# MATHEMATICS

## CLASS - XI

*Time : 3 Hours*                                                                    *100 Marks*

| Units | Unitwise Weightage | Marks | Periods |
|-------|--------------------|-------|---------|
| I. | **Sets, Relations and Functions** [29 marks] | | |
| | 1.   Sets, Relations and Functions | 13 | 23 |
| | 2.   Trigonometric Functions | 16 | 29 |
| II. | **Algebra** [37 marks] | | |
| | 1.   Complex Number and Linear Inequalities | 13 | 23 |
| | 2.   Permutations, Combinations and Binomial Theorem | 15 | 27 |
| | 3.   Sequence and Series | 9 | 16 |
| III. | **Co-ordinate Geometry** [13 marks] | | |
| | 1.   Straight Lines | 8 | 14 |
| | 2.   Circle, Conic Section and Introduction to Three-dimension Geometry | 8 | 14 |
| IV. | **Calculus** [6 marks] | | |
| | Limits and Derivatives | 6 | 12 |
| V. | **Statistics and Probability** [12 marks] | 12 | 22 |
| | Total = | **100** | **180** |

**Unit-I: Sets, Relations and Functions**                                        **[29 marks]**

### 1. Sets

Sets and their representations, Finite and infinite sets, Empty set, Equal sets, Subsets, Subsets of the set of real numbers, especially intervals (with notations), Universal set, Venn diagrams, Complements of a set, Operation on sets (union and intersection and difference of sets).

### 2. Relations and Functions

Ordered pairs, Cartesian product of sets, Number of elements in the Cartesian product of two finite sets. The product sets R×R (or $R^2$) and R×R×R (or $R^3$) where R is the set of real numbers.

Relation from one set to another, Domain and range of a relation. Function as a special kind of relation from one set to another. Domain, Co domain and range of a function. Real valued function of a real variable and their domain and range. Some specific functions and their graphs including constant, identity, polynomial, rational, modulus, signum and greatest integer function. Sum, difference, product and quotients of real valued functions.

3. **Trigonometric functions**

Positive and negative angles, Measurement of angles, Sexagesemal system and circular system, Conversion from one system to another. Definition of trigonometric functions with the help of unit circle. Signs of trigonometric functions (Quadrant Rule). The identity $\sin^2 x + \cos^2 x = 1$. Graphs of trigonometric functions. To express $\cos(x \pm y)$ and $\sin(x \pm y)$ in terms of $\sin x$, $\sin y$, $\cos x$ and $\cos y$. Deduction of other addition and subtraction formulae. To express $\sin x \pm \sin y$ and $\cos x \pm \cos y$ as products. Identities related to multiple and submultiple angles.

## Unit-II: Algebra                                                                 [37 marks]

1. **Complex numbers.**

Need for complex numbers. The fundamental imaginary $\sqrt{-1}$ unit (or i). Complex numbers in the form of a + ib, Real and imaginary parts of a complex number, Complex conjugates, Representation of a complex number by a point in a plane, Argand diagram, Modulus and argument (or amplitude) of a complex number, Algebra of complex numbers.

2. **Linear Inequalities.**

Linear inequalities, Algebraic solution of linear inequalities in one variable and their representation on the number line.

3. **Premutations and Combinations.**

Fundamental principle of counting, Factorial $n$ where $n$ is a non-negative integer, Permutation as an arrangement, Meaning of $^nP_r$ or $P(n,r)$, Permutations in which things (i) may be repeated (ii) are not all different. Combination, Meaning of $^nC_r$ or $C(n,r)$. Important properties of $^nP_r$ and $^nC_r$. Applications of permutations and combinations.

4. **Binomial Theorem.**

Bionomial theorem for a positive integral index (proof). Pascal's triangle, Eproperties of Binomial co-efficients, Simple Applications.

5. **Sequence and Series.**

Sequence and Series, Geometric progression (G.P.), First term, Common ratio, general term, sum to $n$ terms of a G.P., Geometric Mean (G.M.), Relation between A.M. and G.M. Infinite G.P. and its sum.

**Unit-III: Coordinate Geometry** [13 marks]

1. **Straight lines :**

   Brief recall of 2D geometry from earlier classes. Slope of a line and angle between two lines, various forms of equation of a straight line, Parallel to axes, slope-intercept form, point-slope form, two point form, intercepts form. Distance of a point from a line. Distance between two parallel lines.

2. **Circle :**

   Definition, Equation of circle with given centre and radius, General equation of a circle, its centre and radius. Equation of a circle when the end points of a diameter are given.

