

LEARNING STANDARDS IN MATHEMATICS

Mathematics is a compulsory core subject of study at school level. The position paper on mathematics (NCF 2005) has emphasized the main goal of mathematics education as “Mathematics of child’s thought processes”. The primary aim of mathematics education specifically relates to developing the child’s inner resources such as thinking capabilities. The kind of thinking the child learns in mathematics is an ability to handle abstractions and solve problems.

In order to realize these goals and aims of mathematics education the recommendations made are:

- Shifting the focus of mathematics education from achieving primary goal to higher goal ie., a shift in focus from mathematical content to mathematical learning environment where mathematical processes are given importance. These mathematical processes are problem solving, estimation and approximation, use of patterns, visualization and mathematical communication.
- In order to cater to higher goal of teaching mathematics, the mathematics, focus should be on mathematical reasoning. The mathematical processes to be developed are inductive and deductive reasoning, process of generalization, mathematical investigations, verification and validation of mathematical statements, mathematical connections and relationships, reasoning with proofs, critical thinking and creative thinking.

As per the vision of position paper on teaching mathematics “Excellent mathematics education is based on twin premises that all students can learn mathematics and that all students need to learn mathematics” Hence, the learning standards of mathematics outlines what is essential for students to learn during their time at school from first to tenth standard, ie., knowledge, skills and behaviors they are expected to develop and demonstrate at different levels of schooling. Learning standards provide a set of common standards which schools can use to plan students learning programs and assess students’ progress. Learning standards for mathematics are set at a challenging competency level.

Themes and sub-themes

Standard I to V

Sl. No.	Themes	Sub-themes
01.	Number System	1.1 Numbers 1.2 Place value 1.3 Fractional numbers
02.	Number Operations	2.1 Addition 2.2 Subtraction 2.3 Multiplication 2.4 Division
03.	Shapes and spatial understanding	3.1 Spatial relationship 3.2 Shapes of solids around us 3.3. 2-D and 3-D objects and shapes
04.	Measurement	4.1 length 4.2 Weight and volume 4.3 Time
05.	Money	
06.	Data handling	
07.	Patterns	
Standard VI to VIII		
01.	Number system	1.1 knowing about numbers 1.2 playing with numbers 1.3 Fractions and Decimals

		1.4 Percentages
02.	Powers and exponents	
03.	Ratio and Proportion	
04.	Algebra	4.1 Algebraic expressions 4.2 Factorization 4.3 Equations 4.4 Graphs
05.	2-D, 3-D and symmetry	
06.	Triangles and symmetry	
07.	Mensuration	
08.	Data handling	
Standards IX and X		
01.	Number system	1.1 Squares and square roots 1.2 Real numbers 1.3 Euclid's Lemma 1.4 Surds
02.	Sets	
03.	Commercial mathematics	
04.	Permutation, combination and probability	
05.	Algebra	5.1 Multiplication and division of polynomials 5.2 Factorization 5.3 Equations – simultaneous , linear and quadratic
06.	Geometry	6.1 Triangles 6.2 Quadrilaterals 6.3 Circles

07.	Mensuration	
08.	Statistics	
08.	Co-ordinate geometry	
09.	Trigonometry	

LEARNING STANDARDS OF MATHEMATICS

STANDARD I TO V

Theme 1: Numbers

Sub – themes	Standard I	Standard II	Standard III	Standard IV	Standard V
1.1 Numbers	1. Develop a sense of numbers from 1 to 9	1. Count with understanding numbers from 10 to 99	1. Count with understanding numbers from 100 to 999	1. Count with understanding numbers from 1000 to 9999	1. Count with understanding numbers from 10,000 to 99,999
	2. Count with understanding numbers from 1 to 9 and 10 to 20.	2. Read and writes numerals from 10 to 99	2. Read and writes numerals from 100 to 999	2. Read and writes numerals from 1000 to 9999	2. Read and writes numerals from 10,000 to 99,999
	3. Understand ways of representing numbers – numerals from 1 to 9 and 10 to 20	3. Represent numbers on pre-number line	3. Count in various ways – skip counting and back counting.	3. Count in various ways – skip counting and back counting.	3. Count in various ways – skip counting and back counting.
	4. Develop an understanding of the relative position and magnitude of numbers – ordinal	4. Understand the comparison of 2-digit numbers.	4. Understand the comparison of 3-digit numbers.	4. Understand the comparison of 4-digit numbers.	4. Understand the comparison of 5-digit numbers.

	and cardinal numbers.				
	5. Understand the connection between ordinal and cardinal numbers.	5. Count in various ways – group counting, skip counting.			
	6. Represent numbers in many ways – including relating, composing and decomposing. 7. Connect number words and numerals to the quantity they represent.				
1.2 Place Value	1. Develop the sense of grouping objects in ten's.	1. Understand the concept of place - value	1. Understand the concept of place – value structure of the base ten numbers system.	1. Understand the concept of place – value structure of base ten system	1. Understand the concept of place – value structure of base ten number system.
	2. Develop the vocabulary of group of ten's and 'ones'.	2. Expand a number with respect to place – value of digits.	2. Expand 3-digit numerals using place value.	2. Expand 4-digit numerals using place value.	2. Expand 5-digit numerals using place value.
	3. Represent the group of tens and ones by drawing.	3. Use the concept of place value in the comparison of numbers.	3. Represent the numbers in place – value chart.	3. Represent the numbers in place – value chart.	3. Represent the numbers in place – value chart.
	4. Count and connect the number of tens	4. Represent the place value of	4. Compare numbers based on	4. Compare numbers based	4. Compare numbers based

