Class 8

Section I
Pedagogical processes suggested by NCERT
The learner may be provided opportunities in pairs /groups / individually and encouraged to
Explore examples of rational numbers with all the operations and explore patterns in these operations
Use generalised form of numbers up to 3 digits and uses her understanding of algebra to derive the divisibility rules for 2, 3, 4 …. Done earlier by observing patterns on them
Explore patterns in square numbers, square roots, cubes and cube roots of numbers and form rules for exponents as integer
Observe situations that lead to simple equations and solve them using suitable processes
Multiply two algebraic expressions and different polynomials based on previous knowledge of distributive property of numbers and generalise various algebraic identities using concrete examples
Factorise algebraic expressions using relevant activities based on previous knowledge of factorising two numbers
Observe contexts that involve the use of percentages like discount, profit & loss, vat, simple and compound interest, etc.
Generalise the formula of compound interests through repeated use of simple interest
Observe situations where one quantity depends on the other. The quantities increase together, or in which while one increases the other decreases. For example, as the speed of a vehicle increases the time taken by it to cover the distance decreases.
Measure the angles and sides of different quadrilaterals and identify patterns in the relationship among them, make hypothesis on the basis of generalisation of the patterns and later on verify through examples
Verify the properties of parallelograms and apply reasoning by doing activities such as constructing parallelograms, drawing their diagonals and measuring their sides and angles
Express /represent a 3-d shape into its 2-d form from their daily life like, drawing a box on a plane surface, showing bottles on paper, board or wall etc.
Make nets of various shapes like cuboids, cubes, pyramids, prisms, etc. And from nets make the shapes and establish relationship among vertices, edges and surfaces
Demonstrate the construction of various quadrilaterals using geometric kit
Sketch the figure of trapezium and other polygons in the given graph paper and asked student to estimate their areas using counting of unit square
Derive the formula for calculating area of trapezium using the areas of triangle and rectangle (square)
Identify that surfaces of various 3-d objects like cubes, cuboids and cylinder
Derive formulae for surface area of cubes and cuboids using the formulae for areas of rectangles, squares and circles
Demonstrate to find volume of a given cube and cuboid using unit cubes
Collect data, organise it into groups and represent it into bar graphs / pie chart

Conduct activities related to throwing a large number of identical dice /coins together and aggregating the result of the throws to get a large number of individual events and make assumptions for future events on the basis of the above data.

Section II	
Learning Outcomes of NCERT	**Measuring the LOs**
Generalises properties of addition, subtraction, multiplication and division of rational numbers through patterns	Explores patterns in operations in order to generalise properties of addition, subtraction, multiplication and division for rational numbers
Finds out as many rational numbers as possible between two given rational numbers.	Calculates rational numbers between any two given rational numbers in order to prove that there are infinite rational numbers between two rational numbers
Proves divisibility rules of 2, 3,4, 5, 6, 9 and 11	Observes patterns and use algebraic operations in order to derive the divisibility rules of 2,3,4,5,6,9 & 11
Finds squares, cubes and square roots and cube roots of numbers using different methods.	Applies different methods in order to find the squares, cubes, square roots and cube roots of a given number
Solves problems with integral exponents.	Applies rules of exponents in order to solve problems with integral exponents
Solves puzzles and daily life problems using variables.	Uses variables in order to solve puzzles and daily life problems
Multiplies algebraic expressions. E.g. Expands (2x-5) (3x2+7).	Applies distributive property in order to multiply two algebraic identities
Uses various algebraic identities in solving problems of daily life	Uses various algebraic identities in order to solve problems of daily life
Applies the concept of per cent in profit and loss situation in finding discount, vat and compound interest. E.g., calculates discount per cent when marked price and actual discount are given or finds profit per cent when cost price and profit in a transaction are given.	Observes a given context in order to apply the concepts of profit and loss, discount, vat, simple and compound interest

