2025-26

MATHEMATICS (031)

Class – IX

TOTAL MARKS- 100 ¡ 80 (Theory) + 20 (Internal Assessment)À

THEORY: 80 Marks **Time: 3:00 Hrs.**

Units	Unit Name	Marks
I	NUMBER SYSTEMS	10
II	ALGEBRA	20
III	COORDINATE GEOMETRY	04
IV	GEOMETRY	27
V	MENSURATION	13
VI	STATISTICS	06
	Total	**80**

UNIT I: NUMBER SYSTEMS

REAL NUMBERS

1- Review of representation of natural numbers, integers, rational numbers on the number line. Representation of terminating/non-terminating recurring decimals on the number line through successive magnification, Rational numbers as recurring/ terminating decimals. Operations on real numbers.

2- Examples of non-recurring/non-terminating decimals. Existence of non-rational numbers (irrational numbers) such as $\sqrt{2}$, $\sqrt{3}$ and their representation on the number line. Explaining that every real number is represented by a unique point on the number line and conversely, viz. every point on the number line represents a unique real number.

3- Definition of nth root of a real number.

4- Rationalization (with precise meaning) of real numbers of the type $\frac{1}{a+b\sqrt{x}}$ and $\frac{1}{\sqrt{x}+\sqrt{y}}$ (and their combinations) where x and y are natural number and a and b are integers.

5- Recall of laws of exponents with integral powers. Rational exponents with positive real bases (to be done by particular cases, allowing learner to arrive at the general laws.)

Competencies	• *Develops a deeper understanding of numbers, including the set of real numbers and its properties.* • *Recognizes and appropriately uses powers and exponents.* • *Computes powers and roots and applies them to solve problems.*
Explanation	• *Differentiates rational and irrational numbers based on decimal representation.* • *Represents rational and irrational numbers on the number line.* • *Rationalizes real number expressions such as 1/ $a+b\sqrt{x}$ and 1/ $\sqrt{x}+\sqrt{y}$, where x, y are natural numbers and a, b are integers.* • *Applies laws of exponents.*

UNIT II: ALGEBRA

1- POLYNOMIALS

Definition of a polynomial in one variable, with examples and counter examples. Coefficients of a polynomial, terms of a polynomial and zero polynomial.

Degree of a polynomial.

Constant, linear, quadratic and cubic polynomials. Monomials, binomials, trinomials. Factors and multiples.

Zeros of a polynomial.

Motivate and State the Remainder Theorem with examples.

Statement and proof of the Factor Theorem. Factorization of $ax^2 + bx + c$, $a \neq 0$ where a, b and c are real numbers, and of cubic polynomials using the Factor Theorem.

Recall of algebraic expressions and identities. Verification of identities:

$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$

$(x \pm y)^3 = x^3 \pm y^3 \pm 3xy\,(x \pm y)$

$x^3 \pm y^3 = (x \pm y)\,(x^2 \mp xy + y^2$

$x^3 + y^3 + z^3 - 3xyz = (x + y + z)\,(x^2 + y^2 + z^2 - xy - yz - zx)$

and their use in factorization of polynomials.

Competencies	*Learns the art of factoring polynomials*
Explanation	• *Defines polynomials in one variable.* • *Identifies different terms and different types of polynomials.* • *Finds zeros of a polynomial* • *Proves factor theorem and applies the theorem to factorize polynomials.* • *Proves and applies algebraic identities up to degree three.*

2- LINEAR EQUATIONS IN TWO VARIABLES

Recall of linear equations in one variable.

Introduction to the equation in two variables. Focus on linear equations of the type $ax + by + c=0$. Explain that a linear equation in two variables has infinitely many solutions and justify their being written as ordered pairs of realnumbers, plotting them and showing that they lie on a line.

Competencies	*Visualizes solutions of a linear equation in two variables as ordered pair of real numbers on its graph.*
Explanation	*Describes and plot a linear equation in two variables.*

UNIT III: COORDINATE GEOMETRY

COORDINATE GEOMETRY

The Cartesian plane, coordinates of a point

Names and terms associated with thecoordinate plane, notations.

