Class 10

Section I
Pedagogical processes suggested by NCERT
The learners may be provided with opportunities individually /in groups and encouraged to
Extend the methods of finding LCM and HCF of large numbers learnt earlier to general form.
Discuss different aspects of polynomials, such as - their degree, type (linear, quadratic, cubic), zeroes etc., relationship between their visual representation and their zeroes.
Play a game which may involve a series of acts of factorising a polynomial and using one of its factors to form a new one. For example, one group factorising says, (x3 – 2x2 – x – 2) and using one of its factor x-1 to construct another polynomial which is further factorised by another group to continue the process.
Discuss different aspects of linear equations by engaging students in the activities of the following nature: A) One group may ask another to form linear equation in two variables with coefficients from a particular number system i.e. Natural numbers / numbers that are not integers etc.   B) Graphically representing a linear equation in 1d or 2 d and try to explain the difference in their nature.   C) Encouraging students to observe identities & equations and segregate them.
Use graphical ways to visualise different aspects of linear equations such as visualising linear equations in two variables or to find their solution.
Observe and analyse patterns in their daily life situations to check if they form an arithmetic progression and, if so, find rule for getting their nth term and sum of n terms. The situations could be - our savings / pocket money, games such as playing cards and snakes & ladders, etc.
Analyse and compare different geometrical shapes, charts, models made using paper folding and tell about their similarity and congruence.
Discuss in groups different situations such as constructing maps etc. In which the concepts of trigonometry are used.
Work in projects related to heights and distances, that may include situations in which methods have to be devised for measuring the angle of inclination of the top of a building and their own distance from the building.
Device ways to find values of different trigonometric ratios for a given value of a trigonometric ratio.
Observe shapes in the surroundings that are a combination of shapes studied so far such as cone, cylinder, cube, cuboid, sphere, hemisphere etc. They may work in groups and may provide formulas for different aspects of these combined shapes.
To determine areas of various materials, objects, designs around them. For e.g. Design on a handkerchief, design of tiles on the floor, geometry box etc.
Discuss and analyse situations related to surface areas and volumes of different objects such as, (a) given two boxes of a certain shape with different dimensions, if one box is to be changed exactly like another box, which attribute will change, surface area or volume? (b) by

what percent will each of the dimensions of one box have to be changed to make it exactly of the same size as the other box?
Discuss and analyse the chance of happening of different events through simple activities like tossing a coin, throwing two dice simultaneously, picking up a card from a deck of 52 playing cards etc.
Generalise the formulas of mean, median and mode read in the earlier classes by providing situations for these central tendencies.
To draw tangents to a circle from a point which lies outside and a point which lies inside the circle. They may be motivated to evolve different ways to verify the properties of such tangents

Section II	
Learning Outcomes of NCERT	**Measuring the Los**
The learner-	
Generalises properties of numbers and relations among them studied earlier to evolve results, such as, Euclid's division algorithm, fundamental theorem of arithmetic, and applies them to solve problems related to real life contexts.	Generalises properties of numbers and relations among them studied earlier, to evolve results, such as, Euclid's division algorithm, fundamental theorem of arithmetic in order to apply them to solve problems related to real life contexts
Develop a relationship between algebraic and graphical methods of finding the zeroes of a polynomial.	Uses algebraic and graphical method of finding zeroes of a polynomial in order to establish a relationship between them
Finds solutions of pairs of linear equations in two variables using graphical and different algebraic methods.	Uses graphical and other methods in order to finds solutions of pairs of linear equations in two variables
Demonstrates strategies of finding roots and determining the nature of roots of a quadratic equation.	Demonstrates knowledge of application of various strategies in order to find roots and determine the nature of roots of a given equation
Develops strategies to apply the concept of AP to daily life situations.	Develops strategies in order to apply the concept of AP to daily life situations
Works out ways to differentiate between congruent and similar figures.	Uses reasoning in order to differentiate between congruent and similar figures
Establishes properties for similarity of two triangles logically using different geometric criteria	Uses different geometric criteria established earlier such as basic

established earlier such as basic proportionality theorem etc.	proportionality theorem etc. in order to establish properties for similarity of two triangles
Derives formulae to establish relations for geometrical shapes in the context of a coordinate plane, such as finding the distance between two given points, to determine coordinates of a point between any two given points, to find area of a triangle etc.	Derives formulae to establish relations for geometrical shapes in the context of a coordinate plane, such as finding the distance between two given points, in order to determine coordinates of a point between any two given points, to find area of a triangle etc.
Determines all trigonometric ratios with respect to a given acute angle (of a right triangle) and uses them in solving problems in daily life contexts like finding heights of different structures or distances from them.	Determines all trigonometric ratios with respect to a given acute angle (of a right triangle) in order to use them in solving problems in daily life contexts like finding heights of different structures or distances from them.

