



# MANARAT STEM FEST

## 2021

### MATH OLYMPIAD SYLLABUS

# CLASS 3-4

## 1. Number sense & Arithmetic

- Rounding Off: Estimating numbers to the nearest tens, hundreds, or thousands.
- Multiples and Factors: Understanding divisibility, common multiples, and prime/composite factors.
- Simplification: Solving expressions using the correct order of operations (e.g., BODMAS/PEMDAS).
- Fractions: Identifying, comparing, and performing operations with parts of a whole.
- Decimal Numbers: Understanding place value for decimals and basic operations (not applied to Area/Volume yet).
- Percentages: Expressing numbers as a fraction of 100. Averages: Calculating the mean value of a set of numbers

## 2. Geometry and Shapes

- Angles: Recognizing and naming different types of angles (acute, right, obtuse, etc.).
- Circles: Understanding the properties of a circle, including the center, radius, and diameter.
- Constructing Triangles: Using tools to draw triangles based on specific measurements.
- Quadrilaterals: Identifying and remembering the properties of four-sided shapes like squares, rectangles, and parallelograms.

## 3. Measurement

- Area: Calculating the space inside 2D shapes (using whole numbers).
- Volume: Calculating the space occupied by 3D objects (using whole numbers).

# CLASS 5-6

## 1. Arithmetic and Number Theory

- Primes, HCF and LCM: Understanding prime numbers, Highest Common Factor, and Lowest Common Multiple.
- Approximation and Estimation: Rounding and estimating values.
- Number Patterns: Identifying and extending numerical sequences.
- Ratio, Rate and Speed: Comparing quantities and calculating movement over time.
- Percentages: Working with parts of 100.

## 2. Algebra

- Basic Algebra and Algebraic Manipulation: Fundamental algebraic operations and simplifying expressions.
- Linear Equations and Simple Inequalities: Solving for variables and understanding inequality signs.
- Functions and Linear Graphs: Understanding functional relationships and plotting them on a coordinate plane.

## 3. Geometry & Measurement

- Basic Geometry: Fundamental concepts of points, lines, and shapes. Triangles,
- Quadrilaterals and Polygons: Properties and classifications of multi-sided shapes.
- Perimeter and Area of Plane Figures: Measuring the boundary and surface of 2D shapes.
- Volume and Surface Area of Prisms and Cylinders: Measuring the capacity and total outside area of 3D objects.

# CLASS 7-8

## 1. Algebra and Functions

- Indices: Mastering the laws of exponents and powers.
- Solutions of Quadratic Equations: Solving equations where the highest power of the variable is 2 ( $ax^2 + bx + c = 0$ ).
- Inequalities: Solving and graphing mathematical expressions where sides are not equal.
- Functions (Introductory): Introduction to mathematical relations and mapping inputs to outputs.
- Variation: Understanding direct and inverse proportionality between variables

## 2. Numbers and Commercial Math

- Standard Form: Converting large and small numbers into scientific notation
- Percentages: Advanced applications of parts per 100.
- Time: Calculations involving clock time, duration, and time zones.
- Money: Practical math related to currency, interest, or financial transactions.
- Sets: Basic set theory, including notation, unions, and intersections.

## 3. Geometry & Trigonometry

- Coordinate Geometry: Plotting points and lines on a Cartesian plane using x and y coordinates.
- Similarity and Congruence: Identifying shapes that are the same size/shape or proportional in scale.
- Angles and Polygons: Advanced properties of interior/exterior angles in multi-sided shapes.
- Trigonometry (Introductory): Introduction to sine, cosine, and tangent ratios in right-angled triangles.

# CLASS 7-8

## 4. Mensuration (3D Geometry)

•3D Shapes: Calculating surface area and volume for complex solids including:

- Cone
- Cuboid
- Pyramid
- Prism
- Sphere and Hemisphere Cylinder

# CLASS 9-10

## 1. Functions & Algebra

- Functions: Mapping, domain, and range.
- Factors of Polynomials: Remainder and factor theorems.
- Equations, Inequalities, and Graphs: Solving and plotting non-linear relations.
- Logarithmic and Exponential Functions: Master the laws of logs and exponential growth

## 2. Coordinate geometry

- Coordinate Geometry of the Circle: Equations of circles and finding their centers and radii.
- Vectors in Two Dimensions: Adding and subtracting vectors, magnitude, and unit vectors.

## 3. Trigonometry & Mensuration

- Circular Measure: Radian mode, arc length, and sector area.
- Trigonometry: Advanced identities and solving trigonometric equations.

## 4. Counting & Sequences

- Permutations and Combinations: Methods for selecting and arranging objects where order does or doesn't matter.
- Series: Understanding mathematical sequences and progressions.

## 5. Calculus

- Differentiation and Integration:  
Finding slopes of curves (derivatives) and area under curves (integrals).

# CLASS 11-12

## 1. Pure Maths

- **Algebra:** Advanced manipulation, including partial fractions and proof by contradiction.
- **Quadratics & Functions:** Mastering transformations and inverse functions.
- **Coordinate Geometry:** Working with lines and circles in a 2D plane. Circular
- **Measure:** Radian measures for sectors and arcs.
- **Trigonometry:** Advanced identities, double angle formulas, and reciprocal functions (sec, cosec, cot).
- **Exponentials & Logarithms:** Mastering logarithmic laws and exponential growth models.
- **Series:** Understanding arithmetic and geometric progressions.
- **Calculus (Differentiation & Integration):** Mastering complex rules (chain, product, and quotient rules) and integration by parts or substitution. Numerical
- **Solutions:** Methods like the Newton-Raphson iteration for finding roots
- **Vectors:** 3D vector representation and operations.
- **Complex Numbers:** Introduction to imaginary numbers and Argand diagrams.

## 2. Mechanics

- **Forces & Equilibrium:** Understanding how objects remain stable under multiple forces.
- **Kinematics:** Studying motion in a straight line using suvat equations and calculus.
- **Momentum:** Understanding the impact of collisions and impulses. Newton's
- **Laws of Motion:** Applying  $F = ma$  to various physical models.
- **Energy, Work, and Power:** Calculating the capacity of a system to perform work.

# CLASS 11-12

## 3. Statistics

- Representation of Data: Using histograms, box plots, and cumulative frequency.
- Permutations & Combinations: Advanced counting methods for arrangements and selections.
- Probability: Venn diagrams, tree diagrams, and conditional probability.
- Discrete Random Variables: Understanding the behavior of variables that take on distinct values.
- Statistical Distributions: Mastering the Binomial and Normal distributions to model data