

2023-24

MATHEMATICS (031)

Class – IX

TOTAL MARKS- 100 { 80 (Theory) + 20 (Internal Assessment) }

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
<b>Total</b>		<b>80</b>

### UNIT I: NUMBER SYSTEMS

#### REAL NUMBERS

- 1- Review of representation of natural numbers, integers, and rational numbers on the number line. 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.)

### 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.

#### 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 real numbers, plotting

## UNIT III: COORDINATE GEOMETRY

### COORDINATE GEOMETRY

The Cartesian plane, coordinates of a point, names and terms associated with the coordinate plane, 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. Showing the relationship between axiom and theorem, for example:

(Axiom) 1. Given two distinct points, there exists one and only one line through them.

(Theorem) 2. (Prove) Two distinct lines cannot have more than one point in common.

### 2- LINES AND ANGLES

- (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is  $180^\circ$  and the converse.
- (Prove) If two lines intersect, vertically opposite angles are equal.
- (Motivate) Lines which are parallel to a given line are parallel.

### 3- TRIANGLES

- (Motivate) Two triangles are congruent if any two sides and the included angle of one triangle is equal 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 to any two angles and the included side of the other triangle (ASA Congruence).
- (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence).
- (Motivate) 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.
- (Motivate) The sides opposite to equal angles of a triangle are equal.

### 4- QUADRILATERALS

- (Prove) The diagonal divides a parallelogram into two congruent triangles.
- (Motivate) In a parallelogram opposite sides are equal, and conversely.
- (Motivate) In a parallelogram opposite angles are equal, and conversely.
- (Motivate) A quadrilateral is a parallelogram if a pair of its opposite sides is parallel and equal.
- (Motivate) In a parallelogram, the diagonals bisect each other and conversely.
- (Motivate) In a triangle, the line segment joining the mid points of any two sides is parallel to the third side and in half of it and (motivate) its converse.

### 5- CIRCLES

- (Prove) Equal chords of a circle subtend equal angles at the center and (motivate) its converse.
- (Motivate) 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.
- (Motivate) 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.
- (Motivate) Angles in the same segment of a circle are equal.
- (Motivate) 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.
- (Motivate) The sum of either of the pair of the opposite angles of a cyclic quadrilateral is  $180^\circ$  and its converse.

## UNIT V: MENSURATION

### 1. AREAS

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

### 2. SURFACE AREAS AND VOLUMES

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

## UNIT VI: STATISTICS

### STATISTICS

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

## 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) }**

**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 & PROBABILITY	11
<b>Total</b>		<b>80</b>

## 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  $\sqrt{2}, \sqrt{3}, \sqrt{5}$

## UNIT II: ALGEBRA

### 1. POLYNOMIALS

Zeros of a polynomial. Relationship 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 two variables algebraically- by substitution, by elimination. Simple situational problems.

### 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.

### 4. ARITHMETIC PROGRESSIONS

Motivation for studying Arithmetic Progression Derivation of the  $n^{\text{th}}$  term and sum of the first  $n$  terms of A.P. and their application in solving daily life problems.

## UNIT III: COORDINATE GEOMETRY

### Coordinate Geometry

**Review:** Concepts of coordinate geometry, graphs of linear equations. Distance formula. Section formula (internal division).

## UNIT IV: GEOMETRY

### 1. TRIANGLES

Definitions, examples, counter examples of similar triangles.

- (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.
- (Motivate) If a line divides two sides of a triangle in the same ratio, the line is parallel to the third side.
- (Motivate) If in two triangles, the corresponding angles are equal, their corresponding sides are proportional and the triangles are similar.
- (Motivate) If the corresponding sides of two triangles are proportional, their corresponding angles are equal and the two triangles are similar.
- (Motivate) 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.

### 2. CIRCLES

Tangent to a circle at, point of contact

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

## 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  $0^\circ$  and  $90^\circ$ . Values of the trigonometric ratios of  $30^\circ$ ,  $45^\circ$  and  $60^\circ$ . Relationships between the ratios.

### 2. TRIGONOMETRIC IDENTITIES

Proof and applications of the identity  $\sin^2 A + \cos^2 A = 1$ . Only simple identities to be given.

### 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  $30^\circ$ ,  $45^\circ$ , and  $60^\circ$ .

## 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  $60^\circ$ ,  $90^\circ$  and  $120^\circ$  only.

### 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.

## **UNIT VII: STATISTICS AND PROBABILITY**

### **1. STATISTICS**

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

### **2. PROBABILITY**

Classical definition of probability. Simple problems on finding the probability of an event.

## **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 to be conducted throughout the year. 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 result preparation.)

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## **PRESCRIBED BOOKS:**

1. Mathematics - Textbook for class IX - NCERT Publication
2. 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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