Solves problems based on direct and inverse proportions	Solves problems based on direct or inverse proportions in order to establish how one quantity depends on other
Solves problems related to angles of a quadrilateral using angle sum property	Uses angle sum property in order to solve problems related to angles of quadrilateral
Verifies properties of parallelograms and establishes the relationship between them through reasoning.	Applies reasoning through activities such as constructing parallelograms, drawing their diagonals and measuring their sides and angles in order to verify properties of parallelograms
Represents 3D shapes on a plane surface such as sheet of paper, black board etc.	Visualizes 3-D shapes in order to represent them in a plane surface such as sheet of paper, black board, etc.
Verifies Euler's relation through pattern	Analyses patterns in order to verify Euler's relation
Constructs different quadrilaterals using compasses and straight edge.	Uses compasses and straight edge in order to construct a given quadrilateral
Estimates the area of shapes like trapezium and other polygons by using square grid / graph sheet and verifies using formulas.	Uses square grid /graph sheet in order to estimate the areas of various polygons
Finds the area of a polygon.	Uses appropriate methods to find the area of a polygon
Finds surface area and volume of cuboidal and cylindrical object.	Uses appropriate formulae in order to find surface area and volume of cuboidal and cylindrical object
Draws and interprets bar charts and pie charts.	Draws and interpret bar graphs and pie charts in order to answer a variety of questions based on them
Makes hypotheses on chances of future events on the basis of its earlier occurrences or available data like, after repeated throws of dice and coins	Conducts activities in order to makes hypotheses on chances of future events on the basis of its earlier occurrences or available data like, after repeated throws of dice and coins

MAPPING OF GRADE 8 MATHEMATICS TOPICS WITH NCERT LEARNING OUTCOMES			
Important Note: It must be ensured by the teachers that learners are able to use mathematical learning in day to day life and unfamiliar contexts/ situations about which they are not exposed earlier. Learning Objectives should also focus on enhancing the ability of the learner to convert a real life problem into a mathematical problem and the ability to interpret and evaluate mathematical results in the real life contexts.			
Chapter	**Content Area/Concept**	**Learning Objectives**	**Learning Outcome**
1. Rational Numbers	Introduction to Rational Numbers	Define rational number in order to identify whether the given number is a rational number or not	Explores patterns in arithmetic operations in order to generalize properties of addition, subtraction, multiplication and division for rational numbers
		Apply the properties of natural numbers, whole numbers and integers with respect to all the arithmetic operations and extend them for rational numbers	
		Define the additive and multiplicative identity of rational numbers using prior knowledge.	
		Define the additive and multiplicative inverse of rational numbers using prior knowledge of integers and fractions	
		Apply Distributive property of multiplication over addition for rational numbers and simplify a given expression	
	Representation of Rational Numbers on the Number Line	Extend the concepts of number line and represent rational number on the number line	
	Rational Numbers between Two Rational Numbers	Calculate and find rational numbers between any two rational numbers and prove that there are infinite rational numbers between any two given rational numbers	Calculate rational numbers between any two given rational numbers in order to prove that there are infinite rational numbers between two rational numbers

2. Linear Equations in one variable	Meaning of Linear Equation in one variable and its solution	Identify the variable(s) and the highest power of the variable in a given algebraic equation and distinguish whether it is a linear equation in one variable or not	Use variables in order to solve puzzles and daily life problems
		Substitute the given values of variable and verify whether it is the solution of the equation or not	
	Solving Equations which have Linear Expressions on one Side and Numbers on the other Side	Transpose terms to the other side and solve linear equations which have linear expression on one side and numbers on the other side	
	Applications of Linear Equations with one variable	Write simple contextual problems as linear equations in one variable and find its solution	
	Solving Equations having the Variable on both Sides	Transpose terms to the other side and solve linear equations in one variable which have	
	Reducing Equations to Simpler Form	Simplify the given linear equation in one variable and solve them	
	Equations Reducible to the Linear Form	Use cross multiplication and reduce certain equations into their linear form	
	Classification of Polygons	List the properties of a polygon and classify the given figures as a polygon	Use angle sum property in order to solve problems related to angles of quadrilateral

