The Indian Mathematics and Science Association

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ARYABHATTA TALENT SEARCH TEST IN MATHEMATICS AND SCIENCES (ATSTMS)

a) Mathematics:
    i. Junior Aryabhatta Talent Search Test in Mathematics (JATSTM) (Class VI to XII)
    ii. Senior Aryabhatta Talent Search Test in Mathematics (ASTSTM) (UG & PG)

b) Sciences:
    i. Junior Aryabhatta Talent Search Test in Science (AJTSTS): (Class VI to XII)
    ii. Senior Aryabhatta Talent Search Test in Science (ASTSTS): (UG & PG)

c) Miscellaneous Programmes
Popular Invited Lecture, Debates, Quiz Contests, Poster Presentations, Projects, Exhibitions, Essay Writing, STEAM (Science, Technology, Engineering, Arts & Mathematics) Activities.

Introduction

The Aryabhatta Talent Search Test in Mathematics and Sciences (ATSTMS) is a competition organised by the Indian Mathematics and Science Association that challenges students to increase their knowledge and skills in various areas of science and Mathematics. The syllabus for ATSTMS covers a variety of topics. Participants must apply theoretical knowledge to solve real-world problems and think critically about complex problems. The objectives of teaching mathematics intend to help the students to acquire knowledge and critical understanding.

The Syllabus can be downloaded on website: www.imsaindia.org

Syllabus: Mathematics
Classes VI to XII
UG. & PG

Junior Aryabhatta Talent Search Test in Mathematics (Class VI-XII)

Class-VI

Number system, Factors and Multiples, Test of divisibility of numbers, HCF and LCM, Decimals and Fractions, Unitary Method, Elementary Properties of Factorial. Mensuration,

Parameter and Area of simple curve. Algebraic equations and Expressions, Ratio and Proportion, Percentage and their applications, Symmetry, Making symmetry figures, Reflection and Symmetry. Geometry, Understanding Elementary Shapes of 2 and 3 dimensions, Line segment, Parallel lines, Polygons, The Triangles and its properties, Quadrilaterals, Circle. Data Handling.

Class-VII

Elementary properties of real numbers, LCM and HCF, Divisibility rules, Fractions and Decimals, Exponents and Powers, Digit at Unit and tens place in the power of positive integers, Identities, Comparing Quantities, Percentage, Profit and Loss, Simple interest.

Algebraic Equations and Expressions, Law of indices, Exponential Equation. Visualising of Solid Shapes, Lines and Angles, The Triangle and its Properties, Symmetry, Congruence of Triangles, Quadrilaterals, Polygons, Circles. Perimeter and Area of Triangle, Rectangle, Parallelogram, Trapezium, Rhombus, Square, Cube and Cuboid. Data Handling, Arithmetic Mean, Median and Mode. Simple Trigonometrical identities and their properties. Basic concept of Probability.

Class-VIII

Properties of real numbers, LCM and HCF of polynomials, Squares and Square Roots, Cubes and Cube Roots, Exponents and Powers, Comparing Quantities.

Percentage, Simple and Compound Interest, Discount and Partnership, Time and Distance, Work and Time. Algebraic Expressions and Identities, Linear equations and inequations. Plane, Lines, Angles, Triangles, Congruence, Quadrilaterals, Circles Constructions, Mensuration, Visualising Solid Shapes, Circle, Cone, Sphere, Cube and Cuboids Direct and Inverse Proportions, Factorisation, Introduction to Graphs. Data Handling, Mean, Median, Mode and their Simple Properties. Basic concept of Probability. Elementary properties of Sets, Union, Intersection, Venn Diagrams, ordered pairs.

Class-IX

Number Systems, Prime and Composite numbers, Surds and rationalisation of surds, Congruence, Fermat and Wilson theorem, Pythagorean triads, Polynomials, Algebraic expression and identities, Linear Equations in Two Variables, Graph of linear equations Coordinate Geometry, Coordinate of a point, Distance formula, Section formula, Area of Triangle and Quadrilateral.

Introduction to Euclid's Geometry, Lines and Angles, Triangles, Congruent triangle, Condition of similar triangles, Quadrilaterals, Constructions.