	and ones in a given numeral.	digits on place value chart.	place – value of digits.	on place – value of digits.	on place – value of digits.
1.3 Fractional numbers			1. Understand the meaning of fractions as part of unit wholes.	1. Use models, pictures and objects to judge the size of fractions.	1. Understand the meaning of fractions as a part of a collection, as location on number line.
			2. Understand and represent commonly used fractions such as $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$.	2. Identify and generate equivalent forms of commonly used fractions $\frac{2}{4}$, $\frac{1}{2}$, $\frac{3}{3}$, $\frac{4}{4}$ etc.,	2. Identify and generate equivalent fractions.
			3. Relate these fractions to real life situations.	3. Understand the meaning of decimal numbers such as 0.1, 0.2, 0.3 etc.,	3. Understand the comparison of fractions.
				4. Represent these decimal numbers using pictures.	4. Estimate the degree of closeness of a fraction to known fractions ($\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$) using a number line. 5. Relate the fraction to decimal form.

Theme 2: Number Operations

<p>2.1 Addition 2.2 Subtraction</p>	<p>1. Understand the different meaning of addition of whole numbers.</p>	<p>1. Develop understanding of addition and subtraction, algorithm – without regrouping, - regrouping.</p>	<p>1. Use standard algorithm for addition and subtraction for 3-digit numerals – without regrouping, - with regrouping.</p>	<p>1. Use standard algorithm for addition and subtraction for 4 -digit numerals – without regrouping, - with regrouping.</p>	<p>1. Use standard algorithm for addition and subtraction for 5-digit numerals – without regrouping, - with regrouping.</p>
	<p>2. Add using real objects and pictures.</p>	<p>2. Understand the use of place value in standard algorithm of addition and subtraction.</p>	<p>2. Solve addition and subtraction problems in real life situations represented through pictures and stories.</p>	<p>2. Solve addition and subtraction problems in real life situations represented through pictures and stories.</p>	<p>2. Develop problem solving skills and solving addition and subtraction problems from real life situations.</p>
	<p>3. Add numbers using the symbol '+’.</p>	<p>3. Understand the cumulative property of addition through patterns.</p>	<p>3. Frame simple addition and subtraction problems on their own.</p>	<p>3. Frame simple addition and subtraction facts.</p>	<p>3. Appreciate the role of place value in addition and subtraction of algorithm.</p>
	<p>4. Understand the various meanings of subtraction of whole numbers.</p>	<p>4. Develop problem solving skill in solving real life problems involving addition</p>	<p>4. Develop and use strategies for adding and subtracting single digit numbers and</p>	<p>4. Develop and use strategies for adding and subtracting multiples of 10</p>	<p>4. Understand the estimating and appreciation process of sum and differences.</p>

		and subtraction.	two digit numbers mentally.	and 100 mentally.	
	5. Subtract using real objects, pictures and symbol '-'	5. Create and solves problems of addition and subtraction.	5. Develop fluency in mental addition and subtraction.	5. Develop fluency in mental addition and subtraction.	5. Develop fluency in estimating and approximating sums and differences.
	6. Understand the relation between addition and subtraction.	6. Develop and use strategies for adding and subtracting single digit numbers and multiples of ten mentally.			6. Develop and use strategies to estimate the sums and differences. 7. Select appropriate methods and tools for computing – mental work, estimation, calculations, paper and pencil.
	7. Understand the effect of adding and subtracting whole numbers with zero.	7. Develop fluency in addition and subtraction of numbers mentally.			
2.3 Multiplication 2.4 Division		1. Understand the situations involving repeated addition and	1. Understand the situations involving repeated addition and	1. Understand multiplication and division facts.	1. Multiply whole numbers using standard algorithm.

		multiplication.	multiplication.		
		2. Represent repeated addition and subtraction through objects and pictures.	2. Use sign of multiplication to represent multiplication facts.	2. Understand and use lattice and standard algorithm for multiplication of 2 and 3 digit numbers.	2. Develop and use informal and standard division algorithms.
		3. Develop multiplication tables.	3. Understand the multiplication of 2-digit numbers using – standard algorithm, - lattice multiplication algorithm.	3. Understand the process of division using - dots, - grouping, -repeated subtraction, - multiplication of facts.	3. Estimate products and quotients and verifies using approximation.
			4. Understand the meaning of division as – equal grouping, - equal sharing, - repeated subtraction.	4. Frame word problems involving multiplication and division.	
			5. Relate division with multiplication.	5. Solve problems involving multiplication and division from real life situations.	

