

Class - IX

Units :

- I. Number Systems
- II. Algebra
- III. Coordinate Geometry
- IV. Geometry
- V. Mensuration
- VI. Statistics and Probability

Appendix :

1. Proofs in Mathematics,
2. Introduction to Mathematical Modelling.

Number System

1. Real Numbers : (Periods 20)

Review of representation of natural number, 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.

Examples of non-recurring/non-terminating decimals such as $\sqrt{2}, \sqrt{3}, \sqrt{5}$ etc. 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, every point on the number line represents a unique real number.

Existence of \sqrt{x} for a given positive real number x (visual proof to be emphasized). Definition of n^{th} root of real number.

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.)

Rationalisation (with precise meaning) of real number of the type (and their combinations)

$$\text{and } \frac{1}{x + \sqrt{y}} \text{ where } x \text{ and } y \text{ are natural}$$

numbers and a, b are integers.

Algebra

2. Polynomials (Periods 25)

Definition of a polynomial in one variable, its coefficients, with examples and counter examples, its terms, zero polynomial. Degree of a polynomial. constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials. Factors and multiples. Zeros/roots of a polynomial/equation. State and motivate the 'Remainder Theorem with examples and analogy to integers. Statement and proof of the Factor Theorem.

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

Recall of algebraic expressions and identities. Further identities of the type:

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

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

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

and their use in factorization of polynomials. Simple expressions reducible to these polynomials.

3. Co-ordinate Geometry (Periods 9)

The Cartesian plane, coordinates of a point, names and

terms associated with the coordinate plane, notations, plotting points in the plane, graph of linear equations as examples; focus on linear equations of the type $ax + by + c = 0$ by writing it as $y = mx + c$ and linking with the chapter on linear equations in two variables,

4. Linear Equations in Two Variables (periods 12)

Recall of linear equations in one variable. Introduction to the equation in two variables. Prove that a linear equation in two variables has infinitely many solutions, and justify their being written as ordered pairs of real numbers, plotting them and showing that they seem to lie on a line. Examples, problems from real life, including problems on Ratio and Proportion and with algebraic and graphical solutions being done simultaneously.

Geometry:

1. Lines and Angles (Periods 10)

- i) (Motivate) If a ray stands on a line, then the sum of the two adjacent angles so formed is 180° and the converse.
- ii) (Prove) If two lines intersect, the vertically opposite angles are equal.
- iii) (Motivate) Results on corresponding angles, alternate angles, interior angles when a transversal intersects two parallel lines.
- iv) (Motivate) Lines, which are parallel to a given line, are parallel.
- v) (Prove) The sum of the angles of a triangle is 180° .
- vi) (Motivate) If a side of a triangle is produced, the exterior angle so formed is equal to the sum of the two remote interior angles.

2. Triangles (Periods 20)

- i) (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).

- ii) (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).
- iii) (Motivate) Two triangles are congruent if the three sides of one triangle are equal to three sides of the other triangle (SSS Congruence)
- iv) (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.
- v) (Prove) The angles opposite to equal sides of a triangle are equal.
- vi) (Motivate) The sides opposite to equal angles of a triangle are equal.
- vii) (Motivate) Triangle inequalities and relation between 'angle and facing side; inequalities in a triangle.

3. Quadrilaterals : (Periods 10)

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

4. Area : (Period 4)

Review concept of area, recall area of a rectangle.

- i) (Prove) Parallelograms on the same base and between the same parallels have the same area.
- ii) (Motivate) Triangles on the same base and between the same parallels are equal in area and its converse.

5. Circle : (Period 15)

Through examples, arrive at definitions of circle. related concepts, radius, circumference, diameter, chord, arc, subtended angle.

- i) (Prove) Equal chords of a circle subtend equal angles at the centre and (motivate) its converse.
- ii) (Motivate) The perpendicular from the centre of a circle to a chord bisects the chord and conversely, the line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.
- iii) (Motivate) There is one and only one circle passing through three given non-collinear points.
- iv) (Motivate) Equal chords of a circle (or of congruent circles) are equidistant from the centre (s) and conversely.
- v) (Prove) The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
- vi) (Motivate) Angles in the same segment of a circle are equal.
- vii) (Motivate) If a line segment joining two points subtends equal angle at two different points lying on the same side of the line containing the segment, the four points lie on a circle.
- viii) (Motivate) The sum of the either pair of the opposite angles of a cyclic quadrilateral is 180° and its converse.

Mensuration

6. Areas :

- i) **Surface Areas and Volumes :** (Periods 4)
Area of a triangles using Heron's formula (without proof) and its application in finding the area of a quarilateral.
- ii) **Surface Areas and Volumes :** (Periods 10)
Surface areas and volumes of cubes, cuboids, spheres (including hemispheres) and right circular cylinders/cones.

Statistics and Probability

1. **Statistics :** (Periods 13)
Introduction to Statistics : Collection of data, Presentation of data-tabular form, ungrouped/ grouped, frequency polygons, qualitative analysis of data to choose the correct form of presentation for the correct data. Mean median, mode of ungrouped data.
2. **Probability :** (Periods 12)
History, Repeated experiments and observed frequency approach to probability. Focus is on empirical probability. (A long period of time to be devoted to group and to individual activities to motivate the concept; the experiments to be drawn from real-life situations, and from examples used in the chapter on statistics).

Appendix

1. Proof in Mathematics :

What a statement is; when is a statement mathematically valid. Explanation of axiom/ postulates through familiar examples. Difference beteen axiom, conjecture and theorem. the concept and nature of a 'proof' (emphasize deductive nature of the proof, the writing of a proof. Illustrate deductive

proof with complete arguments using simple results from arithmetic, algebra and geometry (e.g., product of two odd numbers is odd etc.) Particular stress on verification not being proof. Illustrate with a few examples of verifications leading to wrong conclusions-include statements like “every odd number greater than 1 is a prime number”.What does disproving mean, use of counter examples.