Constructs
    A) A triangle similar to a given triangle as per a given scale factor.
    B) A pair of tangents from an external point to a circle and justify procedures.
Examines the steps of geometrical constructions and reason out each step
	Examines each step and reasons out each step, in order to:
	    A) Construct a triangle similar to a given triangle as per a given scale factor.
	    B) Construct a pair of tangents from an external point to a circle and justify procedures

Finds surface areas and volumes of objects in the surroundings by visualising them as a combination of different solids like cylinder and a cone, cylinder and a hemisphere, combination of different cubes etc.	Visualizes objects in surrounding as a combination of different solids like cylinder and a cone, cylinder and a hemisphere, combination of different cubes etc.in order to find their surface areas and volumes
Calculates mean, median and mode for different sets of data related with real life contexts.	Calculates mean, median and mode in order to apply them to real life contexts
Determines the probability of an event.	Calculates in order to determine the probability of a given event

MAPPING OF GRADE 10 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. Real Numbers	Euclid's Division	Apply Euclid Division Algorithm and obtain HCF of two positive integers in the context of the given problem	Generalises properties of numbers and relations among them studied earlier, to evolve results, such as, Euclid's division algorithm, fundamental theorem of arithmetic in order to apply them to solve problems related to real life contexts
		Apply Euclid Division Algorithm and prove results of positive integers in the form of ax+b where a and b are constants	
	Fundamental Theorem of Arithmetic	Use the Fundamental Theorem of Arithmetic and calculate HCF and LCM of the given numbers in the context of the given problem	
	Irrational Numbers	Recall the properties of irrational number and prove that whether the sum /difference /product /quotient of two numbers is irrational or not	
		Apply theorems of irrational number and prove whether a given number is irrational or not	
	Decimal Representation of Irrational Numbers	Apply theorems of rational numbers and find out about the nature of their decimal representation and their factors	

2. Polynomials	Geometrical meaning of Zeroes of a Polynomial	Recall degree of polynomial and find the number of zeroes of polynomial	Uses algebraic and graphical method of finding zeroes of a polynomial in order to establish a relationship between them
		Analyse the graph of the polynomials and find the number of zeroes of polynomial	
	Relationship between Zeroes and Coefficients of a Polynomial	Compute zeroes of the polynomials and verify the relationship between zeroes and the coefficients	
		Compute the sum and product of zeroes of the polynomial and find the quadratic polynomial	
	Division Algorithm for Polynomials	Divide the two given polynomials and verify the division algorithm	
		Divide the given polynomial with its known zero and find all the other zeroes of that polynomial	
3. Pair of Linear equations in two variables	Introduction and Properties of Linear equations and non-linear equations	State the properties of linear equation and classify the given equations as linear or non-linear	Uses graphical and other methods in order to finds solutions of pairs of linear equations in two variables
	Graphical Method of Solution of a Pair of Linear Equations	Interpret the concepts of linear equations and represent any given situation algebraically and graphically	
		Plot the lines corresponding to the given two linear equations and comment on the nature /behaviour of the lines representing the linear equations	
	Algebraic method for	Use different algebraic methods and solve a pair	

	solving Linear Equations	of linear equations	
		Use the most appropriate algebraic method and solve the given pair of linear equations	
		Use the concepts of pair of linear equations in two variables and represent any given situation algebraically and find its solution	
		Calculate the ratio of coefficients of linear equations and discuss the nature of pair of linear equations	
	Equations Reducible to a Pair of Linear Equations in Two Variables	Rewrite the given equations (using substitution method) which are reducible to a pair of linear equations and find the solution of those equations	
4. Quadratic Equations	Introduction to Quadratic Equations	In the form of Quadratic Equation represent the given situation algebraically	Demonstrates knowledge of application of various strategies and find roots and determine the nature of roots of a given equation
		Rewrite the given equations in the standard form and check whether they are quadratic or not	
	Factorization Method	Solve quadratic equations through factorization and find its roots	
		Solve quadratic equations through middle term splitting and find its roots	
	Completing Square Method	Solve quadratic equations by completing the square and find its roots	
	Solving a Quadratic	Use the quadratic formula and find the roots of	