Competencies	*Specifies locations and describes spatial relationships using coordinate geometry.*
Explanation	*Describes cartesian plane and its associated terms and notations.*

UNIT IV: GEOMETRY

1- INTRODUCTION TO EUCLID'S GEOMETRY

History- Geometry in India and Euclid's geometry. Euclid's method of formalizing observed phenomenon into rigorous Mathematics with definitions, common/obvious notions, axioms/postulates and theorems.

The five postulates of Euclid. Equivalent versions of the fifth postulate. Showing the relationship between axiom and theorem, for example:

(a) Given two distinct points, there exists one and only one line through them. (Axiom)

(b) (Prove) Two distinct lines cannot have more than one point in common. (Theorem)

Competencies	*Proves theorems using Euclid's axioms and postulates– for triangles, quadrilaterals, and circles and applies them to solve geometric problems.*
Explanation	• *Understands historical relevance of Indian and Euclidean Geometry.* • *Defines axioms, postulates, theorems with reference to Euclidean Geometry.*

2- LINES AND ANGLES

(State without proof) If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse.

(Prove) If two lines intersect, vertically opposite angles are equal.

(State without proof) Lines which are parallel to a given line are parallel.

Competencies	*Derives proofs of mathematical statements particularly related to geometrical concepts, like parallel lines by applying axiomatic approach and solves problems using them.*
Explanation	• *Visualizes, explains and applies relations between different pairs of angles on a set of parallel lines and intersecting transversal.* • *Solves problems based on parallel lines and intersecting transversal.*

3- TRIANGLES

(State without proof) Two triangles are congruent if any two sides and the included angle of one triangle is equal (respectively) to any two sides and the included angle of the other triangle (SAS Congruence).

(Prove) Two triangles are congruent if any two angles and the included side of one triangle is equal (respectively) to any two angles and the included side of the other triangle (ASA Congruence).

(State without proof) Two triangles are congruent if the three sides of one triangle are equal (respectively) to three sides of the other triangle (SSS Congruence).

(State without proof) Two right triangles are congruent if the hypotenuse and a side of one triangle are equal (respectively) to the hypotenuse and a side of the other triangle. (RHS Congruence).

(Prove) The angles opposite to equal sides of a triangle are equal.

(State without proof) The sides opposite to equal angles of a triangle are equal.

Competencies	• *Describe relationships including congruency of two dimensional geometrical shapes (lines, angle, triangles) to make and test conjectures and solve problems.* • *Derives proofs of mathematical statements particularly related to geometrical concepts triangles by applying axiomatic approach and solves problems using them.*
Explanation	• *Visualizes and explains congruence properties of two triangles.* • *Applies congruency criteria to solve problems.*

4- QUADRILATERALS

((Prove) The diagonal divides a parallelogram into two congruent triangles.

(State without proof) In a parallelogram opposite sides are equal, and conversely.

(State without proof) In a parallelogram opposite angles are equal, and conversely.

(State without proof) A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and equal.

(State without proof) In a parallelogram, the diagonals bisect each other and conversely.

(State without proof) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and is half of it and (State without proof) its converse.

Competencies	*Derives proofs of mathematical statements particularly related to geometrical concepts of quadrilaterals by applying axiomatic approach and solves problems using them.*
Explanation	• *Visualizes and explains properties of quadrilaterals.* • *Solves problems based on properties of quadrilaterals.*

5- CIRCLES

(Prove) Equal chords of a circle subtend equal angles at the center and (State without proof) its converse.

(State without proof) The perpendicular from the center of a circle to a chord bisects the chord and conversely, the line drawn through the center of a circle to bisect a chord is perpendicular to the chord.

(State without proof) Equal chords of a circle (or of congruent circles) are equidistant from the center (or their respective centers) and conversely.

(Prove) The angle subtended by an arc at the center is double the angle subtended by it at any point on the remaining part of the circle.

(State without proof) Angles in the same segment of a circle are equal.

(State without proof) If a line segment joining two points subtends equal angle at two other points lying on the same side of the line containing the segment, the four points lie on a circle.

