

NYATO

National Young AI Talent Olympiad

ROUND 1 — DETAILED SYLLABUS

Find your place in the future of AI.

Assessment	Round 1 — Aptitude & Mathematical Reasoning
Total Questions	60
Total Time	75 minutes
Maximum Marks	100
Sections	Mathematics • Quantitative Aptitude • Logical & Analytical Reasoning
Question Style	Conceptual, application-based and problem-solving oriented

Purpose of Round 1

Round 1 is designed to assess a student's mathematical foundation, quantitative thinking, logical reasoning and ability to approach unfamiliar problems. The assessment is intended to go beyond direct formula recall and includes questions that test interpretation, pattern recognition, multi-step reasoning and application of concepts.

Important: This document describes the NYATO assessment scope. It is not a board-examination syllabus and should not be interpreted as a prediction of the exact questions that will appear in the test.

SECTION 1 — MATHEMATICS

Mathematics questions will draw on important concepts from Classes 11 and 12, with emphasis on conceptual understanding, interpretation and application. Students should be comfortable solving problems using multiple representations, algebraic reasoning and appropriate mathematical techniques.

A. Class 11 Mathematics — Sets, Functions & Trigonometry

- Sets: representation of sets, subsets, intervals, power set, union, intersection, difference and complement.
- Venn diagrams and elementary applications of set operations.
- Relations: ordered pairs, Cartesian products, domain and range.
- Functions: concept of a function, domain, codomain and range; types of functions and basic composition.
- Trigonometric functions: angle measurement, trigonometric ratios, signs in different quadrants and standard values.
- Trigonometric identities and simplification of expressions.
- Graphs and basic properties of trigonometric functions.
- Basic trigonometric equations and their solutions.

B. Class 11 Mathematics — Algebra

- Principle of Mathematical Induction: understanding the inductive structure and simple applications.
- Complex numbers: representation, algebraic operations, conjugate, modulus and basic properties.
- Quadratic equations: roots, nature of roots, relationships between roots and coefficients, and applications.
- Linear inequalities: solution sets and graphical interpretation.
- Permutations and combinations: fundamental counting principle, arrangements and selections.
- Binomial theorem: expansion, general term, middle term and simple applications.
- Sequences and series: arithmetic progression, geometric progression and standard summation ideas.

C. Class 11 Mathematics — Coordinate Geometry

- Straight lines: slope, angle between lines, different forms of equations and distance-related applications.
- Circle: standard equation, centre and radius, basic geometric interpretation.
- Conic sections: introductory properties of the parabola, ellipse and hyperbola.
- Introduction to three-dimensional geometry: coordinates, distance and section formula.

D. Class 11 Mathematics — Calculus, Statistics & Probability

- Limits: intuitive understanding and standard algebraic evaluation.
- Derivatives: meaning of the derivative, basic differentiation rules and simple applications.
- Statistics: measures of central tendency and dispersion; interpretation of data.
- Probability: experiments, outcomes, sample spaces, events and elementary probability.

SECTION 1 — MATHEMATICS (CONTINUED)

The Class 12 portion focuses on functions, algebra, calculus, vectors, three-dimensional geometry, probability and linear programming.

E. Class 12 Mathematics — Relations & Functions

- Relations and functions: types of relations and functions, domain, range and composition.
- Inverse functions and conditions for invertibility.
- Inverse trigonometric functions: principal values, domains, ranges and basic identities.
- Continuity and differentiability: conceptual understanding and standard results.

F. Class 12 Mathematics — Algebra

- Matrices: types, order, equality, operations, transpose and elementary properties.
- Determinants: evaluation, properties and applications.
- Inverse of a matrix and solving systems of linear equations using matrices and determinants.

G. Class 12 Mathematics — Calculus

- Continuity and differentiability of functions.
- Derivatives of standard functions and combinations of functions.
- Applications of derivatives: increasing/decreasing functions, maxima and minima, and rate-of-change problems.
- Indefinite integration: standard integrals and basic techniques.
- Definite integrals: properties and evaluation.
- Applications of integrals: area under curves and between simple curves.
- Differential equations: basic terminology, order, degree and standard first-order forms.

H. Class 12 Mathematics — Vectors & Three-Dimensional Geometry

- Vectors: magnitude, direction, components and algebraic operations.
- Dot product and its geometric interpretation.
- Cross product and basic applications.
- Lines and planes in three-dimensional space: equations and relationships.
- Angles and distances involving lines and planes at an appropriate conceptual level.

I. Class 12 Mathematics — Probability

- Conditional probability and the multiplication rule.
- Independent events.
- Bayes' theorem and its applications.
- Random variables and probability distributions.
- Mean (expected value) and basic interpretation of probability distributions.

J. Class 12 Mathematics — Linear Programming

- Formulation of linear programming problems.
- Objective function and constraints.
- Feasible region and graphical representation.
- Corner-point method and interpretation of optimal solutions.

SECTION 2 — QUANTITATIVE APTITUDE

Quantitative Aptitude will test the ability to apply mathematical concepts efficiently to real-world and unfamiliar numerical situations. Questions may combine more than one concept and may reward estimation, interpretation and efficient calculation rather than lengthy computation.

A. Number System

- Natural numbers, integers, rational and real numbers.
- Factors, multiples, prime numbers and factorisation.
- HCF and LCM and their applications.
- Divisibility rules and properties.
- Remainders and modular-style reasoning at an elementary level.
- Powers, roots, exponents and cyclicity.