	Equation	quadratic equation	
	Roots of a Quadratic Equation	Substitute the value of the roots of a given quadratic equation and verify them.	
	Nature of Roots	Examine the discriminant of quadratic equation and find out the nature of its roots	
		Describe the nature of the roots of a quadratic equation and determine that whether a given situation is possible or not	
5. Arithmetic Progression	Introduction to Arithmetic Progressions-	Produce patterns and observe that succeeding terms are obtained by adding a fixed number to the preceding terms.	Develops strategies in order to apply the concept of AP to daily life situations
		Distinguish between finite and infinite AP and determine the nature and write the last term of the given AP	
	nth term of AP	Calculate the nth term of a given AP and find its terms and their nature	
	nth term of AP Sum of an AP	Calculate the nth term of a given AP and solve real-life word problems	
		Calculate the sum of a given AP and get the solution of real-life word problems	
	Sum of an AP Last term of an AP	Calculate the sum of a given AP and solve contextual problems	
		Calculate the last term of the given AP and find solution real-life word problems	

	Last term of an AP	Use appropriate formula to calculate the last term of the given AP	
6. Triangles	Similar figures	Distinguish between congruency and similarity and understand the concept of similar figures	Uses reasoning in order to differentiate between congruent and similar figures
		Compute the angles and ratio of sides of polygons and determine their similarity	Uses different geometric criteria established earlier such as basic proportionality theorem etc. in order to establish properties for similarity of two triangles
	Similarity of triangles	Compute the angles and ratio of sides of triangles and determine their similarity	
		Apply basic proportionality theorem and its converse and determine the ratio of sides in the given triangle(s)	
	Criteria for similarity of Triangles	Apply various criteria of similarity and prove whether given triangles are similar or not	
		Show similarity of triangles and solve real life problems	
	Areas of Similar Triangles	Compute the square of the ratio of the corresponding sides of triangles and find the area of similar triangles	
		Compute the area of similar triangles and find the relation between their sides, medians, mid points of the triangles	
	Pythagoras Theorem	Apply the theorem that if a perpendicular is drawn from the vertex of the right angle of a right triangle to the hypotenuse then triangles on both sides of the perpendicular are similar to	

		the whole triangle and prove Pythagoras Theorem.	
		Prove Pythagoras theorem and its converse and solve real life problems	
		Apply Pythagoras theorem and its converse and determine that whether a given triangle is a right-angled triangle or not	
7. Co-ordinate Geometry	Basics of Graphs	Identify x and y coordinate and plot points on the graph	Derives formulae to establish relations for geometrical shapes in the context of a coordinate plane, such as finding the distance between two given points, in order to determine coordinates of a point between any two given points, to find area of a triangle etc.
	Distance Formula	Apply and derive distance formula and determine the distance between two coordinates on the graph	
		Apply distance formula and solve various mathematical and real-life problems graphically	
	Section Formula	Apply and derive section formula and divide the line segment in a given ratio	
		Apply distance and section formula and determine the vertices /diagonals /mid points of given geometrical shapes	
	Area of a Triangle	Apply and derive the formula of area of triangle geometrically and determine the area of quadrilateral /triangle	
8. Introduction to Trigonometry	Trigonometric Ratios	Describe trigonometry and study the relationship between side and angle of a triangle	Determines all trigonometric ratios with respect to a given acute angle (of a right triangle) in order to use them in solving
		Define and distinguish various trigonometric	