3. Understanding Quadrilaterals		List the properties of different types of polygons and classify them as regular or irregular, concave or convex	
	Angle sum property of polygons	Recall the angle sum property of triangle and extend it for quadrilaterals	
		Relate the angle sum property of triangle and quadrilateral and extend it for an n-sided polygon	
		Apply angle sum property of a quadrilateral and find the measure of the unknown angle in a given quadrilateral	
	Sum of the Measures of the Exterior Angles of a Polygon	Apply exterior angle property of a polygon and find the measure of the unknown angle in a given figure	
	Kind of Quadrilaterals	List the properties of quadrilaterals and classify them as trapezium, kite and parallelogram	Apply reasoning through activities such as constructing parallelograms, drawing their diagonals and measuring their sides and angles in order to verify properties of parallelograms
	Some special Parallelograms	Discuss the properties of a parallelogram in order describe the relation between its opposite sides, angles and diagonals.	
		Discuss the properties of a rhombus and classify it as special case of kite and parallelogram	
		Discuss the properties of a rectangle and show that it is a special case of parallelogram	
		Discuss the properties of a square and show it as special case of parallelogram, rhombus and rectangle	
4. Practical Geometry	Constructing a Quadrilateral	Discuss and list the minimum number of elements required and construct a unique quadrilateral	Use compasses and straight edge in order to construct a given quadrilateral
		List and execute steps of construction and construct a quadrilateral length if its four sides and a diagonal are given	

		List and execute steps of construction and construct a quadrilateral given the length of its three sides and two diagonals	
		List and execute steps of construction and construct a quadrilateral if length of two adjacent sides and measures of three angles are known	
		List and execute steps of construction and construct a quadrilateral given the length of three sides and measures of two included angles are known	
	Some Special Cases	Identify the minimum number of elements required and construct special cases of quadrilaterals	
5. Data Handling	Looking for Information	Represent the given data using the most suitable representation and interpret them applying the knowledge of different types of graphical representation (namely pictograph, bar graph and double bar graph) of data	Draw and interpret bar graphs and pie charts in order to answer a variety of questions based on them
	Organizing raw data	Use tally marks and organize the given raw data in a frequency distribution table	
	Grouping data	Use tally marks and prepare a grouped frequency distribution table for large ungrouped data	
		Construct histogram and represent the given grouped data	
		Explain the elements of the given histogram and interpret it	
	Circle graph or Pie Chart	Construct a circle graph with the given data	
		Infer a variety of information from a given circle graph	
	Chance and Probability	List all the possible outcomes of an experiment and define the equally likely outcomes	Conduct activities in order to makes hypotheses on chances of future events on the basis of its

		List all the possible outcomes of an event and calculate the probability of a given event	earlier occurrences or available data like, after repeated throws of dice and coins
6. Squares and Square roots	Properties of Square Numbers	Define perfect squares and classify the given numbers as perfect squares or non-perfect squares	Apply different methods in order to find the squares, cubes, square roots and cube roots of a given number
		Observe the number and find the unit place of its square	
		Observe different number pattern and deduce square numbers	
		Use the rule that there are exactly 2n non-perfect square numbers between the squares of the number n and (n+1) and find how many numbers, lie between the squares of the given two consecutive numbers	
	Finding the Square of a Number	Use the rule that a perfect square number (n^2) can be written as the sum of first n odd natural numbers and distinguish between square and non-square numbers	
		Use Pythagoras theorem and find the Pythagorean triplet	
	Square Roots	Apply inverse operations on a given perfect square and deduce square root of this number	
		Use method of repeated subtraction and find the square root of the given square number	
		Use prime factorization method and find the square root of the given perfect square	
		Use prime factorization method and determine whether the given number is a perfect square or not	
		Use prime factorization method and find the smallest number to be operated (all the four arithmetic operations) on given number to get a perfect square and then find the square root of the new number	

		Use long division method and find the square root of the given perfect square number	
		Use long division method and find the smallest number to be operated (all the four arithmetic operations) on given number to get a perfect square and then find the square root of the new number	
	Square Roots of Decimals	Use long division method and find the square root of the given decimal number	
	Estimating Square Root	Use estimation and approximate the value of the square root of the given number to the nearest whole	
7. Cubes and cube roots	Cubes	Define perfect cube /cube number and classify the given numbers as cube numbers or non-cube numbers	Apply different methods in order to find the squares, cubes, square roots and cube roots of a given number
		Observe the pattern of cube of even numbers and generalize that cubes of even numbers are even	
		Observe the pattern of cube of numbers with one's digit as 1, 2, 3, 4… etc. and explore the one's digit of their perfect cubes and comment on it	
		Add n consecutive odd numbers and get the sum equal to n^3	
		Use prime factorization and rule out a number as a perfect cube	
		Use prime factorization on the given number and find the smallest number to be operated (all the four arithmetic operations) on given number to get a perfect cube	
	Cube Roots	Use prime factorization and find the cube root of a given number	

