
  - semi-circle
  - central angle
  - secant
  - tangent
  - concentric circles

Surface Area and Volume of pyramid, Sphere and Cone

- calculate the surface area and volume of pyramid
- calculate the surface area and volume of a sphere and hemi-sphere
- calculate the surface area and volume of a cone
- solve problems from real life situations involving surface area and volume of pyramid, sphere, hemi-sphere and cone

Pythagorean Theorem

- state the Pythagoras theorem and give its informal proof
- solve right angled triangles using Pythagoras theorem
- solve problems from real life situation using Pythagoras theorem

Advanced/Additional

Students will be able to:

- *calculate the arc length of the circle by expressing the arc length as a fraction of circumference of the circle.*
- *calculate the area of the sector of a circle by expressing sector area as a fraction of the area of the circle*
- *calculate the surface area and volume of composite shapes including pyramid, sphere, hemi-sphere and cone.*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

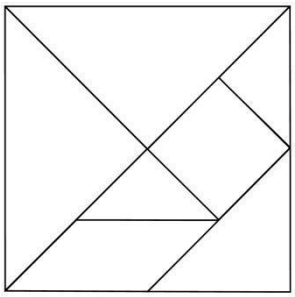
Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Learners make compound shapes with tangram pieces but do not use all pieces. They calculate the area of piece and then the compound shape. How would they *check the area of all pieces?*



2. Provide the learners with unit cubes and encourage them to find how many cubes will fit into boxes of various sizes. Learners will discover how many cubes will fill the box. The number of cubes that fill the box is the volume of the box.
3. Explore geometrical ideas and their relationships with arts, science, and everyday life
4. Ask learners to make a poster showing the parts of a circle with their definitions, including 'radius', 'diameter', 'circumference'
5. Ask learners to measure the length of the circumference of a range of circles given the diameter using a thread. They calculate the ratio of circumference and diameter. Look at the pattern. What can you tell?
6. GeoGebra software can be used to explain the concepts of surface areas and volumes of solid objects
7. Ask students to calculate volume of classroom, whiteboard, and books
8. Provide learners with a set of pictures of objects (or real objects) and ask them how they would measure the area. Ask them how many ways they could measure them.

DOMAIN: Geometry

Sub-Domain: Congruency & Similarity, Construction of Triangles and Transformations

STEP 1 _____

Standard: Students will be to apply facts of congruency and similarity, construct triangles and understand transformations from a two-dimensional perspective.

Student Learning Outcomes: Students will be able to:

- differentiate congruent and similar figures
- apply the properties of congruency and similarity
- construct triangles

- rotate an object and locate the center of rotation and enlarge a figure with the given scale factor.

Knowledge:

Core

Students will be able to know about :

- various types of triangle i.e. equilateral, isosceles and scalene triangles, acute-angled, obtuse-angled and right-angled triangles
- construction of quadrilaterals
- different types of symmetry (reflective and rotational)
- difference between congruent and similar figures
- congruent Triangles
- construction of a triangle w.r.t SSS, SAS, ASA, HS
- Reflection of an object through a line.
- Translation of an object and give precise description of transformation

Advanced/Additional

Students will be able to know about:

- *the enlargement of a figure with the given scale factor (positive or negative)*
- *locating the center and scale factor of enlargement given the original figure and its enlargement*

Skills:

Students will be able to

Congruent and Similar Figures

- explore congruent and similar figures from surroundings
- apply the properties of congruency and similarity for two figures

Congruent Triangles

- apply following postulates for congruency between triangles:
  - SAS≅SAS
  - SSS ≅ SSS,
  - ASA≅ASA
  - HS≅HS

Construction of Triangles

- construct a triangle when three sides (SSS) are given (where possible)
- construct a triangle when two sides and included angle (SAS) are given
- construct a triangle when two angles and included side (ASA) are given
- construct a right-angled triangle when hypotenuse and one side (HS) are given

TRANSFORMATIONS

Rotation

- rotate an object and find the center of rotation by construction

Advanced/Additional

Students will be able to:

Enlargement

- enlarge a figure with the given scale factor (positive or negative)
- locate the center and calculate the scale factor of enlargement given the original figure and its enlargement.

