

## MATHEMATICS (51)

### Aims:

1. To acquire knowledge and understanding of the terms, symbols, concepts, principles, processes, proofs, etc. of mathematics.
2. To develop an understanding of mathematical concepts and their application to further studies in mathematics and science.
3. To develop skills to apply mathematical knowledge to solve real life problems.
4. To develop the necessary skills to work with modern technological devices such as calculators and computers.
5. To develop drawing skills, skills of reading tables, charts and graphs.
6. To develop an interest in mathematics.

### CLASS IX

There will be **one** paper of **two and a half** hours duration carrying 80 marks and Internal Assessment of 20 marks.

The paper will be divided into **two** sections, Section I (40 marks), Section II (40 marks).

**Section I:** will consist of compulsory short answer questions.

**Section II:** Candidates will be required to answer **four** out of **seven** questions.

The solution of a question may require the knowledge of more than one branch of the syllabus.

#### 1. Pure Arithmetic

##### (i) Irrational Numbers

- (a) Rational, irrational numbers as real numbers, their place in the number system. Surds and rationalization of surds.
- (b) Irrational numbers as non-repeating, non-terminating decimals.
- (c) Classical definition of a rational number  $p/q$ ,  $p, q \in \mathbb{Z}$ ,  $q \neq 0$ .

Hence, define irrational numbers as what cannot be expressed as above.

- (d) Simplifying an expression by rationalising the denominator.

#### 2. Commercial Mathematics

##### (i) Profit and Loss

The meaning of Marked price, selling price and discount, thus giving an idea of profit and loss on day to day dealings. Simple problems related to

Profit and Loss and Discount, including inverse working.

##### (ii) Compound Interest

- (a) Compound Interest as a repeated Simple Interest computation with a growing Principal. Use of formula -

$$A = P\left(1 + \frac{r}{100}\right)^n. \text{ Finding CI from the}$$

relation  $CI = A - P$ . Simple direct problems based on above formulae.

#### 3. Algebra

##### (i) Expansions

$$(a \pm b)^2$$

$$(a \pm b)^3$$

$$(x \pm a)(x \pm b)$$

##### (ii) Factorisation

$$a^2 - b^2$$

$$a^3 \pm b^3$$

$$ax^2 + bx + c, \text{ by splitting the middle term.}$$

##### (iii) Changing the subject of a formula.

- Concept that each formula is a perfect equation with variables.
- Concept of expressing one variable in terms of another various operators on terms transposing the terms squaring or taking square root etc.

##### (iv) Linear Equations and Simultaneous (linear) Equations

(a) Solving algebraically (by elimination as well as substitution) and graphically.

(a) Solving simple problems based on these by framing appropriate formulae.

(v) Indices/ Exponents

Handling positive, fractional, negative and “zero” indices.

Simplification of expressions involving various exponents

$$a^m \times a^n = a^{m+n}, a^m \div a^n = a^{m-n}, (a^m)^n = a^{mn}$$

etc use of laws of exponents.

(vi) Logarithms

(a) Logarithmic form vis-à-vis exponential form: interchanging.

(b) Laws of Logarithms and its use

Expansion of expression with the help of laws of logarithm

$$\text{eg. } y = \frac{a^4 \times b^2}{c^3}$$

$$\log y = 4 \log a + 2 \log b - 3 \log c \text{ etc. .}$$

#### 4. Geometry

(i) Triangles, Relation between sides and angles of triangles. Types of triangles, Congruent triangles.

(a) Congruency: four cases: SSS, SAS, AAS, RHS. Illustration through cutouts. Simple applications.

(b) Problems based on:

- Angles opposite equal sides are equal and converse.
- If two sides of a triangle are unequal, then the greater angle is opposite the greater side and converse.
- Sum of any two sides of a triangle is greater than the third side.
- Of all straight lines that can be drawn to a given line from a point outside it, the perpendicular is the shortest.

**Proofs not required.**

(ii) Constructions (using ruler and compasses)

Constructions of triangles involving  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $75^\circ$ ,  $90^\circ$ ,  $120^\circ$ ,  $135^\circ$  angles.

(iii) Mid Point Theorem and its converse, equal intercept theorem

(a) Proof and simple applications of mid point theorem and its converse.

(b) Equal intercept theorem: proof and simple application.

(iv) Similarity, conditions of similar triangles.

(a) As a size transformation.

(b) Comparison with congruency, keyword being proportionality.

(c) Three conditions: SSS, SAS, AA. Simple applications (proof not included).

(d) Applications of Basic Proportionality Theorem.

(v) Pythagoras Theorem

Proof and Simple applications of Pythagoras Theorem and its converse.

(vi) Rectilinear Figures

Rectilinear figures or polygons, Different kinds of polygons and its names interior and exterior angles and their relations. Types of regular polygons parallelograms, conditions of parallelograms, Rhombus, Rectangles. Proof and use of theorems on parallelogram.

(a) Sum of interior angles of a polygon.

(b) Sum of exterior angles of a polygon.

(c) Regular polygons.

(d) Parallelogram:

- Both pairs of opposite sides equal (without proof).
- Both pairs of opposite angles equal.
- One pair of opposite sides equal and parallel (without proof).
- Diagonals bisect each other and bisect the parallelogram.
- Rhombus as a special parallelogram whose diagonals meet at right angles.
- In a rectangle, diagonals are equal, in a square they are equal and meet at right angles.