(State without proof) The sum of either of the pair of the opposite angles of a cyclic quadrilateral is 180° and its converse

Competencies	*Proves theorems about the geometry of a circle, including its chords and subtended angles.*
Explanation	• *Visualizes and explains properties of circles.* • *Solves problems based on properties of circle.*

UNIT V: MENSURATION

1. AREAS

Area of a triangle using Heron's formula (without proof)

Competencies	*Visualizes, represents, and calculates the area of atriangle using Heron's formula.*
Explanation	*States and applies Heron's Formula to find area of a triangle.*

2. SURFACE AREAS AND VOLUMES

Surface areas and volumes of spheres (including hemispheres) and right circular cones.

Competencies	*Visualizes and uses mathematical thinking to discover formulas to calculate surface areas and volumes of solid objects (spheres, hemispheres and right circular cones)*
Explanation	*Solves problems based on surface areas and volumes of threedimensional shapes (spheres/hemisphere, right circular cones).*

UNIT VI: STATISTICS

STATISTICS

Bar graphs, histograms (with varying base lengths), and frequency polygons.

Competencies	*Draws and interprets bar graph, histogram and frequency polygon.*
Explanation	*Represents data using Bar Graph, Histogram and frequency polygon.*

NOTE- The following additional topics are also included in the syllabus, but will not be assessed in the examinations. Subject teachers can integrate these with existing chapters as they align well.

Unit-II : ALGEBRA *LINEAR EQUATIONS IN TWO VARIABLES*

1. *Graph of linear equations in two variables.*
2. *Examples, problems from real life, including problems on Ratio and Proportion and with algebraic and graphical solutions being done simultaneously.*

Unit-III : *COORDINATE GEOMETRY: Plotting points in the plane.*

Unit-IV : *LINES AND ANGLES*

1. *(State without proof) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.*
2. *(Prove) The sum of the angles of a triangle is 180°.*
3. *(State without proof) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two interior opposite angles.*

TRIANGLES (State without proof) Triangle inequalities and relation between 'angle and facing side' inequalities in triangles.

AREAS OF PARALLELOGRAMS AND TRIANGLES

Review concept of area, recall area of a rectangle.

1. *(Prove) Parallelograms on the same base and between the same parallels have equal area.*
2. *(State without proof) Triangles on the same base (or equal bases) and between the same parallels are equal in area.*

CIRCLES

1. *Through examples, arrive at definition of circle and related concepts-radius, circumference, diameter, chord, arc, secant, sector, segment, subtended angle.*
2. *(State without proof) There is one and only one circle passing through three given non-collinear points.*

CONSTRUCTIONS

1. *Construction of bisectors of line segments and angles of measure 60° , 9 0° , 45 ° etc., equilateral triangles.*
2. *Construction of a triangle given its base, sum/difference of the other two sides and one base angle.*

UnitVI : *AREAS- Application of heron's formula in finding the area of a quadrilateral.*

SURFACE AREAS AND VOLUMES- Surface areas and volumes of cubes, cuboids and right circular cylinders.

Unit-VI : *STATISTICS*

1. *Introduction to Statistics: Collection of data, presentation of data-tabular form, ungrouped / grouped data.*
2. *Mean, median and mode of ungrouped data.*

PROBABILITY

1. *History, Repeated experiments and observed frequency approach to probability. Focus is on empirical probability. (A large amount of time to be devoted to group and to individual activities to motivate the concept);*
2. *The experiments to be drawn from real - life situations, and from examples used in the chapter on statistics).*

INTERNAL ASSESSMENT **Max. Marks: 20**

(i) Activities (02)- 2X5 **10 Marks**

(ii) Project Work (01) **05 Marks**

(iii) Continuous Assessment (Unit Test) **05 Marks**

(There will be total 4 Unit Tests to be conducted throughout the year (two Unit Tests before half yearly examination and two after half yearly examination). At the time of half yearly result preparation best of two Unit Tests (I & II) marks will be taken and converted to the weightage of 05 marks. Likewise best of two Unit Tests (III & IV) marks will be taken and converted to the weightage of 05 marks for the annual result preparation.)