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Congruent shapes:

   Two geometrical shapes which are identical in shape and size are said to be congruent. Congruent figures can be obtained by reflection, rotation, and translation original figure. We use the symbol '≅' to denote congruence. For example:

   - Two circles of the same radii.
   - Two line segments of the same length.

2. Similar shapes:

   Geometrical figures which have the same shapes but different size is called similar shape or figure. Similar figures can be obtained by enlargement and reduction of the original figure. We use the symbol '~' to denote similarly. For example:

- Two circles of different radii
- Two line segments of different measure

3. Ask Learners to sort quadrilaterals into groups with similar properties, e.g., those that have right angles, parallel sides, diagonal properties
4. GeoGebra software can be used to explain the concepts of quadrilaterals, polygons, and circles
5. Teachers can use the website Math open reference for the construction of quadrilateral and triangles: www.mathopenref.com
6. Translate polygons on the coordinate grid
7. When a polygon is translated, each vertex of the polygon moves the same distance in the same direction. The size and shape of the image after translation is the same as original polygon.

DOMAIN: Statistics and Probability

Sub-Domain: Information Handling

STEP 1 _____
Standard: Students will be able to collect, classify and tabulate statistical data, represent data graphically, construct and use cumulative frequency diagrams and calculate and interpret measures of central tendency in various problem solving contexts.
Student Learning Outcomes: Students will be able to: ● differentiate between discrete and continuous data and grouped and ungrouped data ● reinforce representing the discrete data using suitable graphs such as Line graph, bar graph, multiple bar graph and pie chart, construct cumulative frequency distribution, histogram and frequency polygon ● solve problems involving mean of grouped and ungrouped data.

Knowledge:

Students will be able to know about :

- frequency table and tally chart
- collecting and organizing data using frequency distribution
- difference between discrete and continuous data
- difference between grouped and ungrouped data
- representing the discrete data using suitable graph such as:
  - line graph
  - bar graph
  - multiple bar graph
  - pie chart
- averages
- calculating mean , median mode and range of ungrouped data

Advanced/Additional

Students will be able to know about:

- *calculating the median and mode for ungrouped data*
- *solving problems from real life situations involving median and mode of grouped data.*

Skills:

Students will be able to

- recall difference between discrete and continuous data and grouped and ungrouped data
- reinforce representing the discrete data using suitable graph such as
  - line graph
  - bar graph
  - multiple bar graph
  - pie chart

Frequency Distribution

- construct cumulative frequency distribution
- represent frequency distribution by constructing:
  - Histogram
  - frequency polygon

Measure of Central Tendency

- solve real life situations involving mean of grouped and ungrouped data

Advanced/Additional

Students will be able to:

- *calculate the median and mode for ungrouped data*
- *solve problems from real life situations involving median and mode of grouped data.*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Design investigation to collect data using observation, surveys, and experiments
   - Construct the frequency table to record the shoes size of everyone in the group/ class.
   - Measure the length of everyone feet and construct a frequency table, deciding on class interval
   - Discuss and understand the correspondence between data set and their graphical representation specially histograms
   - Interpret pH of different acids/ basis/ salts form the given histogram
2. Select the appropriate measure of central tendency using above collected data
3. Use measures of central tendency, focusing on mean, median, and mode and understand how will each representation shows important aspects of data

4. In groups of four, each learner calculates the range, mean, median and mode / modal class of a set of data. Make sure to include examples of discrete and continuous data, and grouped data. Learners then discuss what each statistic shows in the context of the data (e.g., the modal shoe size shows which shoe size is most common for your age group)

DOMAIN: Statistics and Probability

Sub-Domain: Probability

STEP 1 _____
Standard: Students will be to solve problems pertaining to Experimental and Theoretical Probability.
Student Learning Outcomes: Students will be able to: ● find all possible outcomes of a probability experiment such as tossing a coin, rolling a die and spinning a spinner. ● performing probability experiments ● comparing experimental and theoretical probability in simple events ● predicting the outcomes of simple combined events ● calculate the probability of simple combined events.

