

WBJEE Mathematics Syllabus

1. Algebra: A.P., G.P., H.P.

- **Topics:** Definitions of A.P., G.P., and H.P.; General term; Summation of first n -terms of series $\sum n$, $\sum n^2$, $\sum n^3$; Arithmetic/Geometric series, A.M., G.M. and their relation; Infinite G.P. series and its sum.

2. Logarithms

- **Topics:** Definition; General properties; Change of base.

3. Complex Numbers

- **Topics:** Definition in terms of ordered pair of real numbers and its representation in a plane; Argand plane and properties of complex numbers; Complex conjugate; Triangle inequality; Amplitude of complex numbers and its properties; Square root of complex numbers; Cube roots of unity and its applications; De Moivre's theorem (statement only) and its elementary applications; Solution of quadratic equation in the complex number system.

4. Polynomial Equation

- **Topics:** Polynomial equation with real coefficients; Fundamental theorem of Algebra; Quadratic equations with real coefficients; Relations between roots and coefficients; Nature of roots; Formation of a quadratic equation; Sign and magnitude of the quadratic expression $ax^2 + bx + c$ (where a, b, c are rational numbers and $a \neq 0$).

5. Permutation and Combination

- **Topics:** Permutation of n different things taken r at a time ($r \leq n$); The permutation of things which are not all different; Permutation with repetitions; Combinations of n different things taken r at a time ($r \leq n$); Combination of things not all different; Problems involving both permutations and combinations.

6. Principle of Mathematical Induction

- **Topics:** Statement of the principle; Proof by induction for the sum of squares; The sum of cubes of first n natural numbers; Divisibility properties like $2^{2n} - 1$ is divisible by 3 ($n \geq 1$), 7 divides $3^{2n+1} + 2^{n+2}$ ($n \geq 1$), etc.

7. Binomial Theorem (positive integral index)

- **Topics:** Statement of the theorem; General term; Middle term; Equidistant terms and Properties of binomial coefficients and its applications.

8. Matrices & Determinants

- **Topics:** Concepts of $m \times n$ ($m \leq 3, n \leq 3$) real matrices; Operations of addition, Scalar multiplication and Multiplication of matrices; Transpose of a matrix; Determinant of a square matrix; Properties of determinants; Minor, Cofactor and Adjoint of a matrix; Non-singular matrix; The inverse of a matrix; Solutions of system of linear equations (Not more than 3 variables); Application of Determinants in finding the area of triangle.

9. Sets, Relations and Mappings

- **Topics:** Concept of sets; Subsets, Power set, Complement, Union, Intersection, Difference and Symmetric difference of sets; Venn diagram; De Morgan's Laws; Inclusion / Exclusion formula for at most three sets; Cartesian product of sets.

10. Relation and its Properties

- **Topics:** Equivalence relation — definition and elementary examples; Mapping; Range and Domain; Injective, Surjective, and Bijective mappings; Composition of mappings; Inverse of a mapping.

11. Statistics and Probability

- **Topics:** Measure of dispersion; Mean; Variance and Standard deviation; Frequency distribution; Notion of probability; Addition and Multiplication rules of probability; Conditional probability and Bayes' Theorem; Independence of events; Repeated independent trials and Binomial distribution.

12. Trigonometry

- **Topics:** Trigonometric functions; Compound angles; Addition and Subtraction formulae; Formulae involving Multiple and Submultiple angles; General solution of trigonometric equations; Inverse trigonometric functions and their properties.

13. Coordinate Geometry of Two Dimensions: Coordinates

- **Topics:** Distance formula; Section formula; Area of a triangle; Condition of collinearity of three points in a plane; Polar coordinates; Transformation from Cartesian to polar coordinates and vice versa; Parallel transformation of axes;

Concept of locus; Problems on Locus involving familiar geometrical configurations.

14. Straight Lines

- **Topics:** The slope of a straight line; Equation of straight lines in different forms; The angle between two straight lines; Condition of perpendicularity and parallelism of two straight lines; Distance of a point from a straight line; Distance between two parallel straight lines; Straight lines through the point of intersection of two straight lines; Equations of bisectors of angles between two straight lines.

15. Circle & Conic Sections

- **Topics:** Equation of a circle with a given centre and radius; Condition that a general equation of second degree in x, y may represent a circle; Equation of a circle in terms of endpoints of a diameter; Parametric equation of a circle; Equation of tangent, normal and chord of a Circle; The intersection of a straight line with a circle; Equation of common chord and common tangent of two intersecting circles; Definition of conic section; Directrix, Focus and Eccentricity; Classification based on eccentricity; Equation of Parabola, Ellipse and Hyperbola in standard form; Their foci, directrices, eccentricities and parametric equations.

16. Co-ordinate Geometry of Three Dimensions

- **Topics:** Direction cosines and Direction ratios; Distance between two points and Section formula; Equation of a straight line; Equation of a plane and Distance of a point from a plane and straight lines; Angle between two straight lines; Shortest distance between two skew lines.

17. Differential Calculus

- **Topics:** Functions; Domain and Range of functions; Composition of two functions and Inverse of a function; Basic properties of functions; Limit; Continuity; Differentiability; Derivative; Chain rule and Derivative of functions in various forms; Concept of differential and its applications; Second order derivative.

18. Rolle's Theorem and Lagrange's Mean Value Theorem

- **Topics:** Statement only for Rolle's Theorem and Lagrange's Mean Value Theorem; Their geometric interpretation and Elementary application;

L'Hospital's rule (statement only) and applications.

19. Integral Calculus

- **Topics:** Integration as a reverse process of differentiation; Indefinite integral of standard functions; Integration by parts; Integration by substitution and Partial fraction; Definite integral as a limit of a sum with equal subdivisions; Fundamental theorem of integral calculus and its applications; Properties of definite integrals.

20. Differential Equations

- **Topics:** Formation of ordinary differential equations; Order and Degree of differential equations; Solution of homogeneous differential equations; Separation of variables method; Linear first order differential equations.

21. Application of Calculus

- **Topics:** Differential coefficient as a measure of rate; Determination of monotonicity of functions; Maxima and Minima of functions; Tangent and Normal; Conditions of tangency; Motion in a straight line with constant acceleration; Calculation of area bounded by elementary curves and Straight lines; The area of the region included between two elementary curves.

22. Vectors

- **Topics:** Addition of vectors; Scalar multiplication; Dot and Cross products; Scalar triple product; Geometrical interpretation of these products and their applications.