Class – X

TOTAL MARKS- 100 ¡ 80 (Theory) + 20 (Internal Assessment)À

THEORY: 80 Marks **Time: 3:00 Hrs.**

Units	Unit Name	Marks
I	NUMBER SYSTEMS	06
II	ALGEBRA	20
III	COORDINATE GEOMETRY	06
IV	GEOMETRY	15
V	TRIGONOMETRY	12
VI	MENSURATION	10
VII	STATISTICS & PROBABILTY	11
	Total	**80**

UNIT I: NUMBER SYSTEMS

REAL NUMBER

Fundamental Theorem of Arithmetic- statements after reviewing work done earlier and after illustrating and motivating through examples

Proofs of irrationality of $\sqrt{2}, \sqrt{3}\ \sqrt{5}$

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Competencies	• *Develops understanding of numbers, including the set of real numbers and its properties.* • *Extends the understanding of powers (radical powers) and exponents.* • *Applies Fundamental Theorem of Arithmetic to solve problems related to real life contexts.*
Explanation	• *Describes Fundamental Theorem of Arithmetic with examples* • *Prove algebraically the Irrationality of numbers like √2, √3, √5, 3 + 2√5 etc.*

UNIT II: ALGEBRA

1. POLYNOMIALS

Zeros of a polynomial.

Relationship between zeros and coefficients of quadratic polynomials.

Competencies	*Develops a relationship between algebraic and graphical methods of finding the zeroes of a polynomial.*
Explanation	*Find the zeros of polynomial graphically and algebraically and verifying the relation between zeros and coefficients of quadratic polynomials.*

2. PAIR OF LINEAR EQUATIONS IN TWO VARIABLES

Pair of linear equations in two variables and graphical method of their solution, consistency/inconsistency.

Algebraic conditions for number of solutions.

Solution of a pair of linear equations in twovariables algebraically- by substitution, by elimination.

Simple situational problems.

Competencies	• *Describes plotting a pair of linear equations and graphically finding the solution.* • *Models and solves contextualized problems using equations (e.g., simultaneous linear equations in two variables).*
Explanation	*Find the solution of pair of linear equations in two variables graphically and algebraically (substitution and elimination method)*

3. QUADRATIC EQUATIONS

Standard form of a quadratic equation $ax^2 + bx + c = 0, (a \neq 0)$.

Solutions of quadratic equations (only real roots) by factorization, and by using quadratic formula.

Relationship between discriminant and nature of roots.

Situational problems based on quadratic equations related to day to day activities to be incorporated.

Competencies	*Demonstrates strategies of finding roots and determining the nature of roots of a quadratic equation.*
Explanation	• *Solves quadratic equations using factorization and quadratic formula* • *Determines the nature of roots using discriminant* • *Formulates and solves problems based on real life context*

4. ARITHMETIC PROGRESSIONS

Motivation for studying Arithmetic Progression

Derivation of the n^{th} term and sum of thefirst n terms of AP and their application in solving daily life problems.

Competencies	*Develops strategies to apply the concept of AP to daily life situations.*
Explanation	• *Applies concepts of AP to find the* n^{th} *term and sum of n terms.* • *Application of AP in real life problems*

UNIT III: COORDINATE GEOMETRY

Coordinate Geometry

Review: Concepts of coordinate geometry. Distance formula. Section formula (internal division).

Competencies	*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 the coordinates of a point between any two given points.
Explanation	*Solves problems using distance formula and section formula.*

UNIT IV: GEOMETRY

1. TRIANGLES

Definitions, examples, counter examples of similar triangles.

a. (Prove) If a line is drawn parallel to one side of a triangle to intersect the other two sides in distinct points, the other two sides are divided in the same ratio.
b. State (without proof) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
c. State (without proof) If in two triangles, the corresponding angles are equal, their correspondingsides are proportional and the triangles are similar.
d. State (without proof) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
e. State (without proof) If one angle of a triangle is equal to one angle of another triangle and the sides including these angles are proportional, the two triangles are similar.

Competencies	• *Works out ways to differentiate between congruent and similar figures.* • *Establishes properties for similarity of two triangles logically using different geometric criteria established earlier such as, Basic Proportionality Theorem, etc.*
Explanation	• *Prove Basic Proportionality theorem and applying the theorem and its converse in solving questions.* • *Prove similarity of triangles using different similarity criteria.*

2. CIRCLES

Tangent to a circle at, point of contact

a. (Prove) The tangent at any point of a circle is perpendicular to the radius through thepoint of contact.
b. (Prove) The lengths of tangents drawn from an external point to a circle are equal.