			6. Use sign of division to represent facts.	6. Estimate products.	
Theme 3. Shapes and Spatial Understanding					
3.1 Spatial relationship	1. Develop and use vocabulary of spatial relationship – top and bottom, on and under, above and below, near and far, before and after, inside and outside.				
3.2 Shapes of solids around us 3.3. 2-D and 3-D shapes and objects.	1. Identify, sort and describe the objects like pebbles, balls, pipes, cones etc.,	1. Develop and uses geometrical attributes such as roundness, face, edge, corner, vertex found in the objects.	1. Identify, compare and analyzes attributes of two and three - dimensional shapes.	1. Create shapes and tiles geometrical shapes	1. Explore intuitively as – the reflections, - the rotations, - symmetry of 2-D and 3-D shapes.
	2. Sort 2-D shapes.	2. Identify and use the names of 3-D shapes such as, - sphere, cube, cuboid, cylinder and cone.	2. Develop vocabulary to describe the attributes of 2-D and 3-D shapes.	2. Investigate the result of rotating a coin, stacking up bangles etc.,	2. Draw intuitively plans, elevation and side view of 3-D objects.
	3. Represent circles, triangles and rectangles through	3. Identify and use names of 2-D shapes such as	3. Describe the shapes using the attributes.	3. Explore the perimeter and area of 2-D	3. Understand the different types of angles, represent

	pictures and cut-outs.	triangle, rectangle, square, circle.		shapes.	angles by – drawing, tracing paper folding.
	4. Describe the way shapes affect the movements- rolling and sliding.	4. Describe the properties of 2-D shapes.	4. Relate 2-D and 3-D objects.	4. Draw circles and identify the centre, radius and diameter.	4. Represent angles by – drawing, tracing, paper folding.
	5. Draw circle, triangles and rectangles(freehand)	5. Trace the 2-D outlines of 3-D objects by observing their shadows.	5. Investigate and predict the result of putting together and taking apart 2-D and 3-D shapes.		5. Use various instruments to draw circles.
		6. Draw freehand figures.	6. Create 2-D shapes by various methods – paper folding, - paper cutting.		6. Identify and describe the line and rotational symmetry in 2-D and 3-D shapes.
			7. Identify the shapes that tile and that do not tilt.		
Theme 4: Measurement					
4.1 Length 4.2 Weight and volume.	1. Develop and use the vocabulary – long and short, -thin and thick, -heavy and light.	1. Seriate objects by comparing their lengths.	1. Understand the need for measuring length with standard unit – meter and	1. Relate meter with centimeter and converts one unit to another.	1. Understand the meaning of perimeter and area of simple geometrical

			centimeter		figures.
	2. Identify the attributes of length and weight and compares objects.	2. Estimate distances and lengths and verify using non-standard units.	2. Estimate the length and verify by measuring using a ruler.	2. Use the units to solve problems on lengths and distances.	2. Solve real life problems involving perimeter and area.
	3. Understand the measurement of length using non-standard units.	3. Compare between heavy and light objects.	3. Estimate the weight of objects using non-standard units.	3. Determine weight of objects using a balance and standard units.	3. Relate commonly used larger and smaller units of length, weight and volume.
			4. Understand the concept of 'volume'.	4. Measure the volume of given liquid with standard units.	4. Carry out the conversion of units and use them in solving real life problems.
			5. Measure and compare the volume (capacity) using non-standard units.	5. Estimate the weights and volumes and verify by measuring.	
			6. Develop an understanding of conservation of weight and volume.	6. Determine the sums and differences of weights and volumes.	
4.3 Time	1. Develop the sense	1. Understand the	1. Understand the	1. Read clock time	1. Use addition

	of long and short duration, earlier and later and sequence of events.	sequence of events and time duration.	method of reading time and calendar.	to nearest minutes.	and subtraction finding time intervals.
	2. Familiarize with days and months.	2. Familiarize with 12 page calendar and month	2. Sequence the events chronologically.	2. Estimate the time duration.	
				3. Compute the number of days and weeks in a year and justifies the reason for leap year.	
Theme 5. Money					
Money	1. Identify and acquaint with currency notes and coins.	1. Acquaint with the transaction of amount using 3- notes and coins.	1. Relate rupee to paise and converts.	1. Solve problems involving addition and subtraction of money.	1. Analyse and solve problems involving money by applying the four basic operations.
	2. Relate the cost of material with currency.	2. Add and subtracts money mentally	2. Add and subtract amounts using column algorithm.	2. Understand and describe rate charts and bills.	2. Prepare rate charts and bills.
			3. Get familiar		

			with rate charts and bills.		
Theme 6: Data handling					
6.1 Data handling	1. Pose questions and gather data about themselves and surrounding.	1. Collect data by observation	1. Collect data using observation and measurement.	1. Represent the data in the form of bar graph.	1. Collect and represent the data in the form of a table and graphs – pictograph and bar graph.
	2. Represent the data using objects, pictures and interpret it.	2. Sort and classify the data and represent it through pictures, objects.	2. Record the data using tally marks.	2. Draw conclusions through discussions.	2. Interpret the graphs.
		3. Draw inferences from the data.	3. Represent the data pictorially using a scale.		
			4. Draw conclusions from the data.		
Theme 7. Patterns					
7.1 Patterns	1. Observe and identify simple patterns found in shapes in the surrounding.	1. Identify the number pattern and extend it.	1. Identify number patterns in odd an even numbers, multiplication	1. Identify patterns in multiplication tables and multiples of 10's,	1. Identify square and triangular numbers through patterns.

			etc.,	100's etc.,	
	2. Identify, describe and extend the given sequence of pattern.	2. Create block patterns.	2. Identify symmetrical shapes and related patterns and makes the patterns.	2. Identify geometrical patterns based on symmetry.	2. Create border strip and tiling patterns.