		Use estimation and find the cube root of a given perfect cube	
8. Comparing Quantities	Recalling Ratios and Percentages	Convert ratios to percentage and solve the given questions	Observe a given context in order to apply the concepts of profit and loss, discount, VAT, simple and compound interest
	Discount, Profit, Loss	Apply the formula for discount and discount percentage and solve the given problem on discount	
		Calculate the discount in given situations and comment whether the seller has made a profit /loss in the given transaction	
	Simple Interest and Compound Interest	Define and compare simple interest and compound interest and comment on the situations where either of the two are applied	
		Calculate the simple interest and find the total amount to be paid by the debtor	
	Deducing a Formula for Compound Interest	Use formula of simple interest and deduce the formula to calculate the compound interest	
		Calculate the compound interest and find the total amount to be paid by the debtor	
	Rate Compounded Annually or Half Yearly (Semi Annually)	Define the terms 'compounded annually', 'compounded half yearly' and 'compounded quarterly' and give examples and differentiate between the three	
	Applications of Compound Interest Formula	Use formula of compound interest and solve problems related to increase (or decrease) in population	
		Use formula of compound interest and solve problems related to increase (or decrease) in the price of an item in intermediate years	

9. Algebraic Expressions and Identities	Monomials, Binomials and Polynomials	Count the number of terms in an algebraic expression and classify them as monomial, binomial, trinomial or polynomial in general	Apply distributive property in order to multiply two algebraic expressions
	Addition and Subtraction of Algebraic Expressions	Identify like and unlike terms in algebraic expressions and add or subtract the given algebraic expressions	
	Multiplying a Monomial by a Monomial	Use rules of exponents and powers and multiply a monomial by a monomial	
		Extend the multiplication of monomial by a monomial and obtain the product of any number of monomials	
	Multiplying a Monomial by a Polynomial	Use distributive property of multiplication over addition and subtraction and obtain the product of a monomial and a binomial	
		Use distributive property of multiplication over addition and subtraction and obtain the product of a monomial and a trinomial	
	Multiplying a Polynomial by a Polynomial	Simplify the algebraic expressions and find the value of expression for the given value of the variable	
		Use distributive law of multiplication and obtain the product of two binomials	
		Use distributive law of multiplication and obtain the product of a binomial and a trinomial	
	What is an Identity?	Define and compare equation and identity and classify a given question into either of the two	Use various algebraic identities in order to solve problems of daily life
	Standard Identities	Use multiplication of binomials and explore and verify the standard identities for squares of binomials	

	Applying Identities	Use identities and simplify the given algebraic expressions	
		Use identities and find the product of the given numbers	
10. Visualizing solid shapes	Views of 3D-Shapes	Compare 2D shapes and 3D shapes and classify a given shape into either	Visualize 3-D shapes in order to represent them in a plane surface such as sheet of paper, black board, etc.
		Identify different shapes in nested objects and match the object with its shape	
		Visualize 3D objects and draw them from different perspectives	
		Discuss the given front, top and side view of an object and identify the object	
	Mapping Space Around Us	Discuss the elements in a map and differentiate between a map and a picture	
		Read and interpret simple map and answer questions based on them	
		Choose appropriate scale and use symbols to denote landmarks and draw a simple map	
	Faces, Edges and Vertices	Identify faces, edges and vertices in a given solid and classify it as a polyhedron or a non-polyhedron	
		Count vertices, edges and faces in 3D figures with flat faces and verify Euler's formula	Analyze patterns in order to verify Euler's relation
11. Mensuration	Adjoint figures	Calculate area and perimeter of circle, square, rectangle, triangle and calculate area and perimeter of adjoint shapes	Use square grid /graph sheet in order to estimate the areas of various polygons
	Area of Trapezium	Breakdown a given trapezium into known figures (triangles, squares, rectangles) and derive the formula for the area of a trapezium	