Properties of Polygons, Mensuration, Areas of Parallelograms and Triangles, Heron's Formula, Area of Cyclic quadrilateral, Surface Areas and Volumes of cube, cuboid, cylinder, cone, sphere and Circle. Introduction of Statistics, Graphical representation of statistical data, Mean, Median of ungrouped data. Trigonometrical identities and their Properties, Logarithm. Definition of probability, Terms of probability.

Class-X

Real and Complex Numbers, Polynomials, Pair of Linear Equations in Two Variables, Quadratic Equations and Expressions, Arithmetic Progressions. Concepts of Coordinate Geometry, Straight Lines, Pair of Straight Lines.

Trigonometrical Ratio, compound angles, Multiple angles and Submultiple angles, Conditional Identities, Height and distance.

Geometry of triangle, Circles, Constructions, Mensuration, Areas related to Circles, Surface Areas and Volumes of Cylinder, Cone and Sphere.

Introduction of Statistics, Basic concepts of Mean, Median, Mode, Histograms and Ogive.

Probability of Random experiments, Sample space, Events, simple problem of single events.

Class-XI

Unit 1

1. Sets

Sets and their representations, different kinds of sets, algebra of sets, Subsets, and Subsets of a set of real numbers, intersection, complement, difference and symmetric difference of sets and their algebraic properties, Universal set. Venn diagrams, De-Morgan's laws on union, intersection, difference, Complement of a set. Properties of Complement.

2. Relations & Functions

Ordered pairs. Cartesian product of sets & their properties, Definition of relation, pictorial diagrams, domain, co-domain, and range of a relation. Function as a special type of relation. Pictorial representation of a function, domain, co-domain, and range of a function. Real valued functions, domain, and range of these functions, constant, identity, polynomial, rational, modulus, signum, exponential, logarithmic, and greatest integer functions, with their graphs. Sum, difference, product, and quotients of functions.

3. Trigonometric Functions

Trigonometric identities and functions, Definition of trigonometric functions with the help of unit circle. Domain and range of trigonometric functions and their graphs.

Inverse trigonometric functions their properties, Definition, range, domain, principal value branch. Graphs of inverse trigonometric functions.

Unit-II: Algebra

1. Complex Numbers and Quadratic Equations and Expressions

Algebra of complex numbers, addition, multiplication, conjugation, polar

representation, Argand plane, properties of modulus and principal argument, triangle inequality, cube roots of unity, geometric interpretations.

Relations between roots and coefficients, nature of roots, the formation of quadratic equations with given roots, Fundamental Theorem of Algebra, symmetric functions of roots, Common roots of the quadratic equations.

2. Linear Inequalities

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

3. Permutations and Combinations

Fundamental principle of counting. Factorial n. (n!) Permutations and combinations, derivation of Formulae for nPr and nCr and their connections, simple applications, Circular Permutation.

4. Binomial Theorem

Binomial theorem for positive integral indices, Binomial theorem for a positive integral index, general term and middle term and simple applications, simple applications, Properties of Binomial Coefficients.

5. Sequence and Series

Sequence and Series. Arithmetic and Geometric progressions, Harmonic Progressions Arithmetic Mean (A.M.) Geometric Progression (G.P.), general term of a G.P., the sum of n terms of a G.P., infinite G.P., and its sum, Sums of squares and cubes of the first n natural numbers. Logarithms and their properties, geometric mean (G.M.), the relation between A.M, G.M and H.M

Unit-III: Coordinate Geometry

1. Straight Lines

Cartesian system of rectangular coordinates in a plane, distance formula, sections formula, locus and its equation, the slope of a line, parallel and perpendicular lines, intercepts of a line on the co-ordinate axis. Straight line: Various forms of equations of a line, intersection of lines, angles between two lines, conditions for concurrence of three lines, the distance of a point form a line, co-ordinate of the centroid, orthocenter, Incentre and circumventer of a triangle.

2. Conic Sections

conic sections: A standard form of equations of a circle, the general form of the equation of a circle, its radius and center, equation of a circle when the end points of a diameter are given, Equation of a circle in various forms, equations of tangent, normal and chord, points of intersection of a line and a circle with the center at the origin, Equations of a parabola, ellipse and hyperbola in standard form, their foci, directrix and eccentricity, parametric equations, equations of tangent and normal. Locus problems.