		ratios and describe and verify sine, cosine, tangent, cosecant, secant, cotangent of an angle	problems in daily life contexts like finding heights of different structures or distances from them
		Use given trigonometric ratio(s) and find and verify other trigonometric ratios /angles of the triangle	
	Trigonometric Ratios of Some Specific Angles	Compute the trigonometric ratio $0°,30°,45°,60°$ and $90°$ and use these for different angles	
	Trigonometric Ratios of Complementary Angles	Compute the trigonometric ratio of complimentary angles and apply the values in solving contextual problems	
	Trigonometric Identities	Compute and apply trigonometric identities and simplify and solve mathematical problems	
9. Some applications of Trigonometry	Heights and Distances	Identify line of sight and determine angle of elevation and angle of depression	Determines all trigonometric ratios with respect to a given acute angle (of a right triangle) in order to use them in solving problems in daily life contexts like finding heights of different structures or distances from them.
		Apply trigonometric ratios (of specific angles) and determine heights and distances of the objects in the real-life context.	
10. Circles	Tangent to a Circle	Draw, identify and differentiate between secant and tangent of a circle and prove and apply various theorems related to circles	-
	Number of Tangents from a Point on a Circle	Prove and apply theorems related to tangent of a circle and determine number of tangents from the given point(s)	
		Prove and apply theorem related to tangent of a	

		circle and determine length of the tangent	
11. Constructions	Division of a Line Segment	List and execute steps of construction and divide a line segment in a given ratio	Examines each step and reasons out each step, in order to:
	Construction of a similar triangle	List and execute steps of construction and construct a similar triangle as per a given scale factor	A) Construct a triangle similar to a given triangle as per a given scale factor. B) Construct a pair of tangents from an external point to a circle and justify procedures
	Construction of Tangents to a Circle	List and execute steps of construction and construct tangent(s) to a given circle	
12. Areas related to circles	Perimeter and Area of a Circle — A Review	Describe the relationship between circumference and diameter of a circle and define Π	-
		Apply the concepts of circumference and area of and solve in for various circular objects in real life	
	Areas of Sector and Segment of a Circle	Describe sector and segment of a circle and differentiate between the two	
		Describe minor and major sector of a circle and differentiate between the two	
		Describe minor and major segment of a circle and differentiate between the two	
		Apply the formula of area of sector and segment of a circle, and compute the area of a specified region	
		Calculate the length of an arc of a circle and comment whether it is the major arc or minor	

		arc	
	Areas of Combinations of Plane Figures	Calculate the area of various combinations of plane figures and apply the concepts of circles, quadrilaterals and triangles	
13. Surface areas and volumes	Surface Area of a Combination of Solids	Apply formulae of surface area of different 3D solids and derive the surface area of combination of these solid objects	Visualizes objects in surrounding as a combination of different solids like cylinder and a cone, cylinder and a hemisphere, combination of different cubes etc.in order to find their surface areas and volumes
	Volume of a Combination of Solids	Apply formulae of volume of different 3D solids and derive the volume of the combination of these solid objects	
	Conversion of Solid from One Shape to Another	Combine different solid shapes to create a new solid form	
	Frustum of a Cone	Apply the formula of surface area of a cone and derive the total surface area of the frustum	
		Apply the formula of volume of a cone and derive the volume of the frustum	
	Applications of surface areas and volumes	Use concepts of surface areas and volumes for variety of 3-D objects and apply them into real life situations	
14. Statistics	Mean of Grouped Data	Apply direct method and calculate the mean of the grouped data	Calculates mean, median and mode in order to apply them to real life contexts
		Apply assumed mean method and calculate the mean for a grouped data	
	Mode of Grouped	Compute the mean and mode of the given data	

	Data	and interpret these two measures of central tendency	
	Median of Grouped Data	Apply formula for the median of a given grouped data and calculate missing values of frequency	
	Mean, median and mode	Differentiate between mean, median and mode with examples and use most effective measure of central tendency in various cases	
	Graphical Representation of Cumulative Frequency Distribution	Derive the co-ordinates to plot a graph and represent the two ogives	
		Graph both ogives for the data obtained and determine the median of the given grouped data	
15. Probability	Probability — A Theoretical Approach	Differentiate between Empirical Probability and Theoretical Probability and find the two for a variety of cases	Calculates and determine the probability of a given event
		Calculate the probability of given events in an experiment and comment whether they are Complementary Events /Sure Events /Impossible Events	
		Represent using organized lists, tables, or tree diagrams and list the sample space for compound events	
		Calculate the probability of various events and rank them from most to least probable events.	