	Area of a Polygon	Calculate the area of a given polygon after breaking down the polygon in multiple ways and compare the values and comment on it	Uses appropriate methods to find the area of a polygon
	Surface Area of Cube, Cuboid and Cylinder	Illustrate 2-D representation of a cuboid, cube and cylinder and compute the surface areas by breaking them in to areas of known figures	Use appropriate formulae in order to find surface area and volume of cuboidal and cylindrical object
		Calculate the surface area of a cube, cuboid and cylinder to determine the cost of painting /covering their surface	
	Volume of Cube, Cuboid and Cylinder	Calculate the volume of a given cube, cuboid, cylinder and infer the quantity of any substance it can hold	
		Modify the values of l, b, h and examine the effect it has on the value of the surface area /volume of a cuboid	
		Modify the values of r, h and examine the effect it has on the value of the surface area /volume of a cylinder	
		Calculate the volume of a given cuboid, cylinder and determine the time taken to fill it with a liquid at a given rate	
12. Exponents and Powers	Powers with Negative Exponents	Simplify powers with negative exponents and calculate the multiplicative inverse of a number	Apply rules of exponents in order to solve problems with integral exponents
	Laws of Exponents		
		Apply the first law of exponents and principles of negative exponents and derive the rest of the laws of exponents	
		Apply laws of exponents and simplify a given expression. Give different examples of application of the laws.	

	Use of Exponents to Express Small Numbers in Standard Form	Express very large and very small numbers in the standard form and compare and estimate quantities	
13. Direct and Inverse proportions	Direct proportion and Inverse proportion	Observe the relationship between the given two quantities and solve to find constant of proportionality	Solve problems based on direct or inverse proportions in order to establish how one quantity depends on other
		Examine situations and decide whether two quantities are proportional to each other or not	
		Complete a given table showing two proportional quantities and answer questions based on them	
		Convert the given statement on relationship (directly or inversely proportional) between two quantities into a table and identify the missing quantity and solve for its value	
		Observe the table and determine which pair of variables are inversely proportional	
		Create a scale using a suitable proportionality constant and draw a given figure with large dimensions	
14. Factorization	Factors of algebraic expressions	Express each term as a product of irreducible factors and find the common factors of the given terms	
	Method of common factors	Use the method of common factors and factorize the given algebraic expression	
	Factorization by regrouping terms	Regroup the terms and factorize the given algebraic expressions	
	Factorization using identities	Apply the standard algebraic identities and factorize the given algebraic expressions (for perfect squares)	

	Factors of the form	Factorize algebraic expressions in the form and express it as a product of its irreducible factors of the form	
	Division of Algebraic Expressions	Use the common factor method and divide a monomial by a monomial	
		Use the common factor method and divide a polynomial by a monomial	
		Divide each term in the numerator by the denominator and divide a polynomial by a monomial	
		Use the common factor method and divide a polynomial by a polynomial	
	Find the Error	Check the given mathematical statements and find and give reasons for the possible errors in them	
15. Introduction to Graphs	A line graph	Draw a line graph and represent the given data that changes continuously over periods of time	
		Interpret the given line graph and answer the given questions	
	Linear graph and Location of a point /coordinates	Plot a point on the graph and describe its coordinates	
		Plot the given points on the graph and verify if they lie on the same line or not	
		Choose an appropriate scale and plot a graph for the given data	
	Some applications	Construct the line graph and discuss the relationship between independent and dependent variable in a given mathematical or a real life situation	
16. Playing with numbers	Numbers in General Form	Use the concepts of place value and express the given numbers in their generalized form	Observe patterns using algebraic operations in order to derive the divisibility rules of 2,3,4,5,6,9 & 11
	Games with Numbers	Apply the divisibility rule of 11 and check whether a given number is divisible by 11 or not	

		Add or subtract a two-digit number and its reverse and check whether it is divisible by 9 or not	
		Subtract a three-digit number and its reverse and verify that it is divisible by 99	
		Form all possible three-digit numbers using the given 3 digits and verify that the sum of these numbers will be divisible by 37	
	Letters for Digits	Use addition and multiplication and find the values of the letters in the given puzzles	
	Tests of Divisibility	Apply the divisibility rule of 10 and check whether a given number is divisible by 10 or not	
		Apply the divisibility rule of 5 and check whether a given number is divisible by 5 or not	
		Apply the divisibility rule of 2 and check whether a given number is divisible by 2 or not	
		Apply the divisibility rule of 3 and 9 and check whether a given number is divisible by them	
		Apply the divisibility rule of 2,5 and 10 and check whether a given number is divisible by all of them or not.	