Competencies	*Derives proofs of theorems related to the tangents of circles.*
Explanation	• *Prove the theorems based on the tangent to a circle.* • *Applies the concept of tangents of circle to solve various problems*

UNIT V: TRIGONOMETRY

1. INTRODUCTION TO TRIGONOMETRY

Trigonometric ratios of an acute angle of a right-angled triangle. Proof of their existence (well defined)

Motivate the ratios whichever are defined at 0º and 90º. Values of the trigonometric ratios of 30^0, 45^0 and 60^0.

Relationships between the ratios.

Competencies	*Understands the definitions of the basic trigonometric functions (including the introduction of the sine and cosine functions).*
Explanation	• *Evaluates trigonometric ratios* • *Describes trigonometric ratios of standard angles and solving related expressions*

2. TRIGONOMETRIC IDENTITIES

Proof and applications of the identity $sin^2A + cos^2A = 1$.

Only simple identities to be given.

Competencies	*Uses Trigonometric identities to solve problems.*
Explanation	*Proves trigonometric identities using $\sin^2A + \cos^2A = 1$ and other identities*

3. HEIGHTS AND DISTANCES: Angle of Elevation, Angle of Depression.

Simple problems on heights and distances. Problems should not involve more than two right triangles. Angles of elevation / depression should be only 30°, 45°, and 60°.

Competencies	*Applies Trigonometric ratios in solving problems in daily life contexts like finding heights of different structures or distance from them.*
Explanation	*Find heights and distances in real life word problems using trigonometric ratios*

UNIT VI: MENSURATION

1. AREAS RELATED TO CIRCLES

Area of sectors and segments of a circle.

Problems based on areas and perimeter/circumference of the above said plane figures. (In calculating area of segment of a circle, problems should be restricted to central angle of 60°, 90° and 120° only.

Competencies	*Derives and uses formulae to calculate areas of plane figures.*
Explanation	*Visualises and evaluates areas of sector and segment of a circle.*

2. SURFACE AREAS AND VOLUMES

Surface areas and volumes of combinations of any two of the following: cubes, cuboids,spheres, hemispheres and right circular cylinders/cones.

Competencies	*Visualises and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders/cones, and their combinations).*
Explanation	*Evaluates the surface areas and volumes of combinations of solids by visualisation*

UNIT VII: STATISTICS AND PROBABILITY

1. STATISTICS

Mean, median and mode of grouped data (bimodal situation to be avoided).

Competencies	*Calculates mean, median and mode for different sets of data related with real life contexts.*
Explanation	• *Computes the mean, of a grouped frequency distribution using direct, assumed mean and step deviation method.* • *Computes the median and mode of grouped frequency distribution by algebraic method*

2. PROBABILITY

Classical definition of probability.

Simple problems on finding the probability of an event.

Competencies	*Applies concepts from probability to solve problems on the likelihood of everyday events.*
Explanation	*Determines the probabilities in simple real-life problems*

INTERNAL ASSESSMENT **Max. Marks: 20**

(i) Activities (02)- 2X5 **10 Marks**

(ii) Project Work (01) **05 Marks**

(iii) Continuous Assessment (Unit Test) **05 Marks**

(There will be total 3 Unit Tests (two Unit Tests before half yearly examination and one after half yearly examination) and a pre-board examination. At the time of half yearly result preparation best of two Unit Tests (I & II) marks will be taken and converted to the weightage of 05 marks. In annual board examination, marks of the best out of 3 Unit Tests will be taken and converted to the weightage of 05 marks for the board result preparation.)

PRESCRIBED BOOKS:

1. Xkf.kr (Mathematics) - Textbook for class IX - NCERT Publication

2. Xkf.kr (Mathematics) - Textbook for class X - NCERT Publication

3. Laboratory Manual - Mathematics, secondary stage - NCERT Publication

4. Mathematics exemplar problems for class IX, NCERT publication.

5. Mathematics exemplar problems for class X, NCERT publication.

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