3. **Conic section :**

   Sections of a cone. Definition of a conic section (degenerated conic section). Equation of a conic section having given eccentricity, focus and directrix. Standard equation and simple properties of parabola, ellipse and hyperbola.

4. **Introduction to Three-dimentional Geometry :**

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

**Unit-IV: Calculus** [06 marks]

Limits and derivatives :

Idea of limit, Left hand and right hand limits, conditions for existence of limit. Fundamental Theorem on limit (statement only) and standard limits

(i) $\lim\limits_{x \to a} \dfrac{x^n - a^n}{x - a} = na^{n-1}$ (with proof)

(iii) $\lim\limits_{x \to 0} \dfrac{e^x - 1}{x} = 1$ (with proof)

(ii) $\lim\limits_{x \to 0} \dfrac{\sin x}{x} = 1$ (with proof)

(iv) $\lim\limits_{x \to 0} \dfrac{\log(1+x)}{x} = 1$ (with proof)

Derivative introduced as rate of change both as that of distance function and geometrically. Definition of derivative, relate it to slope of tangent to a curve; Derivative of sum, difference, product and quotient of functions. Derivative of polynomial and trigonometric functions.

**Unit-V: Statistics and Probability** [12 marks]

1. **Statistics :**

   Measure of dispersion, Mean deviation, Variance and Standard deviation of ungrouped/grouped data.

2. **Probability :**

   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.

**Appendix :**

1. **Infinite series :** Exponential and Logarithmic series.
2. **Mathematical Modelling :**

   Consolidating the understanding developed upto Class X. Focus on modelling problems related to real life (like environment, travel, etc.) and connecting with other subjects of study where many constraints may really need to be ignored, formulating the model, looking for solutions, interpreting them in the problems situation and evaluating the model.

## PRESCRIBED TEXTBOOK :

1. Mathematics
   Textbook for Class XI
   Published by : NCERT, New Delhi

## REFERENCE BOOKS :

1. A Textbook of Mathematics Book-I for Class XI
   By : S.N. Chhibber, G.D. Dhall & J.C. Nijhawan.
   Published by : Macmillan Publishers India Pvt. Ltd.

2. Modern's abc of Mathematics for Class XI
   By : J.P. Mohindru
   Published by : Modern Publishers, Jalandhar.

3. Mathematics (Textbook for Class XI)
   Published by : NCERT, New Delhi.

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# DESIGN OF
# QUESTION PAPER

Subject : MATHEMATICS
Class : XI
Full Mark : 100
Time : 3 Hours

| | | | | | |
|---|---|---|---|---|---|
| **I** | **WEIGHTAGE TO OBJECTIVES:** | | | | |
| | **Objectives** | | | **Marks** | **Percentage** |
| | Knowledge (K) | | | 15 | 15 |
| | Understanding (U) | | | 51 | 51 |
| | Application (A) | | | 30 | 30 |
| | Skill (S) | | | 04 | 04 |
| | **Total:** | | | **100** | **100** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **II** | **WEIGHTAGE TO FORM OF QUESTIONS:** | | | | | |
| | **Form of Questions** | **No. of Question** | **Time (in minutes)** | **Marks** | **Percentage** | |
| | Essay/Long Answer: (E/LA) | 6 | 65 | 36 | 36 | |
| | Short Answer (SA-I) | 5 | 36 | 20 | 20 | |
| | Short Answer (SA-II) | 4 | 22 | 12 | 12 | |
| | Short Answer (SA-III) | 6 | 22 | 12 | 12 | |
| | Very Short Answer(VSA) | 8 | 14 | 8 | 8 | |
| | MCQ | 12 | 21 | 12 | 12 | |
| | **Total:** | **41** | **180** | **100** | **100** | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **III** | **WEIGHTAGE TO CONTENT:** | | | | | |
| | **UNIT** | | **CONTENTS** | | **Marks** | **Percentage** |
| | **I** | 1.1 | Sets, Relations and Functions | | 13 | 13 |
| | | 1.2 | Trigonometric functions | | 16 | 16 |
| | **II** | 2.1 | Complex Numbers and Linear Inequalities | | 13 | 13 |
| | | 2.2 | Permutations & Combinations and Binomial Theorem | | 15 | 15 |
| | | 2.3 | Sequence and Series | | 9 | 9 |
| | **III** | 3.1 | Straight lines | | 8 | 8 |
| | | 3.2 | Circle, Conic Section and Introduction to Three dimensional Geometry | | 8 | 8 |
| | **IV** | 4.1 | Limits and Derivatives | | 6 | 6 |
| | **V** | 5.1 | Statistics and Probability | | 12 | 12 |
| | | | **Total:** | | **100** | **100** |

| | | |
|---|---|---|
| **IV** | SCHEME OF SECTIONS | : **NIL** |
| **V** | SCHEME OF OPTIONS | : **Internal option in two SA-I (including case study question), two in SA-II, one in SA-III and three in E/LA** |
| **VI** | DIFFICULTY LEVEL : **Difficult** :30% of the total marks **Average** :50% of the total marks **Easy** :20% of the total marks | |