Knowledge:	**Skills:**
Students will be able to know about : ● finding all possible outcomes of a probability experiment such as ▪ tossing a coin ▪ rolling a die ▪ spinning a spinner ● probability experiment, outcomes, sample space, events, equally likely events ● computing the probability of equally likely events ● expressing the probability of an event of a probability experiment as ratio, fraction and percent through probability scale ● the probability of an event occurring is P and an event 'not occurring' is 1−P ● the difference between experimental and theoretical probability	Students will be able to : ● determine that the probability of an event occurring is P and an event 'not occurring' is 1−P **Experimental and Theoretical Probability** ● perform probability experiments (for example tossing a coin, rolling a die, spinning a spinner etc. for certain number of times) to estimate probability of a simple event ● compare experimental and theoretical probability in simple events **Probability of a Simple Combined Events** ● predict the outcomes of simple combined events with the help of: ▪ sample space ▪ tree diagram

Advanced/Additional

Students will be able to know about:

- *combining probabilities with "AND" and "OR"*

- calculate probability of simple combined events
- apply the probability concepts to real life situations

Advanced/Additional

Students will be able to:

- *calculate combining probabilities with "AND" and "OR"*

STEP 2 _____

Assessments:

Formative Assessments

Some of the types of formative assessment teachers may use are:

- Question & Answer(open and closed)
- Quick Quiz
- Learning Walks
- Projects,
- Selected responses (may include MCQs, true: false, matching short answers, fill-in-the-blanks, etc),
- Observation diaries
- Inquiry charts,
- Four Corners: Gather students in the middle of the room, and read multiple-choice questions and their possible answers aloud. Students then move to the corner that represents what they believe is the correct answer. The top left room corner can be option A, the bottom-left can be B and so on

Summative Assessments

Some of the forms of summative assessment are:

- End of Unit Test
- Class Test
- Periodic/Monthly Tests
- Mid-year Exam
- End of Year Exam
- Standardized tests
- External Exams

STEP 3 _ _____

Learning Activities

1. Display three large sheets of paper labelled 'Impossible' 'Uncertain' 'Certain'. In pairs,

learners think of at least two events that they could put into each category. Take feedback and list all the events on the sheets of paper

2. Use bags of sweats/ beads with different color and find out the probability of picking a red sweat.
3. Carry out this activity 20 times. Record the results and calculate their experimental probability of picking of red sweat.

Mathematics
Guidelines for Textbook Authors (Grades 1-8)

GUIDELINES FOR THE TEXTBOOK AUTHORS

A textbook is an important teaching and learning tool and a standard source of information for the formal study of a subject. Writing a textbook is an extremely important and technical task in the sense that it requires the translation of curriculum learning outcomes at the proper cognitive level of the learners. The textbook authors are required to understand the curriculum in letter and spirit. In this regard, the following key points are of fundamental importance:

- Complete understanding of the content of the curriculum
- Background knowledge of the development of the Single National Curriculum (SNC)
- Understanding of the CPA (Concrete-Pictorial-Abstract) approach
- Realization of the thoughts of the ones who developed the curriculum
- Realization of the responsibility of a National Textbook Author

Keeping the above key points in mind, the textbook authors are recommended to follow the following, but not limited to these, guidelines:

- The first and foremost responsibility of a textbook author is to translate the spirit of the curriculum into content and activities/exercises of the textbook. Therefore, the textbook author needs to go through the curriculum by time and again in order to have an in-depth understanding.

- Prepare a mind map of themes and learning outcomes, that is, chapter-wise distribution/ presentation of the scheme of the SLOs.

- It is necessary for the authors to remember, all the time, that the learning approach adopted in the development of this curriculum is the CPA approach. Therefore, it is required for the authors to introduce each and every concept following the CPA approach. Ignorance in this regard might result in a great deviation from our goals.

- The textbook should be written in such a manner that it should carry a thorough continuation among the contents presented in a different chapter.

- Retain and limit the textual material to the learning outcomes details. Consider the time allocated to the subject in the scheme of studies. This will help to decide the length, width, and depth of chapters/topics and concepts.