STANDARD VI and VII

Theme 1: Number System

Sub themes	Standard VI	Standard VII
1.1 Knowing about numbers	1. Sense the place value of a natural number up to 10 digits 2. Identify the smaller and bigger numbers; 3. Use appropriate symbols like $<$, $>$, $=$ etc., 4. Solve simple word problems 5. Convert the unit of length and mass from meter to centimeter and kilogram to grams 6. Approximates large numbers to the nearest tens, hundreds and thousands 7. Compare decimal system of numbers with international system of numbers 8. Simplify by removing brackets	
1.2 Playing with numbers	1. Identify the rules of divisibility of numbers 2. Comprehend the set of even, odd, prime and	

	<p>composite numbers</p> <p>3.find the prime factors of a composite number and express them as the product of prime factors</p> <p>4.find the Highest Common Factor(HCF) of two natural numbers by factorization method</p> <p>5.Find the LCM of numbers by prime factorization method;</p> <p>6.Establish relationship between HCF and LCM of numbers using the property $HCF \times LCM = \text{product of given number}$.</p> <p>7.Find the HCF or LCM using the above property</p>	
1.3 Whole numbers	<p>1.Perform arithmetic computations involving natural numbers and whole numbers</p> <p>2. Represent addition, subtraction and multiplication of numbers on number line.</p> <p>3.Explain commutative, associative and distributive property of natural numbers and whole numbers</p>	
1.4 Integers	<p>1. Illustrate situations involving negative numbers</p> <p>2.Represent negative numbers on number line</p> <p>3.Generates patterns, identify and formulate rules for addition and subtraction of integers</p> <p>4.Perform simple operations on addition and subtraction of integers and represent the</p>	<p>1. State the rule of multiplication and division of integers through patterns</p> <p>2.States the commutative and associative properties of integers for addition and multiplication</p> <p>3.States the distributive property of integers – multiplication over addition</p> <p>4.Construcs counter examples related to the</p>

	same on number line.	above properties 5.Generates counter examples like subtraction is not commutative over whole numbers; 6.Solve word problems on properties and operations of integers
1.5 Fractions and Decimals	<p>1 Represent fractions pictorially and on number line</p> <p>2. Understands the meaning of fraction as a division</p> <p>3.Explain the meaning of proper, improper and mixed fractions with examples</p> <p>4. Expresses given fractions as equivalent fractions</p> <p>5.Compare fractions and arrange them in ascending and descending orders.</p> <p>6. Develop strategies for computing addition and subtraction with fractions</p> <p>7. Understand the meaning of decimal fractions and the place value of digits in it.</p> <p>8.Convert fractions into decimal form and vice-versa</p> <p>9. Develop and analyse the strategies for computing addition and subtraction of decimal fractions up to 100th place.</p> <p>10.Solve word problems involving addition</p>	<p>1.Perform multiplication of fractions</p> <p>2.Understand the meaning of fraction as an operator</p> <p>3. Express the reciprocal of fraction</p> <p>4. Develop and use strategies for division of fractions</p> <p>5. Uses appropriate estimates to evaluate calculations involving mixed fractions</p> <p>6.Solve word problems involving mixed fractions</p> <p>7. Understand the meaning of rational numbers</p> <p>8.Represent the rational numbers on number line</p> <p>9. Perform operations on rational numbers (involving all operations)</p> <p>10.Represent rational numbers as decimals and computes to a required accuracy in</p>

	and subtractions on decimals, related to two operations together on money, mass, length, temperature and time.	terms of decimal places and significant figures 11.Perform multiplication and division of decimal fractions 12.Solve word problems on rational numbers (involving all operations) 13.Convert units of length and mass 14.Solve problems including all operations on length and mass
1.6 Percentage		1. Understand the meaning of percentage as the fraction with 100 as the denominator 2. Convert fractions and decimals into percentage and vice-versa 3.Apply the concept of percentage in computing problems based on simple interest(time period in complete year)
Theme 2: Ratio and Proportion		
2.1Ratio	1. Understand ratio as comparison of quantities of same kind 2.Understand that two quantities in ratio can be compared if they have the same units 3.Express day to day situation related to ratio 4.Understand the concept of proportion as equality of two ratios 5.Use unitary method for calculating unknown in equivalent ratio 6.Solve problems using unitary method	1. Explain the meaning of unitary method 2.Analyse and Solve higher order problems using unitary method

Theme 3: Exponents		
3.1 Exponents		1.Evaluate natural numbers given in exponent form 2.State the laws of exponents by observing patterns 3.Use the laws of exponents to simplify numerical expressions
Theme 4: Algebra		
4.1 Introduction to Algebra	1 Develop the concept of variable using recognisable patterns 2.Recognise the patterns using the objects; 3.Approximate the numbers of objects required for forming a given number pattern 4.Frame expressions involving unknown terms (variables)for word problems and vice-versa	1.Identify constants, variables, coefficients and powers 2.Understand the meaning of algebraic expressions and degree of expressions 3.Distinguish between like and unlike terms 4.Perform addition and subtraction on algebraic expressions whose coefficients are integers 5.Find the product of two or more algebraic expressions with integral coefficients
4.2Linear equation		1.Understand the concept of simple linear equation 2.Frame linear equation for given statements 3. Solve simple linear equations in one variable (in contextual problems) with two operations like addition and subtraction

Theme 5:Geometry

5.1Basic geometrical ideas

- 1.Understand and describe the linkage of geometrical concepts in everyday experience
- 2.Understands the concept of open and closed figures; interior and exterior of closed figures
- 3.Develop conceptual understanding of angle, vertex, arm, interior and exterior angles
- 4.Develop conceptual understanding of triangle; it's vertices, sides, angles, interior angle, exterior angle; altitude and medians of a triangle
- 5.Develop conceptual understanding of quadrilateral(only convex quadrilateral), its sides, vertices, angles, diagonals, adjacent sides and opposite sides
- 6.Develop conceptual understanding of circle; related terms such as centre, radius, diameter, chord, arc, semi circle, circumference; interior and exterior region of circle