**Special Instruction**: 
1) Two questions of MCQ will be Assertion-Reason type question.
2) One question of SA-I will be case study question
3) First option will be (a) & second option will be (b) in the internal option

**Abbreviation** : K(Knowledge),U(Understanding),C(Comprehension), Exp.(Expression), Skill(S), E(Essay Type), SA (Short Answer Type), VSA (Very Short Answer Type), MCQ(Multiple Choice Question)

# MATHEMATICS
## CLASS - XII

*One Paper*                *Time : 3 Hours*                *100 Marks*

| Units | Unitwise Weightage | | Marks | Periods |
|-------|--------------------|--|-------|---------|
| **I.** | **Relations and Functions** | **[10 marks]** | | |
| | 1.   Relations and Functions | | 5 | 9 |
| | 2.   Inverse Trigonometric Functions | | 5 | 9 |
| **II.** | **Algebra** | **[13 marks]** | | |
| | 1.   Matrices | | 7 | 13 |
| | 2.   Determinants | | 6 | 11 |
| **III.** | **Calculus** | **[44 marks]** | | |
| | 1.   Continuity and Differentiability | | 10 | 18 |
| | 2.   Applications of Derivatives | | 8 | 14 |
| | 3.   Integrals | | 14 | 26 |
| | 4.   Applications of Integrals | | 4 | 7 |
| | 5.   Differential Equations | | 8 | 14 |
| **IV.** | **Vectors and Three Dimensional Geometry** | **[17 marks]** | | |
| | 1.   Vectors | | 8 | 14 |
| | 2.   Three dimensional Geometry | | 9 | 16 |
| **V.** | **Linear Programming** | **[06 marks]** | 6 | 11 |
| **VI.** | **Probability** | **[10 marks]** | 10 | 18 |
| | | **Total :** | **100** | **180** |

**Unit-I:    Relations and Functions**                **[10 marks]**

**1.    Relations and Functions :**

Relation in a set. Types of relations, reflexive, symmetric, transitive and equivalence relations. Types of functions, injective (one-one), subjective (onto), bijective functions. Inverse of a function.

**2.    Inverse Trigonometric Functions :**

Definition, range, domain, principal value branches. Graphs of inverse trigonometric functions.

**Unit-II:** **Algebra** [13 marks]

**Matrices :**

Concept, notation, order, equality, types of matrices, zero-matrix, transpose of a matrix, symmetric and skew symmetric matrices. Addition, multiplication and scalar multiplication of matrices, simple properties of addition, multiplication and scalar multiplication. Non-commutativity of multiplication of matrices and existence of non-zero matrices whose product is the zero matrix (restrict to square matrices of order 2)

**Determinants :**

Determinant of a square matrix (upto 3x3 matrices), minors, cofactors and applications of determinants in finding the area of a triangle. Adjoint and inverse of a square matrix. Consistency, inconsistency and number of solutions of system of linear equations by examples, solving system of linear equations in two or three variables (having unique solution) using inverse of a matrix.

**Unit-III:** **Calculus** [44 marks]

1. **Continuity and Differentiability :**

   Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function. Concept of exponential and logarithmic functions and their derivatives.

   Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives.

2. **Applications of Derivatives :**

   Applications of derivatives : Rate of change, increasing/decreasing functions, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

3. **Integrals :**

   Integration as inverse process of differentiation. Integration of a variety of functions by substitution, by partial fractions and by parts, only simple integrals of the type to be evaluated.

$$\int \frac{dx}{x^2 \pm a^2}, \int \frac{dx}{\sqrt{x^2 \pm a^2}}, \int \frac{dx}{\sqrt{a^2 - x^2}}, \int \frac{dx}{ax^2 + bx + c}, \int \frac{dx}{\sqrt{ax^2 + bx + c}},$$

$$\int \frac{(px + q)}{ax^2 + bx + c} dx, \int \frac{(px + q)}{\sqrt{ax^2 + bx + c}} dx, \int \sqrt{a^2 \pm x^2} \, dx \text{ and } \int \sqrt{x^2 - a^2} \, dx$$

Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.

