

CLASS - XI
12. MATHEMATICS

Time: 3:00 hrs

Theory: 90 Marks
CCE: 10 Marks
Total: 100 Marks

1. All Questions are Compulsory.
2. Q 1 will consist of 10 parts and each part will carry one (1) Mark.
3. Q 2 to Q 9 each will be of 2 Marks.
4. Q 10 to Q 19 each will be of 4 marks.
5. Q 20 to 23 each will of 6 marks.
6. There will be no overall choice. There will be an internal choice in any 3 questions of 4 marks each and all questions of 6 marks.(Total of 7 internal choices)
7. Use of Calculator is not allowed.

Sr. No	Topic	Q. Carrying 1-Marks	Q. Carrying 2-Marks	Q. Carrying 4-Marks	Q. Carrying 6-Marks	Total Marks
1	Sets	1	-	1	-	05
2	Relations & Functions	1	-	1	-	05
3	Trigonometric Functions	1	2	1	-	09
4	Principle of Mathematical Induction	-	-	1	-	04
5	Complex numbers & Quadratic Equations	1	1	-	1	09
6	Linear Inequalities	-	-	-	1	06
7	Permutations & Combinations	1	-	1	-	05
8	Binomial Theorem	-	2	-	-	04
9	Sequence & Series	1	-	1	-	05
10	Straight lines	1	-	1	-	05
11	Conic Sections	1	-	1	-	05
12	Introduction to Three-dimensional Geometry	-	1	-	-	02
13	Limits & Derivatives	1	-	1	1	11
14	Mathematical Reasoning	-	2	-	-	04
15	Statistics	-	-	-	1	06
16	Probability	1	-	1	-	05
Total Questions		1(10Parts)	8	10	4	23
Total Marks		10	16	40	24	90

1. Sets:

Sets and their representations. Empty set, Finite & Infinite sets, Equal sets. Subsets, Subsets of the set of real numbers especially intervals (with notations).Power set. Universal set. Venn diagrams. Union and Intersection

of sets. Difference of sets. Complement of a set, Properties of complement sets.

2. Relations & Functions:

Ordered pairs, Cartesian product of sets. Number of elements in the Cartesian product of two finite sets. Cartesian product of the reals with itself (upto $\mathbb{R} \times \mathbb{R} \times \mathbb{R}$).

Definition of relation, pictorial diagrams, domain, co-domain and range of a relation. Function as a special kind of relation from one set to another. Pictorial representation of a function, domain, co-domain and range of a function. Real valued function of the real variable, domain and range of these functions, constant, identity, polynomial, rational, modulus, signum and greatest integer functions with their graphs. Sum, difference, product and quotients of functions.

3. Trigonometric Functions:

Positive and negative angles. Measuring angles in radians and in degrees and conversion from one measure to another. Definition of trigonometric functions with the help of unit circle. Truth of the identity $\sin^2 x + \cos^2 x = 1$, for all x . Signs of trigonometric functions and sketch of their graphs. Expressing $\sin(x \pm y)$ and $\cos(x \pm y)$ in terms of $\sin x$, $\sin y$, $\cos x$ & $\cos y$. Deducing the identities like following:

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x \cdot \tan y}, \quad \cot(x \pm y) = \frac{\cot x \cdot \cot y \mp 1}{\cot y \pm \cot x}$$

$$\sin x + \sin y = 2 \sin \frac{x+y}{2} \cos \frac{x-y}{2}, \quad \cos x + \cos y = 2 \cos \frac{x+y}{2} \cos \frac{x-y}{2}$$

$$\sin x - \sin y = 2 \cos \frac{x+y}{2} \sin \frac{x-y}{2}, \quad \cos x - \cos y = -2 \sin \frac{x+y}{2} \sin \frac{x-y}{2}$$

Identities related to $\sin 2x$, $\cos 2x$, $\tan 2x$, $\sin 3x$, $\cos 3x$ and $\tan 3x$.

General solution of trigonometric equations of the type $\sin \theta = \sin \alpha$, $\cos \theta = \cos \alpha$ and $\tan \theta = \tan \alpha$. Proofs and simple applications of sine and cosine formulae.

4. Principle of Mathematical Induction:

Process of the proof by induction, motivating the application of the method by looking at natural numbers as the least inductive subset of real numbers. The principle of mathematical induction and simple applications.

5. Complex Numbers and Quadratic Equations:

Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve every quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers. Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system. Square-root of a Complex number.

6. Linear Inequalities:

Linear inequalities, Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables - graphically.

7. Permutations & Combinations :

Fundamental principle of counting, Factorial $n(n!)$ Permutations and combinations, derivation of formulae and their connections, simple applications.

8. Binomial Theorem :

History, statement and proof of the binomial theorem for positive integral indices. Pascal's triangle , general and middle term in binomial expansion, simple applications.

9. Sequence and series:

Sequence and Series , Arithmetic Progression (A.P), Arithmetic Mean (A.M) , Geometric Progression (G.P), general term of a G.P, sum of n terms of a G.P . Arithmetic and Geometric series, infinite G.P. and its sum. Geometric mean (G .M), relation between A.M and G.M, Sum to n term of the special series $\sum n$, $\sum n^2$ and $\sum n^3$.

10. Straight Lines :

Brief recall of 2-D from earlier classes, Shifting of origin. Slope of a line and angle between two lines .Various forms of equations of a line: parallel to axes, point-slope form, slop-intercept form, two-point form, intercept form and normal form ,General equation of a line. Equation of family of lines passing through the point of intersection of two lines. Distance of a point from a line.

11. Conic Sections :

Sections of a cone; circles, ellipse, parabola, hyperbola, a point, a straight line and a pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equations of a circle;

12. Introduction to Three-dimensional Geometry:

Coordinate axes and coordinate planes in three dimensions.Coordinates of a point. Distance between two points and section formula.

13. Limits and Derivatives:

Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit.

$$\lim_{x \rightarrow 0} \frac{\log_e(1+x)}{x}, \lim_{x \rightarrow 0} \frac{e^x - 1}{x}$$

Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

14. Mathematical Reasoning:

Mathematically acceptable statements. Connecting words/phrases—consolidating the understanding of “if and only if (necessary and sufficient) condition”, “implies”, “and/or”, “implied by”, “and”, “or”, “there exists” and their use through variety of examples related to real life and Mathematics, Validating the statements involving the connecting words—difference between contradiction, converse and contrapositive.

15. Statistics:

Measure of dispersion: mean deviation, variance and standard deviation of ungrouped/grouped data. Analysis of frequency distributions with equal means but different variances.

16. Probability:

Random experiments: outcomes, sample spaces(set representation). Events: Occurrence of events, ‘not’, ‘and’ & ‘or’ events, exhaustive events, mutually exclusive events. Axiomatic (set theoretic) probability, connections with the theories of earlier classes. Probability of an event, probability of ‘not’, ‘and’ & ‘or’ events.

Note:- The subtopics which are printed in the book published by Punjab School Education Board but are not mentioned in syllabus, should be considered as part of syllabus.