B. Arithmetic

- Percentages and percentage change.
- Ratio, proportion and variation.
- Averages and weighted averages.
- Profit, loss, discount and marked price.
- Simple interest and compound interest.
- Mixtures and alligation.
- Partnership and proportional distribution.

C. Work, Time & Motion

- Time and work.
- Work efficiency and combined work.
- Pipes and cisterns as applications of work-rate reasoning.
- Speed, time and distance.
- Relative speed and average speed.
- Trains, basic upstream/downstream problems and related applications.

D. Algebraic Quantitative Reasoning

- Linear equations and systems of equations.
- Quadratic equations and their applications.
- Algebraic identities and simplification.
- Inequalities and ranges.
- Sequences, patterns and simple recurrence-based reasoning.

E. Geometry & Mensuration

- Lines, angles and triangles.
- Similarity and basic properties of geometric figures.
- Quadrilaterals and polygons.
- Circles and elementary circle geometry.
- Perimeter, area and volume.
- Coordinate-based geometric interpretation.

F. Counting & Elementary Probability

- Fundamental counting principle.
- Basic permutations and combinations.
- Counting through cases.
- Elementary probability and complementary probability.
- Simple conditional situations.

G. Data Interpretation

- Tables and numerical datasets.
- Bar graphs, line graphs and pie charts.
- Percentage and ratio interpretation from data.
- Comparing trends and extracting relevant information.
- Multi-step data interpretation and approximation.

SECTION 3 — LOGICAL & ANALYTICAL REASONING

Logical and Analytical Reasoning will assess how students identify patterns, organise information, draw valid conclusions and solve structured problems. Questions may be presented through text, tables, symbols, sequences or diagrams.

A. Series & Pattern Recognition

- Number series and missing-number patterns.
- Alphabet and alphanumeric series.
- Mixed series and alternating patterns.
- Pattern completion and rule identification.
- Figure-based and visual pattern recognition.

B. Analogy & Classification

- Word and number analogies.
- Figure analogies.
- Odd-one-out and classification.
- Identifying relationships between objects, numbers or symbols.

C. Coding-Decoding

- Letter and number coding.
- Symbol-based coding.
- Pattern-based coding-decoding.
- Decoding information using stated rules.

D. Blood Relations & Direction Sense

- Family relationships and generation-based reasoning.
- Coded blood-relation problems.
- Direction and distance.
- Position-based reasoning using maps or movement sequences.

E. Ranking, Ordering & Sequencing

- Rank and position problems.
- Ordering by age, height, marks or other attributes.
- Before/after and relative-position constraints.
- Scheduling and sequence-based problems.

F. Syllogisms & Deductive Reasoning

- Statements and conclusions.
- Statements and assumptions.
- Syllogism-based deductions.
- Logical validity and elimination of inconsistent conclusions.
- Venn-diagram representation of categorical statements.

G. Arrangements & Analytical Puzzles

- Linear seating arrangements.
- Circular arrangements at a basic-to-moderate level.
- Grouping and distribution.
- Selection under constraints.
- Scheduling and multi-condition puzzles.

H. Data Sufficiency & Critical Reasoning

- Determining whether the given information is sufficient to answer a question.
- Identifying relevant versus irrelevant information.
- Cause-and-effect relationships.
- Decision-making based on stated conditions.
- Inference from structured information.

I. Visual & Non-Verbal Reasoning

- Figure completion.
- Mirror-image and water-image concepts.
- Paper folding and simple spatial reasoning.
- Embedded figures and figure classification.
- Rotation and orientation-based reasoning.

HOW TO PREPARE

Students should prepare for NYATO by understanding concepts first and then practising unfamiliar problems. Memorising formulas alone will not be sufficient for the full range of questions.

Focus Area	What students should be able to do
Conceptual clarity	Explain and apply the underlying idea, not just recall a formula.
Problem solving	Break an unfamiliar problem into smaller, solvable steps.
Quantitative thinking	Estimate, compare, calculate and interpret numerical information.
Logical reasoning	Identify rules, relationships, constraints and valid conclusions.
Data interpretation	Extract relevant information from tables, graphs and structured data.
Time management	Choose an efficient approach and avoid spending disproportionate time on one problem.

WHAT THE QUESTIONS MAY TEST

The exact questions will not be published in advance. Students should be prepared for questions that test:

- Direct conceptual understanding of a stated topic.
- Application of a familiar concept in an unfamiliar context.
- Combination of two or more concepts.
- Pattern recognition and logical deduction.
- Interpretation of tables, graphs, diagrams or constraints.
- Efficient problem-solving under time pressure.

SYLLABUS BOUNDARY

The syllabus is intentionally organised around broad competencies rather than a promise that every listed subtopic will carry a fixed number of questions. Question difficulty and distribution may vary within the stated assessment scope.

For the Mathematics component, the structure is informed by the broad Class XI–XII mathematics curriculum for the 2026–27 academic session. The official CBSE curriculum emphasises mathematical understanding, reasoning, problem solving and application alongside content knowledge.

Reference: CBSE Academic — Mathematics Curriculum, 2026–27. NYATO is a separate assessment, and its final question paper, marking scheme and difficulty distribution are determined by the NYATO organising team.