4. **Applications of Integrals :**

Application in finding the area under simple curves, especially lines, areas of circles, parabolas/ellipses (in standard form only), area under the curves $y = \sin x$, $y = \cos x$, etc. (the region should be clearly identifiable).

5. **Differential Equations :**

Definition, order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equations of the type :

$\dfrac{dy}{dx} + p(x)y = q(x)$, where $p(x)$ and $q(x)$ are functions of $x$ and

$\dfrac{dx}{dy} + p(y) = q(y)$, where $p(y)$ and $q(y)$ are functions of $y$.

**Unit-IV:  Vectors and Three dimensional Geometry**                                          **[17 marks]**

1. **Vectors**

Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors.

2. **Three-dinensional Geometry :**

Direction cosines, direction ratios. Cartesian and Vector equation of a line, Skew lines, Shortest distance between two lines. Angle between Two Lines. Conditions for perpendicularity and parallelism. Distance between parallel lines.

**Unit-V:    Linear Programming**                                                                            **[6 marks]**

1. **Linear Programming :**

Introduction, definition of related terminology such as constraints, objective function, optimization. Graphical method of solving linear programming problems.

**Unit-VI:      Probability**                                                                                      **[10 marks]**
1. **Probability :**

Multiplication theorem on probability, Conditional probability, independent events, total probability, Baye's theorem.

**Appendix :**

**1.    Proofs in Mathematics :**

Through a variety of examples related to mathematics & already familiar to the learner, bring out different kinds of proofs : direct, contrapositive, by contradiction, by counter example.

**2.    Mathematical Modelling :**

Modelling real-life problems where many constraints may really need to be ignored (continuing from Class XI). However, now the models concerned would use techniques/results of matrices, calculus and linear programming.

**PRESCRIBED TEXTBOOK :**

1.    Mathematics Part-I
      Textbook  for  Class  XII
      Published  by :  NCERT,  New  Delhi

2.    Mathematics Part-II
      Textbook  for  Class  XII
      Published  by :  NCERT,  New  Delhi

**REFERENCE BOOKS :**

1.    A Textbook of Mathematics Book-II for Class XII
      By : S.N. Chhibber, G.D. Dhall & J.C. Nijhawan.
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2.    Modern's abc of Mathematics for Class XII
      By : J.P. Mohindru
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3.    Mathematics Part I & II (Textbook for Class XII)
      Published by : NCERT, New Delhi.

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# DESIGN OF
# QUESTION PAPER

Subject    :  **MATHEMATICS**
Class      :  XII
Full Mark  :  100
Time      :  3 Hours

| | | | | Marks | Percentage |
|---|---|---|---|---|---|
| **I** | **WEIGHTAGE TO OBJECTIVES:** | | | | |
| | Objectives | | | **Marks** | **Percentage** |
| | Knowledge(K) | | | 20 | 20 |
| | Understanding (U) | | | 46 | 46 |
| | Application (A) | | | 30 | 30 |
| | Skill (S) | | | 4 | 4 |
| | | | **Total :** | **100** | **100** |

| | **WEIGHTAGE TO FORMS OF QUESTIONS:** | | | | |
|---|---|---|---|---|---|
| | **FORM OF QUESTIONS** | **No. of questions** | **Time(in minutes)** | **Marks** | **Percentage** |
| **II** | Essay/Long Ans: (E/LA) | 6 | 65 | 36 | 36 |
| | Short Answer (SA-I) | 7 | 51 | 28 | 28 |
| | Short Answer (SA-II) | 8 | 28 | 16 | 16 |
| | Very Short Answer(VSA) | 10 | 18 | 10 | 10 |
| | MCQ | 10 | 18 | 10 | 10 |
| | **Total:** | **41** | **180** | **100** | **100** |

| | **WEIGHTAGE TO CONTENT:** | | | | |
|---|---|---|---|---|---|
| | **Unit** | | **CONTENTS :** | **Marks** | **Percentage** |
| | I | 1.1 | Relations and Functions | 5 | 5 |
| | | 1.2 | Inverse Trigonometric Functions | 5 | 5 |
| | II | 2.1 | Matrices | 7 | 7 |
| | | 2.2 | Determinants | 6 | 6 |
| **III** | III | 3.1 | Continuity and Differentiability | 10 | 10 |
| | | 3.2 | Applications of Derivatives | 8 | 8 |
| | | 3.3 | Integrals | 14 | 14 |
| | | 3.4 | Applications of Integral | 4 | 4 |
| | | 3.5 | Differential Equation | 8 | 8 |
| | IV | 4.1 | Vectors | 8 | 8 |
| | | 4.2 | Three - dimensional Geometry | 9 | 9 |
| | V | 5.1 | Linear Programming | 6 | 6 |
| | VI | 6.1 | Probability | 10 | 10 |
| | | | **Total:** | **100** | **100** |