- 1.Develop conceptual understanding of pair of angles such as linear, supplementary, complementary, adjacent, vertically opposite angles
- 2.Practically verify the property related to vertically opposite angles
- 3.Develop conceptual understanding of angles related to parallel lines with transversal – corresponding, alternate, interior and exterior angles
- 4.Generalises and states the properties of angles related to parallel lines with transversal
- 5.Uses the properties to find the angles

5.2Triangles

- 1.State the angle sum property of triangle and verify it practically, through paper folding
- 2.State and verify the exterior angle property of triangle
3. State and verify side sum property of triangle
- 4.Apply the properties of triangle to analyse

		and solve problems 5.State and verify Pythagoras statement on right angled triangle.
5.3 Understanding elementary shapes (2-Dimensional and 3-Dimensional)	<ol style="list-style-type: none"> 1.Measure line segments and angles using suitable instruments 2.Develop conceptual understanding of pair of lines such as intersecting lines, perpendicular lines and parallel lines 3.Identify types of angles – acute, obtuse and right angles, reflex angles, complete angle and zero angle 4.Classify triangles on the basis of sides and angles 5.Identify types of quadrilaterals – trapezium, parallelogram, rectangle, square and rhombus 6.Identify simple polygons up to octagons including regular as well as non regular polygons 7.Identify 3-dimensional shapes like cubes, cuboids, cylinder, sphere cone, prism and pyramids 8.Identify 3-D shape objects in the surrounding 9.Identify the elements of 3-D shapes – faces, edges and vertices. 	
5.4 Symmetry	<ol style="list-style-type: none"> 1. Identify 2-D symmetrical objects for reflection symmetry; 2.Perform operation of reflection of simple 2-D objects by taking mirror images 3.Identifies reflection symmetry and its axis 	<ol style="list-style-type: none"> 1.Understand the idea of rotational symmetry of 2-D objects (90°, 120°, 180°) 2.Perform operation of rotation through 90° and 180° of simple figures

		<p>3.Generate examples of figures with both rotation and reflection symmetry;</p> <p>4.Gives example of figures that have both reflection and rotational symmetry and vice-versa; (representing 3-D in 2-D)</p> <p>5.Draw 2-D nets to construct simple three dimensional objects such as prism, pyramid etc.,</p> <p>6.Identify the congruency of geometrical shapes and objects through superimposition</p> <p>7.Make tessellations from simple shapes</p> <p>8.Identify and count the number of faces, edges and vertices of 3-D shape objects through 2-D pictures(nets of cubes, cuboids etc. through pictures)</p> <p>9.Match 2-D pictures with 3-D objects and identify their names</p> <p>10.Understand the concept of congruency through super imposition of objects/ things available in day to day life</p> <p>11. Extends the idea of congruency to simple geometrical shapes like triangles, circles</p> <p>12.Use co-ordinates to identify position of objects/things in plane</p>
5.5 Constructions – using scale, protractor and compasses	<p>1.Understand the procedure of construction of line segment, circle, perpendicular bisector</p> <p>2.Construct different angles using protractor</p> <p>3.Construct angles 60° and 120° using</p>	<p>1.Understand and the procedure construct perpendicular bisector, angle bisector – making angles 20°, 45°, 90° etc. using</p>

	compasses.	compasses 2. Construct angles equal to a given angle by using compass 3. Draw a line perpendicular to a given line from a point on the line and outside the line 4. Construct a line parallel to a given line from a point outside it
Theme 6: Mensuration		
6.1 Concept of perimeter and area	1. Develop conceptual understanding of perimeter of different shapes 2. Identify different shapes having same perimeter 3. Deduce the formula of the perimeter of rectangle and then square through pattern recognition and generalisation 4. Develop conceptual understanding of the concept of area - area of rectangle and area of square	1. Finds the area of square, triangle, parallelogram and circle using basic unit area 2. Computes simple calculations related to the area of shapes like triangle, square, rectangle.
Theme 7: Data Handling		
7.1 Data handling	1. Select appropriate data to examine a hypothesis 2. Collect, Organise and represent the data in tally bars and table 3. Represent the data in pictograph 4. Discuss and appreciate the need for scaling while representing data through bar graph and pictograph	1. Understand the need for collection of data for hypotheses testing 2. Understand the concept of mean, median and mode for ungrouped data and make simple inference based on this data. 3. Understand the representation of uni-variate data in appropriate graphical

	<p>5. Construct the bar graphs using suitable scales</p> <p>6. Interpret the data represented in tally bars and tables</p>	<p>forms including bar graph</p> <p>4. Construct bar graphs</p> <p>5. Develop conceptual understanding of the concept of probability using data through random experiments like tossing coins, dice etc.</p> <p>6. Tabulate and count occurrences of 1 through 6 in a number of throws of a dice</p> <p>7. Represents outcome of random experiments through bar graphs</p>
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Standard VIII