- Select accurate, authentic, and up-to-date text, and real-life examples.

- Make the mathematical concepts interesting and easy to understand for the children through relevant activities, information boxes, and pictures etc.

- The material must help to enhance the knowledge of learners, develop inquiry skills, and engage them in higher-order thinking.
- The content should be interactive and appealing for further learning of the learners.
- The content should help the child make connections between the different concepts.
- The material should help learners to understand the world in which they live and grow as lifelong learners.
- The material must be relevant and error-free.
- The material must be free from gender, ethnic, regional, and all sorts of biasedness.
- Use attractive and engaging text, tables, graphs etc. along with clear and appropriate illustrations which must be properly labeled and captioned.
- The textbook should have a variety of practical and thought-provoking activities to develop long-lasting learning of the learners.
- Exercises should include clues to encourage learners to think, develop skills, and use the information for a variety of purposes.
- If a particular topic involves various types of problems or techniques, each type should be given importance individually. Accordingly, the exercises should also include the questions of every type in the order they are introduced in the text.
- Authors should consider introducing structural questions (involving a gradually increasing level of difficulty i.e., from low to moderate, and then to higher-order)
- The textbook must contain a Table of Contents, a list of Mathematical symbols, and a Glossary.
- The textbook must be contextually relevant and applicable in the normal classroom environment.
- The figures, illustrations, and pictures should be from the local/Pakistani environment.
- Include an appropriately developed assessment after a few concepts/themes, topics/subtopics in each chapter.
- Last but not the least, the textbook should contain material that could make the learners to think beyond the textbook.

Guidelines for Writing a Chapter

In order to make the learning interesting and exciting and to provide a strong foundation for

higher-order learning, each chapter in the mathematics textbooks must have the following, but not limited to these, features:

- A chapter should start as a continuation of the previous chapter or even a previous section. It is necessary for the authors to start with the facts (either from the existing knowledge of the learners or from daily-life situations) that highlight the need for the contents of that chapter.
- ***Chapter opener to introduce the chapter with title, full page-colored photographs, and Specific Learning Outcomes (SLOs).***
- ***SLOs*** at the beginning of each chapter clearly describes the objectives and the tasks that are to be achieved in the chapter.
- Keywords, terms and definitions **to be highlighted in the text.**
- ***Headings and subheadings with specific colors to show different levels of activities.***
- ***Math tidbits*** to provide snippets of interesting and useful knowledge.
- Attractive and colorful illustrations to **captivate learners.**
- Questions like ***"Do You Know?"*** to recall, think, and apply what they have learned as well as to reinforce the learning of key concepts and principles.
- ***Relevant everyday experiences and contexts are used.***
- ***Hands-on activities to encourage the learners to make their own inquiries.***
- ***Skills and processes to infuse values, ethics and attitude.***
- ***Mini-exercise*** to provide questions involving scientific investigations and relating mathematics contents with the technology, society, and environment.
- Authors are encouraged to introduce the activities/exercises to be done in groups to make the students interact and share their mathematical concepts with each other. This will indirectly refine their mathematical concepts and will contribute to leading them towards collaborative studies.
- ***Awareness beyond the classroom*** to widen the horizon of the learners by providing interesting information and introducing, more advanced relevant concepts according to grade level in an understandable way.
- ***Key Points*** to provide a summary of the concepts and principles studied in a chapter should be included at the end of that chapter.
- ***Review Questions*** at the end of each chapter to:
    - recall and integrate previous learning
    - engage and develop their creativity
    - move from lower higher-order thinking
    - develop process skills
    - develop multiple intelligences
- ***Think-Tank/Investigate*** to include open-ended questions to provoke learners' thinking, creativity and investigation skills.
- **Addresses of relevant websites and online learning centers/resources** should be mentioned at the end of each chapter so that the learners and teachers can get up-to-date information

about the concepts. The material should reflect the role of technology to promote learning with understanding. Beware that the referred websites or centers should not include material contrary to our religious, moral, ethical, cultural, and social values.

- Teacher Guide should include tips to teachers at relevant places in chapters to explain different concepts and to use a variety of tools/materials, and activities.