3. Three-Dimensional Geometry

Coordinates of a point in space, the distance between two points, section formula, direction ratios and direction cosines and the angle between two intersecting lines. Equation of a line; Skew lines, the shortest distance between them and its equation.

equation of a plane, distance of a point from a plane, angle between two lines, angle between two planes, angle between a line and the plane, coplanar lines.

Unit-IV: Calculus

1. Limits and Derivatives

Real–valued functions, algebra of functions; polynomial, rational, trigonometric, logarithmic and exponential functions; inverse functions. Graphs of simple functions. Limits, continuity and differentiability. Differentiation of the sum, difference, product and quotient of two functions. Differentiation of trigonometric, inverse trigonometric, logarithmic, exponential, composite and implicit functions; derivatives of order two.

Unit-V Statistics and Probability

1. Statistics

Measures of Dispersion: calculation of mean, median, mode of grouped and ungrouped data, calculation of standard deviation, variance and mean deviation for grouped and ungrouped data, Range, Mean deviation, variance, and standard deviation of ungrouped/grouped data.

2. Probability

Random experiment, sample space, different types of events (impossible, simple, compound), addition and multiplication rules of probability, conditional probability, independence of events, total probability.

Class-XII

Unit-I: Relations and Functions

1. Relations and Functions

Types of relations: reflexive, symmetric, transitive and equivalence relations. One to one and onto functions, Composition of a Functions Inverse of a Function,

Unit-II: Algebra

1. Matrices

Matrices as a rectangular array of real numbers, equality of matrices, addition, multiplication by a scalar and product of matrices, elementary row and column

transformations, transpose of a matrix, symmetric and skew symmetric matrices. Invertible matrices and uniqueness of inverse.

2. Determinants

Determinant of a square matrix, minors, co-factors 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

1. Limit, Continuity and Differentiability

Limit of a function at a real number, continuity of a function, limit and continuity of the sum, difference, product and quotient of two functions, L'Hospital rule of evaluation of limits of functions. Continuity of composite functions, intermediate value property of continuous functions

Continuity and differentiability, derivative of composite functions, chain rule, derivative of inverse trigonometric functions, derivative of implicit functions, exponential and logarithmic functions. Derivatives of logarithmic and exponential functions. Logarithmic differentiation, derivative of functions expressed in parametric forms. Second order derivatives.

2.Mean Value Theorem

Rolle's theorem and Lagrange's mean value theorem, geometric interpretation of the two theorems, derivatives up to order two of implicit functions, geometric interpretation of derivatives

3. Applications of Derivatives

Applications of derivatives: rate of change of quantities, increasing/decreasing functions, maxima and minima.

4. Integrals

Integral as an anti-derivative, Fundamental integrals involving algebraic, Indefinite integrals of standard functions, trigonometric, exponential and logarithmic functions, definite integrals as the limit of sums, definite integral and their properties, fundamental theorem of integral calculus. Integration by parts, integration by the methods of substitution and partial fractions.

properties of definite integrals. Evaluation of definite integrals.

5. Applications of the Integrals

Applications in finding the area under simple curves as lines, circles, parabolas, ellipses.

6. Differential Equations

Ordinary differential equations, their order and degree, general and particular solutions of a differential equation. Solution of differential equations by method of

separation of variables, solutions of homogeneous differential equations of first order and first degree. Solutions of linear differential equation.

Unit-IV: Vectors and Three-Dimensional Geometry

1. Vectors

Vectors and scalars, magnitude and direction of a vector. Direction cosines and direction ratios of a vector. 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. Definition, Geometrical Interpretation, properties and application of scalar (dot) product of vectors, vector (cross) product of vectors, Scalar and Vector triple product.

2. Three – dimensional Geometry

Direction cosines and direction ratios of a line joining two points. Cartesian equation and vector equation of a line, skew lines, shortest distance between two lines. Angle between two lines.

Unit-V: Linear Programming

1. Linear Programming

Introduction, related terminology such as constraints, objective function, optimization, graphical method of solution for problems in two variables, feasible and infeasible regions (bounded or unbounded), feasible and infeasible solutions, optimal feasible solutions (up to three non-trivial constraints).

Unit-VI: Probability

Conditional probability, multiplication theorem on probability, independent events, total probability, Bayes' theorem, Random variable and its probability distribution, mean of random variable, computation of probability of events using permutations and combinations.