Theme 1: Number System

Sub themes	Learning Standards
1.1 Rational numbers	<p>1. Understand the meaning of rational number</p> <p>2. Represent rational numbers and its properties on number line</p> <p>3. Develop the skill of performing arithmetic operations on rational numbers</p> <p>4. State and use the properties of addition and multiplication like closure, commutative, associative and distributive to simplify computations with rational numbers</p> <p>5. Understand and use the existence of identity element and inverse element of addition and multiplication to simplify and solve problems</p> <p>6. Estimate the results of computations on rational numbers and judge the reasonableness of results.</p>

1.2 Squares, square roots, cubes and cube roots of perfect cubes only	1. Understand and use the squaring, cubing of numbers 2. Find square roots, cube roots by factor method 3. Estimate the square roots and cube roots
1.3 Playing with numbers	1. Create puzzles using numbers by applying the four operations like addition, subtraction, multiplication and division 2. Solve number puzzles, number games and magic squares 3. Deduce the divisibility test rules of 2, 3, 5, 9, 10 and 11 for 2, 3 or 4 digit numbers
1.4 Percentages, Profit and Loss, Discount, commission, tax and simple interest	1. Develop and use the formula of percentages, profit and loss, discount and commission to solve problems 2. Develop and use the formula of simple interest to solve advanced problems 3. Select and apply the suitable formula to solve problems on tax
Theme 2: Exponents	
2.1 Exponents and laws of exponents	1. Develop conceptual understanding of the meaning of exponent and a^n 2. Generate the laws of exponent through pattern recognition and state in general form 3. Analyse, select and apply the suitable law of exponents to simplify problems
Theme 3: Algebra	
3.1 Polynomials and operations on it	1. Understand the meaning of polynomial and types of polynomials 2. Select and apply the rule of addition, subtraction and multiplication of integers while simplifying the problems on algebraic expressions and polynomials 3. Find special products like $(x+a)(x+b)$, $(a+b)^2$, $(a-b)^2$, $(a+b)(a-b)$

	<ul style="list-style-type: none"> 4. Understand the meaning of identities 5. Use identity to expand the algebraic expressions
3.2 Factorization	<ul style="list-style-type: none"> 1. Select and apply the suitable identity to factorise the algebraic expressions
3.3 Linear Equations	<ul style="list-style-type: none"> 1. Express the linear equation in general form 2. Analyse and solve linear equations in one variable involving multiplication and division
3.4 Introduction to graph	<ul style="list-style-type: none"> 1. Develop conceptual understanding of Cartesian plane, axes and coordinates of a point 2. Draw coordinate axes on graph sheet and locate points on it 3. Plot the graph for linear equation and also for different situations 4. Read, analyze and interpret the plotted graphs 5. Express the relationship between equations and graphs of lines
Theme 4: Geometry	
4.1 Axioms, postulates and theorems	<ul style="list-style-type: none"> 1. Understand the meaning of axioms, postulates, enunciations and theorems 2. State and verify axioms and postulates 3. State and verify the statements practically related to linear pair, vertically opposite angles and parallel lines 4. State and verify the statement related to the theorem on alternate and interior angles 5. Analyse and deduce the logical proof of the theorem 6. Solve numerical problems and prove riders based on the theorem
4.2 Theorems on Triangles	<ul style="list-style-type: none"> 1. State and verify the statement practically which is related to the theorem on angle sum property of triangle 2. Analyse and deduce the logical proof of the theorem on angle sum property of triangle

	<p>3. Develop conceptual understanding of exterior angle of the triangle</p> <p>4. State and verify the statement practically which is related to the theorem on exterior angle of the triangle</p> <p>5. Analyse and deduce the logical proof of the theorem on exterior angle of the triangle</p> <p>6. Analyse and solve riders based on the theorems</p>
4.3 Congruency of triangles	<p>1. Develop conceptual understanding of congruency of plane figures</p> <p>2. Create and critique inductive and deductive arguments concerning geometrical idea such as congruency of triangles and postulates based on it</p> <p>3. State and verify practically the postulates on congruency of triangles (SAS, SSS, ASA, RHS)</p> <p>4. Analyse and solve riders based on these postulates</p>
4.4 Base angles theorem and RHS theorem	<p>1. State and verify practically the statement of base angle theorem</p> <p>2. Analyse and prove the base angle theorem logically</p> <p>3. State and prove the converse statement of the base angle theorem</p> <p>4. Analyse and prove the riders based on base angle theorem and its converse</p> <p>5. Analyse and deduce the logical proof for the RHS statement</p>
4.5 Construction of triangles	<p>1. Selects and uses appropriate geometrical instruments to construct different types of triangles based on all criteria of data</p> <p>2. Construct triangles accurately to given measurements with precision</p>
4.6 Quadrilaterals	<p>1. Use geometrical models to represent and explain the quadrilateral, properties and its types</p> <p>2. Compare, classify and differentiate the different types of quadrilaterals</p> <p>3. States and verify the properties of parallelograms by practical method</p> <p>4. Analyse and solve problems based on properties of parallelogram</p>

Theme 5: Mensuration	
5.1 Surface area and volume of cube and cuboids	<ol style="list-style-type: none"> 1. Use geometrical models to represent and explain cube and cuboids 2. Develop strategies to determine the surface area and volume of cube and cuboids and derive the formulae 3. Select and apply techniques and tools to find accurately surface area and volume of cube and cuboids 4. Understand, select and use units appropriate to measure surface area and volume of cube and cuboids
Theme 6: Data handling	
6.1 Preparation of frequency distribution table and bar graph for grouped and ungrouped data.	<ol style="list-style-type: none"> 1. Prepare, analyse and interpret the data in the form of tables and bar graph; 2. Discuss and understand the correspondence between data sets and their graphical representations especially bar graph
6.2 Calculation of measures of central tendency	<ol style="list-style-type: none"> 1. Compute the mean, median and mode for ungrouped and grouped data 2. Analyse and interpret the results on mean, median and mode

