

TGT (Mathematics)

Real Number:

Representation of natural numbers, integers, rational numbers on the number line. Representation of terminating / non-terminating recurring decimals, on the number line through successive magnification. Rational numbers as recurring / terminating decimals. Examples of non-recurring / non-terminating decimals. Existence of non-rational numbers (irrational numbers) and their representation on the number line. Explaining that every real number is represented by a unique point on the number line and conversely, every point on the number line represents a unique real number.

Laws of exponents with integral powers. Rational exponents with positive real bases. Rationalization of real numbers. Euclid's division lemma, Fundamental Theorem of Arithmetic. Expansions of rational numbers in terms of terminating / non-terminating recurring decimals.

Elementary Number Theory:

Peano's Axioms, Principle of Induction; First Principle, Second Principle, Third Principle, Basis Representation Theorem, Greatest Integer Function, Test of Divisibility, Euclid's algorithm, The Unique Factorisation Theorem, Congruence, Chinese Remainder Theorem, Sum of divisors of a number. Euler's totient function, Theorems of Fermat and Wilson.

Matrices :

R , R^2 , R^3 as vector spaces over R and concept of R^n . Standard basis for each of them. Linear Independence and examples of different bases. Subspaces of R^2 , R^3 . Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigenvalues and eigenvectors for such transformations and eigenspaces as invariant subspaces. Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix, Solutions of a system of linear equations using matrices.

Polynomials:

Definition of a polynomial in one variable, its coefficients, with examples and counter examples, its terms, zero polynomial. Degree of a polynomial, Constant, linear, quadratic, cubic polynomials; monomials, binomials, trinomials. Factors and multiples. Zeros / roots of a polynomial / equation. Remainder Theorem with examples and analogy to integers. Statement and proof of the Factor Theorem. Factorization of quadratic and of cubic polynomials using the Factor Theorem. Algebraic expressions and identities and their use in factorization of polynomials. Simple expressions reducible to these polynomials.

Linear Equations in two variables:

Introduction to the equation in two variables. Proof that a linear equation in two variables has infinitely many solutions and justify their being written as ordered pairs of real numbers, Algebraic and graphical solutions.

Pair of Linear Equations in two variables:

Pair of linear equations in two variables. Geometric representation of different possibilities of solutions / inconsistency. Algebraic conditions for number of solutions. Solution of pair of linear equations in two variables algebraically - by substitution, by elimination and by cross multiplication.

Quadratic Equations:

Standard form of a quadratic equation. Solution of the quadratic equations (only real roots) by factorization and by completing the square, i.e. by using quadratic formula. Relationship between discriminant and nature of roots. Relation between roots and coefficients, Symmetric functions of the roots of an equation. Common roots.

Arithmetic Progressions:

Derivation of standard results of finding the n th term and sum of first n terms.

Inequalities:

Elementary Inequalities, Absolute value, Inequality of means, Cauchy -Schwarz Inequality, Tchebychef's Inequality.

Calculus:

Sets. Functions and their graphs: polynomial, sine, cosine, exponential and logarithmic functions. Step function, Limits and continuity. Differentiation, Methods of differentiation like Chain rule, Product rule and Quotient rule. Second order derivatives of above functions. Integration as reverse process of differentiation. Integrals of the functions introduced above.

Euclidean Geometry:

Axioms / postulates and theorems. The five postulates and Euclid. Equivalent versions of the fifth postulate. Relationship between axiom and theorem. Theorems and lines and angles, triangles and quadrilaterals, Theorems on areas of parallelograms and triangles, Circles, theorems on circles, Similar triangles, Theorem on similar triangles. Constructions.

Coordinate Geometry: The Cartesian plane, coordinates of a point, Distance between two points and section formula, Area of a triangle.

Areas and Volumes:

Area of a triangle using Hero's formula and its application in finding the area of a quadrilateral. Surface areas and volumes of cubes, cuboids, spheres (including hemispheres) and right circular cylinders/cones. Frustum of a cone.

Area of a circle: area of sectors and segments of a circle.

Trigonometry:

Trigonometric ratios of an acute angle of a right - angled triangle. Relationships between the ratios. Trigonometric identities. Trigonometric ratios of complementary angles. Heights and distances.

Statistics:

Introduction to Statistics: Collection of data, presentation of data, tabular form, ungrouped / grouped, bar graphs, histograms, frequency polygons, qualitative analysis of data to choose the correct form of presentation for the collected data. Mean, median, mode of ungrouped data. Mean, median and mode of grouped data. Cumulative frequency graph.

Probability:

Elementary Probability and basic laws. Discrete and Continuous Random variable, Mathematical Expectation, Mean and Variance of Binomial, Poisson and Normal distribution. Sample mean and Sampling Variance. Hypothesis testing using standard normal variate. Curve Fitting. Correlation and Regression.