2. ***Introduction to Mathematical modelling :***

The concept of mathematical modelling, review of work done in earlier classes while looking at situational problems, aims of mathematical modelling, discussing the broad stages of modelling in real life situations, setting up of hypothesis, determining an appropriate model, solving the mathematical problem equivalent, analyzing the conclusions and their real-life interpretation, validating the model. Examples to be drawn from ratio, proportion, percentages, etc.



LIST OF PRACTICALS IN MATHEMATICS FOR CLASS-IX

1. Draw the Square Spiral
2. Locate the following irrational numbers on the Number line

$$(ii) 2 + \sqrt{3}$$

$$(iii) 3 - \sqrt{2}$$

$$(iv) 4 - \sqrt{3}$$

$$(v) 2\sqrt{3}$$

$$(vi) 3\sqrt{2}$$

$$(vii) -2\sqrt{3}$$

$$(viii) -3\sqrt{2}$$

3. Represent $\sqrt{7.9}$ on the Number line.
4. The relation between the two scales of temperature in Fahrenheit and Celsius is given by the following equation:

$$F = \left(\frac{9}{5}\right)C - 32, \text{ where } F \text{ represents Fahrenheit and } C$$

represents Celsius.

Draw the graph of this equation and answer the following question with the help of the graph.

- (i) If the temperature is 30°C , what is the temperature in Fahrenheit?
 - (ii) If the temperature is 95°F , what is the temperature in Celsius?
 - (iii) If the temperature is 0°C , what is the temperature in Fahrenheit and if the temperature is 0°F , what is the temperature in Celsius?
 - (iv) At what point temperature in Fahrenheit and Celsius scale are numerically equal?
5. Verify all the properties of parallel lines related to various types of angles formed by a transversal with the parallel lines?

6. Verification of angle sum property of triangle.
7. Verification of angle sum property of quadrilateral.
Verification of the following two theorems.
8. Angles opposite to equal sides of an isosceles triangle are equal.
9. The sides opposite to equal angles of a triangle are equal.
10. If two sides of a triangle are unequal, the angle opposite to the longer side is larger (or greater)
11. In any triangle the side opposite to the larger (greater) angle is longer.
12. A diagonal of a parallelogram divides it into two congruent triangles.
13. In a parallelogram opposite sides are equal.
14. In a parallelogram, opposite angles are equal.
15. The diagonals of a parallelogram bisect each other.
16. If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.
17. If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.
18. The line segment joining the mid points of two sides of a triangle is parallel to the third side.
19. Parallelograms on the same base and between the same parallels have equal area.
20. If the angles subtended by the chords of a circle at the centre are equal, then the chords are equal in length.
21. The perpendicular from the centre of a circle to a chord, bisects the chord.
22. The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.
23. There is one and only one circle passing through three given non-collinear points.
24. Equal chords of a circle (or of congruent circles) are equidistant from the centre (or centres)

25. Chords equidistant from the centre of a circle are equal in length.
26. The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.
27. Angles in the same segment of a circle are equal.
28. The sum of either pair of opposite angles of a cyclic quadrilateral is 180°
29. Verification of Heron's Formula for area of triangle.
30. Construct a cuboid and verify the formula of its surface area.
31. Construct a cube and verify the formula of its surface area.
32. Construct a frequency distribution table showing cumulative frequency of certain data collected by yourself practically and draw the histogram and frequency polygon. (This practical should be compulsory)
33. Find the probability of getting head and tail from the experiment of tossing a coin practically. (students should toss the coin at least hundred times)
34. **Project :** (1) Write a brief history on Geometry/Algebra/Trigonometry.
(2) Write about the discoveries/inventions of 3/4 great mathematicians.

Important Note :

N.B. - Students should do at least 15 practicals and at least one project work.

Revised syllabus of Mathematics, Class-IX

GENERAL MATHEMATICS

Subject Code : C2

Class : IX
Full Marks : 100

Time : 3 hours
Pass Marks : 30

Theory : 90
Internal Assessment : 10
Pass marks in written examination : 27

Chapter No.	Chapter Name	Units Required	Units Omitted	Tentative number of classes required	Marks	
					Half Yearly	Annual
	Revision Chapter	Part I	Part II	9	✓	✓
1.	Number System	Whole chapter	Nil	13	✓	✓
2.	Polynomials	Whole chapter	Nil	22	✓	✓
3.	Coordinate Geometry	Whole chapter	Nil	22	✓	✓
4.	Linear Equations in two variables	Whole chapter	Nil	14	✓	✓
5.	Introduction to Euclid's Geometry	Whole chapter	Nil	8	✓	✓
6.	Lines and Angles	Whole chapter	Nil	10	✓	✓
7.	Triangles	Whole chapter	Nil	12	✓	✓
8.	Quadrilaterals	Whole chapter	Nil	11		✓
9.	Areas of Parallelograms and Triangles	Whole chapter	Nil	19		✓
10.	Circles	Whole chapter	Nil	19		✓
11.	Heron's Formula	Whole chapter	Nil	15		✓
12.	Surface Area and Volume	Whole chapter	Nil	12		✓
13.	Statistics	Whole chapter	Nil	12		✓
	Theory Total				90	90
	Internal Assessment				10	10
	Grand Total				100	100

Textbook : Mathematics (for class IX), published by ASTPPCL

* Questions from each Unit/Lesson will carry marks 2-15.