## Quadrilaterals

- (e) *Construction of quadrilaterals (including parallelograms and rhombus) and regular hexagon using ruler and a pair of compasses only.*
- (f) Proof and use of area theorems on parallelograms:
- *Parallelograms on the same base and between the same parallels are equal in area.*
  - *The area of a triangle is half that of a parallelogram on the same base and between the same parallels.*
  - *Triangles between the same base and between the same parallels are equal in area (without proof).*
  - *Triangles with equal areas on the same bases have equal corresponding altitudes.*

**Note: Proofs of the theorems given above are to be taught unless specified otherwise.**

## 5. Statistics

Introduction, collection of data, presentation of data, Graphical representation of data, Mean, Median of ungrouped data.

- (i) *Understanding and recognition of raw, arrayed and grouped data.*
- (ii) *Tabulation of raw data using tally-marks.*
- (iii) *Understanding and recognition of discrete and continuous variables.*
- (iv) *Mean, median of ungrouped data*
- (v) *Class intervals, class boundaries and limits, frequency, frequency table, class size for grouped data.*
- (vi) *Grouped frequency distributions: the need to and how to convert discontinuous intervals to continuous intervals.*
- (vii) *Drawing a histogram and frequency polygon.*
- (viii) *Understanding of how a histogram differs from a bar chart.*

## 6. Mensuration

Area and perimeter of a triangle and a quadrilateral. Area and circumference of a circle. Surface area and volume of Cube, Cuboids and Cylinder.

- (a) *Area and perimeter of triangle (including Heron's formula), square, rhombus, rectangle, parallelogram and trapezium.*
- (ii) *Circle: Area and circumference*
- (iii) *Simple direct problems involving inner and outer dimensions and cost.*
- (b) *Surface area and volume of 3-D solids: cube, cuboid and cylinder including problems of type involving:*
- *Different internal and external dimensions of the solid.*
  - *Cost.*
  - *Concept of volume being equal to area of cross-section  $\times$  height.*
  - *Open/closed cubes/cuboids/cylinders.*

## 7. Trigonometry

- (a) *Trigonometric Ratios: sine, cosine, tangent of an angle and their reciprocals.*
- (b) *Trigonometric ratios of standard angles- 0, 30, 45, 60, 90 degrees. Evaluation of an expression involving these ratios.*
- (c) *Simple 2-D problems involving one right-angled triangle.*
- (d) *Concept of sine and cosine being complementary with simple, direct application.*

## 8. Co-ordinate Geometry

Cartesian System, Plotting a point in the plane for given coordinates.

- (a) *Dependent and independent variables.*
- (b) *Ordered pairs, co-ordinates of points and plotting them in the Cartesian Plane.*
- (c) *Graphs of  $x=0$ ,  $y=0$ ,  $x=a$ ,  $y=a$ ,  $x=y$ ,  $y=mx+c$  including identification and conceptual understanding of slope and y-intercept.*
- (d) *Recognition of graphs based on the above.*

## INTERNAL ASSESSMENT

A minimum of three assignments are to be done during the year as prescribed by the teacher.

### Suggested Assignments

- Surveys of a class of students - height, weight, number of family members, pocket money, etc.
- Correlation of body weight to body height.
- Planning delivery routes for a postman/milkman.
- Running a tuck shop/canteen.
- Visit one or two stores where sales are being offered to investigate - cost price, marked price, selling price, discount, profit/loss.
- Study ways of raising a loan to buy a car or house, e.g. bank loan or purchase a refrigerator or a television set through hire purchase.

## INTERNAL ASSESSMENT IN MATHEMATICS- GUIDELINES FOR MARKING WITH GRADES

Criteria	Preparation	Concepts	Computation	Presentation	Understanding	Marks
Grade I	Exhibits and selects a well defined problem. Appropriate use of techniques.	Admirable use of mathematical concepts and methods and exhibits competency in using extensive range of mathematical techniques.	Careful and accurate work with appropriate computation, construction and measurement with correct units.	Presents well stated conclusions; uses effective mathematical language, symbols, conventions, tables, diagrams, graphs, etc.	Shows strong personal contribution; demonstrate knowledge and understanding of assignment and can apply the same in different situations.	4 marks for each criterion
Grade II	Exhibits and selects routine approach. Fairly good techniques.	Appropriate use of mathematical concepts and methods and shows adequate competency in using limited range of techniques.	Commits negligible errors in computation, construction and measurement.	Some statements of conclusions; uses appropriate math language, symbols, conventions, tables, diagrams, graphs, etc.	Neat with average amount of help; assignment shows learning of mathematics with a limited ability to use it.	3 marks for each criterion
Grade III	Exhibits and selects trivial problems. Satisfactory techniques.	Uses appropriate mathematical concepts and shows competency in using limited range of techniques.	Commits a few errors in computation, construction and measurement.	Assignment is presentable though it is disorganized in some places.	Lack of ability to conclude without help; shows some learning of mathematics with a limited ability to use it.	2 marks for each criterion
Grade IV	Exhibits and selects an insignificant problem. Uses some unsuitable techniques.	Uses inappropriate mathematical concepts for the assignment.	Commits many mistakes in computation, construction and measurement.	Presentation made is somewhat disorganized and untidy.	Lack of ability to conclude even with considerable help; assignment contributes to mathematical learning to a certain extent.	1 mark for each criterion
Grade V	Exhibits and selects a completely irrelevant problem. Uses unsuitable techniques.	Not able to use mathematical concepts.	Inaccurate computation, construction and measurement.	Presentation made is completely disorganized, untidy and poor.	Assignment does not contribute to mathematical learning and lacks practical applicability.	0 mark