**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:**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
 | **Skills:**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:

* The length of hypotenuse $\sqrt{2}$ is an irrational number.
* The square root of a prime number is always an irrational number.
1. **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.1. **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.
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**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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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; 4,916,9001. 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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 numbers1. 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
2. LCM is used for adding and subtracting fractions with different denominators.
3. 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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.1. 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.1. 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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.) 1. Use algebraic disc for activities
2. Provide learners with real life problems to write as a simple algebraic expression
3. Calculate the number of electrons in a given orbit using the 2n2 formula
4. 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.1. Describe, extend, and make penalizations about geometric and numeric patterns
2. Make a set of cards as shown

Each player will start with the number 10 000 written on their paperThe cards will be piled as face downPlayers will be instructed to take turns and turn over a card and add or subtract from their starting number as the card shownStudents will keep track of their numbers using their pen and paperThe 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:**Students will be able to know about : * the difference between
* open and close sentences
* expression and equation
* equation and inequality
* addition, subtraction, multiplication and 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*
 | **Skills:**Students will be able to* recall the difference between
* open and close sentences
* expression and equation
* equation and inequality
* 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 = a2+ b2 + 2ab
* (a $-$b)2 = a2+ b2 $-$2ab
* (a + b) (a $-$ b) = a2 – b2
* 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)
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* Projects,
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* Inquiry charts,
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| **Learning Activities**1. Ask learners to explain method of simplification of expression by collecting like terms?

 4x + 7 + 3x – 3 – x.1. Explore the n-degree polynomial in one variable as an algebraic expression of the form

$a\_{0}$ $+ a\_{1}x$ $+$ $a\_{2}x^{2}+$... $+ a\_{n}x^{n}$.1. Use algebra tiles to explain learners the concept of factorization in quadratic expressions
2. Recognize and generate equivalent form of simple algebraic expressions and solve linear equations
3. Use algebra to explore relationships between symbolic expressions and graphs with emphasis on the meaning of intercept and slope
4. Use algebra to represent real life situations and to solve problems especially those involving linear relationships
5. 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:**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:** *representing the solution of linear inequality on the number line*
 | **Skills:**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
* 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.,
* $ax>b or$ $cx<d$
* $ax+b<c$
* $ax+b>c$

***Advanced/Additional****Students will be able to:** *represent the solution of linear inequality on the number line*
 |
| ***STEP 2*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **Learning Activities**1. Re-enforce the idea of an unknown by providing learners with sample equations to solve, for example,

$2+∎=8$$6-∎=8.$1. 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’.
2. 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
3. Describe and name the location of the points with simple relations in coordinates system such as maps
4. Describe, name, and interpret relative position in plane
5. Find and name the locations of point in coordinates system, such as maps
6. For graphical method, the teacher may use GeoGebra as teaching tool to improve students’ conceptual understanding of linear equations in one or two variables.
7. Design a real-life story involving two linear equations in two variables and ask students to:
8. 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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?*

1. 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.
2. Explore geometrical ideas and their relationships with arts, science, and everyday life
3. Ask learners to make a poster showing the parts of a circle with their definitions, including ‘radius’, ‘diameter’, ‘circumference’
4. 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?
5. GeoGebra software can be used to explain the concepts of surface areas and volumes of solid objects
6. Ask students to calculate volume of classroom, whiteboard, and books
7. 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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.
1. 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
1. Ask Learners to sort quadrilaterals into groups with similar properties, e.g., those that have right angles, parallel sides, diagonal properties
2. GeoGebra software can be used to explain the concepts of quadrilaterals, polygons, and circles
3. Teachers can use the website Math open reference for the construction of quadrilateral and triangles: [www.mathopenref.com](http://www.mathopenref.com)
4. Translate polygons on the coordinate grid
5. 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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
1. Select the appropriate measure of central tendency using above collected data
2. Use measures of central tendency, focusing on mean, median, and mode and understand how will each representation shows important aspects of data
3. 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:**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

***Advanced/Additional****Students will be able to know about:** *combining probabilities with “AND” and “OR”*
 | **Skills:**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
* 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*  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  |
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| **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.
 |