Standard IX and X

Theme 1: Numbers

Sub-theme	Standard IX	Standard X
1.1 Square root by division method	1.Realize the need for the division method of finding square root. 2.Understand and find the square root of the given number by division method	
1.2 Real Numbers	1.Verify the basic properties of real numbers 2.Compare and differentiate the rational and irrational numbers	
1.3 Euclid's Lemma, Fundamental theorem of arithmetic. Irrationality of $\sqrt{2}, \sqrt{3}, \sqrt{5}$		1.Develop an understanding of Euclid's lemma and fundamental theorem of arithmetic. 2.Apply the knowledge to prove various ideas of mathematics 3.Prove that $\sqrt{2}, \sqrt{3}, \sqrt{5}$ are irrational, by method of contradiction
Theme 2: Progressions		
2.1 Arithmetic progression		1.Develop conceptual understanding of meaning of sequence, arithmetic sequence, series, common difference 2.Frame the formula for n^{th} term and sum of arithmetic progression 3.Solve application problems on arithmetic progression
2.2 Geometric progression		1.Develop conceptual understanding of meaning of geometric sequence, series,

		<p>common ratio</p> <p>2.Frame the formula for n^{th} term and sum of geometric progression</p> <p>3.Solve application problems on geometric progression</p>
2.3 Harmonic progression		<p>1.Develop conceptual understanding of meaning of harmonic sequence and series</p> <p>2.Frame the formula for n^{th} term of harmonic progression</p> <p>3.Solve problems on harmonic progression</p>
2.4 Arithmetic mean, geometric mean and harmonic mean – relation between A.M., G.M. and H.M.		<p>1.Develop conceptual understanding of A.M., G.M. and H.M.</p> <p>2.Understand the relationship between A.M., G.M. and H.M.</p>
Theme 3: Sets		
3.1 Set and Set operations	<p>1.Develop an understanding of sets and set operations</p> <p>2.Represnt sets and set operations using appropriate symbols and through Venn diagrams</p>	
3.2 Properties of set operations		<p>1.Perform operations on sets</p> <p>2.Compare the results and draw conclusions</p> <p>3.State the properties of set operations</p> <p>4.Communicate mathematical idea through set language.</p>
Theme 4: Surds		
4.1 Surd and its types	<p>1.Understands the meaning of surds and its types.</p> <p>2.Convert surds into index form and vice versa.</p>	

4.2 Representing $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ on number line.	1.Represent irrational numbers geometrically on a number line. 2.Apply the Pythagoras theorem to represent $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ on number line.	
4.3 Operations on surds		1.Classify the surds as like and unlike surds 2.Perform the basic operation on surds 3.Understand and perform the operation to rationalize the surd
Theme 5: Statistics and Probability		
5.1 Measures of Central tendency Measures of Dispersion	1.Calculate the mean/median/mode for the given data. 2.Analyse and realize the need for measures of data. 3.Calculate the different measures of dispersion 4.Compare and draw conclusions about merits/demerits of each measure.	1.Calculate the standard deviation for the given data 2.Draws conclusion about the best measure of dispersion
5.2 Graphical representation	1.Represent data in the form of histogram, ogives and frequency polygons using appropriate scale. 2.Discuss and understand correspondence between data sets and their graphical representation. 3.Compare different representations of the same data and evaluate how they show different representations	1.Represent data in the form of a pie chart. 2.Read, analyze and interpret the data represented by pie-chart. 3.Construct pie-chart.

5.3 Permutation and Combination		<p>1.Develop an understanding of permutations and combinations as counting techniques.</p> <p>2.Compare and contrast the concepts of permutation and combination.</p> <p>3.Develop, analyze and use formula for computing number of permutations and combinations.</p>
5.4Probability	<p>1.Understands the meaning of a random experiment</p> <p>2.Develop an understanding about chance of occurrence of an event</p>	<p>1.Understand the concept of sample space and construct sample spaces</p> <p>2.Understand how to compute probability of an event</p>
Theme 6: Commercial Mathematics		
6.1Banking	<p>1.Familiarize with passbook, challan, cheques and drafts</p> <p>2.Calculate the interest on deposits in SB account using appropriate method</p>	
6.2 Compound Interest	<p>1.Differentiate between simple and compound interest;</p> <p>2.Calculate compound interest</p> <p>3.Derive a formula to find compound interest and use it for computations</p>	
6.3Hire purchase	<p>1.Differentiate between hire purchase and installment.</p> <p>2.Calculate EMI, rate of interest in hire purchase.</p>	

6.4 Proportion	1. Understand the meaning of proportion and its types 2. Develop, analyze and explain the method of solving problems involving proportions	
Theme 7: Operations on Algebraic Expressions		
7.1 Multiplication	1. Use appropriate identities to find the product of algebraic terms 2. Apply the knowledge to find the product of large numbers.	
7.2 Factorisation	1. Factorise the expressions using appropriate methods.	
7.3 Division	1. Divide one algebraic expression by another to find the quotient and remainder; 2. Verify the result of division.	1. Divide one polynomial by another (synthetic division) 2. State the remainder theorem 2. Find the remainder by using the remainder theorem and verify by actual division.
7.4 GCF and LCM of algebraic expressions	1. List the factors and find the highest common factor. 2. Find the least common multiple of the given algebraic expressions.	
Theme 8: Equations		
8.1 Simultaneous linear equations	1. Understand the meaning of simultaneous linear equations 2. Write equivalent forms of expressions, equations and relation; 3. Solve two simultaneous linear equations to find the solution	