| | | |
|---|---|---|
| **IV** | **SCHEME OF SECTIONS** | **: NIL** |
| **V** | **SCHEME OF OPTIONS** | **: Internal option in any five SA-I Type and in any Four Essay Type.** |
| **VI** | **DIFFICULTY LEVEL** | **:** |
| | **Difficult : 30%** | |
| | **Average : 50%** | |
| | **Easy : 20%** | |

**Abbreviation :**    K(Knowledge), U(Understanding ), C(Comprehension), Exp.(Expression), Skill(S), E(Essay Type), SA (Short Answer Type), VSA (Very Short Answer Type), MCQ(Multiple Choice Question)

**FROM THE ACADEMIC SESSION 2025-26**

# DESIGN OF
# QUESTION PAPER

Subject : **MATHEMATICS**
Class : XII
Full Mark : 100
Time : 3 Hours

| | **WEIGHTAGE TO OBJECTIVES:** | | |
|---|---|---|---|
| | Objectives | **Marks** | **Percentage** |
| | Knowledge (K) | 15 | 15 |
| I | Understanding (U) | 51 | 51 |
| | Application (A) | 30 | 30 |
| | Skill (S) | 04 | 04 |
| | **Total:** | **100** | **100** |

| | **WEIGHTAGE TO FORM OF QUESTIONS:** | | | | |
|---|---|---|---|---|---|
| | **Form of Questions** | **No. of Question** | **Time (in minutes)** | **Marks** | **Percentage** |
| | Essay/Long Answer: (E/LA) | 6 | 65 | 36 | 36 |
| | Short Answer (SA-I) | 5 | 36 | 20 | 20 |
| II | Short Answer (SA-II) | 4 | 22 | 12 | 12 |
| | Short Answer (SA-III) | 6 | 22 | 12 | 12 |
| | Very Short Answer(VSA) | 8 | 14 | 8 | 8 |
| | MCQ | 12 | 21 | 12 | 12 |
| | **Total:** | **41** | **180** | **100** | **100** |

| | **WEIGHTAGE TO CONTENT:** | | | | |
|---|---|---|---|---|---|
| | **UNIT** | | **CONTENTS** | **Marks** | **Percentage** |
| | I | 1.1 | Relations and Functions | 5 | 5 |
| | | 1.2 | Inverse Trigonometric Functions | 5 | 5 |
| | II | 2.1 | Matrices | 7 | 7 |
| | | 2.2 | Determinants | 6 | 6 |
| | | 3.1 | Continuity and Differentiability | 10 | 10 |
| III | III | 3.2 | Applications of Derivatives | 8 | 8 |
| | | 3.3 | Integrals | 14 | 14 |
| | | 3.4 | Applications of Integral | 4 | 4 |
| | | 3.5 | Differential Equations | 8 | 8 |
| | IV | 4.1 | Vectors | 8 | 8 |
| | | 4.2 | Three - dimensional Geometry | 9 | 9 |
| | V | 5.1 | Linear Programming | 6 | 6 |
| | VI | 6.1 | Probability | 10 | 10 |
| | | | **Total:** | **100** | **100** |

| | | |
|---|---|---|
| IV | **SCHEME OF SECTIONS** | : NIL |
| V | **SCHEME OF OPTIONS** | : Internal option in two SA-I (including case study question), two in SA-II, one in SA-III and three in E/LA |
| VI | **DIFFICULTY LEVEL** : <br> Difficult : 30% of the total marks <br> Average : 50% of the total marks <br> Easy : 20% of the total marks | |

Special Instruction:    1)    Two questions of MCQ will be Assertion-Reason type question.
                   2)    One question of SA-I will be case study question
                   3)    First option will be (a) & second option will be (b) in the internal option

Abbreviation :    K(Knowledge),U(Understanding),C(Comprehension), Exp.(Expression), Skill(S), E(Essay Type), SA (Short Answer Type), VSA (Very Short Answer Type), MCQ(Multiple Choice Question)