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 in real life situations.
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) and 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

Rational and Irrational Numbers

Rational, irrational numbers as real numbers, their place in the number system. Surds and rationalization of surds. Simplifying an expression by rationalizing the denominator. Representation of rational and irrational numbers on the number line.

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

2. Commercial Mathematics

Compound Interest

(a) Compound interest as a repeated Simple Interest computation with a growing Principal. Use of this in computing Amount over a period of 2 or 3 years.

(b) Use of formula $A = P(1 + \frac{r}{100})^n$. *Finding CI from the relation CI = A – P.*

- *Interest compounded half-yearly included.*
- *Using the formula to find one quantity given different combinations of A, P, r, n, CI and SI; difference between CI and SI type included. Rate of growth and depreciation.*

Note: Paying back in equal installments, being given rate of interest and installment amount, **not included**.

3. Algebra

(i) Expansions

Recall of concepts learned in earlier classes.

$(a \pm b)^2$

$(a \pm b)^3$

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

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

(ii) Factorisation

$a^2 - b^2$

$a^3 \pm b^3$

$ax^2 + bx + c$, *by splitting the middle term.*

(iii) Simultaneous Linear Equations in two variables. (With numerical coefficients only)

- *Solving algebraically by:*
  - *Elimination*
  - *Substitution and*
  - *Cross Multiplication method*
- *Solving simple problems by framing appropriate equations.*

(iv) 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.

(v) Logarithms

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

(b) Laws of Logarithms and their uses.

Expansion of expression with the help of laws of logarithms

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

log y = 4 log a + 2 log b – 3 log c etc.

4. Geometry

(i) Triangles

(a) Congruency: four cases: SSS, SAS, AAS, and 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.

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

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

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

(d) Pythagoras Theorem

Area based proof and simple applications of Pythagoras Theorem and its converse.

(ii) Rectilinear Figures

(a) Proof and use of theorems on 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.*

(b) Constructions of Polygons

Construction of quadrilaterals (including parallelograms and rhombus) and regular hexagon using ruler and compasses only.

(c) 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.*

(iii) Circle*:*

(a) Chord properties

- *A straight line drawn from the centre of a circle to bisect a chord which is not a diameter is at right angles to the chord.*

- *The perpendicular to a chord from the centre bisects the chord (without proof).*
- *Equal chords are equidistant from the centre.*
- *Chords equidistant from the centre are equal (without proof).*
- *There is one and only one circle that passes through three given points not in a straight line.*

(b) Arc and chord properties:

- *If two arcs subtend equal angles at the centre, they are equal, and its converse.*
- *If two chords are equal, they cut off equal arcs, and its converse (without proof).*

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 frequency polygon.

6. Mensuration

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

(a) Area and perimeter of triangle (including Heron's formula), all types of Quadrilaterals.

(b) Circle: Area and Circumference. Direct application problems including Inner and Outer area.

Areas of sectors of circles other than quarter-circle and semicircle are not included.

(c) Surface area and volume of 3-D solids: cube and cuboid including problems of type involving:

- *Different internal and external dimensions of the solid.*
- *Cost.*
- *Concept of volume being equal to area of cross-section* x *height.*
- *Open/closed cubes/cuboids.*

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 trigonometric ratios of complementary angles and their direct application:

$\sin A = \cos (90 - A), \cos A = \sin (90 - A)$

$\tan A = \cot (90 - A), \cot A = \tan (90 - A)$

$\sec A = \operatorname{cosec} (90 - A), \operatorname{cosec} A = \sec (90 - A)$

8. Coordinate Geometry

Cartesian System, plotting of points in the plane for given coordinates, solving simultaneous linear equations in 2 variables graphically and finding the distance between two points using distance formula.

(a) Dependent and independent variables.

(b) Ordered pairs, coordinates of points and plotting them in the Cartesian plane.

(c) Solution of Simultaneous Linear Equations graphically.

(d) Distance formula.

INTERNAL ASSESSMENT

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

Suggested Assignments

- Conduct a survey of a group of students and represent it graphically - height, weight, number of family members, pocket money, etc.
- Planning delivery routes for a postman/milkman.
- Running a tuck shop/canteen.
- 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.
- Cutting a circle into equal sections of a small central angle to find the area of a circle by using the formula $A = \pi r^2$.
- To use flat cutouts to form cube, cuboids and pyramids to obtain formulae for volume and total surface area.
- Draw a circle of radius r on a ½ cm graph paper, and then on a 2 mm graph paper. Estimate the area enclosed in each case by actually counting the squares. Now try out with circles of different radii. Establish the pattern, if any, between the two observed values and the theoretical value (area = πr^2). Any modifications?