	4.Solve the linear equations graphically.	
8.2 Quadratic Equations		1.Understand the meaning of quadratic equation and its types. 2.Solve the quadratic equations by various methods; 3.Judge the limitations of factorization method; 4.Derive a formula to find its roots; 5.Draw conclusions about the nature of roots based on the value of discriminant. 6.Use a variety of symbolic representations of quadratic equations and explain the relationships.
Theme 9: Variation		
9.1 Variation - Types of variation	1.Understand and explain the meaning of variation and its types; 2.Analyse and solve problems involving direct inverse and compound variations.	
Theme 10. Polygons		
10.1 Polygons and its types	1.Understand the meaning of polygons and its types 2.Identify and classify polygons 3.Inscribe a polygon of given number of sides 4.Identify different types of quadrilaterals and their properties 5.Calculate the areas of quadrilaterals using appropriate formula 6.Construct quadrilaterals for the given measurement	

	7Analyse and logically prove theorems based on parallelograms.	
Theme 11: Concurrent lines in a triangle		
11.1 Concurrent lines Medians Altitudes Perpendicular bisectors Angular bisectors	<ol style="list-style-type: none"> 1.Understand the meaning of concurrent lines. 2.Analyse properties and determine the attributes of concurrent lines in triangles 3.Explore the properties and relationships and solve problems on them. 4.Construct various possible concurrent lines in a triangle; 5.Verify the properties of concurrent lines by construction. 	
Theme 12: Similar triangles		
12.1 Basic proportionality theorem		<ol style="list-style-type: none"> 1.State and prove the basic proportionality theorem logically 2.State the corollaries 3.Analyse and deduce logical proof for riders based on the theorem
12.2 Theorems based on similar triangles		<ol style="list-style-type: none"> 1.Identify similar figures and their corresponding elements 2.State and prove the theorems based on similar triangles logically 3.Establish the validity of the statements using deduction 4.Analyse and deduce logical proof for riders based on the theorem

12.3 Pythagoras theorem		1. Identify the relation between the sides of a right angled triangle 2. State and prove Pythagoras theorem logically 3. Analyse and state the converse of the theorem 4. Analyse and deduce the logical proof for riders based on Pythagoras theorem
Theme 13: Circles		
13.1 Terms related to a circle	1. Identify, define and give examples for the terms related to a circle.	
13.2 Chord properties of a circle	1. State and prove the theorem based on chord properties logically.	1. Constructs and verifies the properties practically.
32.3 Angle properties of a circle	1. State and prove the theorem based on angle properties logically.	1. Verify the properties by construction.
13.4 Cyclic quadrilaterals	1. Understand the meaning and properties of a cyclic quadrilateral; State and prove the theorem logically.	1. Verify the properties by construction.
13.5 Tangents to a circle		1. Understand the meaning of a tangent 2. Construct tangents to a given circle 3. Construct common tangents to two circles
13.6 Touching circles		1. State the condition for two circles to touch each other 2. State and prove theorems logically

Theme 14: Mensuration		
14.1 Surface area and volume of solids * prism * Pyramid * Cylinder * Cone * Frustrum of a cone * Objects made up a two sides.	1.List out the properties of prism and pyramid 2.Compare and contrast their properties; 3.Calculate the surface areas and volume of prisms and pyramids 4.Apply the knowledge to calculate the surface area and volume of objects made up of two solids.	1.Identify properties of cylinder, cone, sphere 2.Calculate the surface area and volume; 3.Calculate the surface area and volume of combination of solids.
14.2 Scale drawing of figures of irregular shapes		1.Draw to scale the figures of irregular shapes 2.Judge the appropriate scale to which the figure is drawn
Theme 15. Polyhedra and networks		
15.1 Polyhedra		1.Identify the features of a polyhedron 2.Establish the relation between number of faces, vertices and edges of a polyhedral 3.Verify Euler's formula for polyhedral
15.2 Networks		1.Identify the regions, nodes and arcs 2.Verify Euler's formula for graphs 3.State the condition for traversability of graphs

Theme 16: Co-ordinate geometry		
16.1 Slope of a liner equation		1.Understand the meaning of slope of a line and calculate the slope of the line 2.Judge the effect of variation of slope
16.2Equation of a line		1.Derive the equation of a line in slope intercept form. 2.Represent geometrical figures algebraically using co-ordinates.
16.3Distance formula		1.Derive relations to find the distance between two points in a Cartesian plan; 2.Calculates the lengths of the sides using the relation.
Theme 17: Trigonometry		
17.1 Trigonometric ratios and identities		1.Define the trigonometric ratios for the acute angle in a right angles triangle; 2.List the values of trigonometric ratios for some standard angles 3.Establish the trigonometric identities ; 4.Define the trigonometric ratios of complementary angles.
17.2 Angle of elevation and depression		1.Identify the values of angle of elevation/depression in a given situation; 2.Calculate height/distance using the values of angle of elevation/depression.