

Purpose of screening test:

- Knowledge of topics taught in Algebra, Combinatorics, Geometry and Number Theory as part of the “*Foundation of Mathematics and Introduction to Olympiad Maths*” program is a **prerequisite** for the topics that will be taught during the “*Olympiad Level 1*” program.
- Essentially, the “*Olympiad Level 1*” program is a **continuation** of the “*Foundation of Mathematics and Introduction to Olympiad Maths*” program i.e. it starts off from the point where the latter program ends.
- It has been observed that many students who do not fulfil this prerequisite find it very tough to understand the topics taught in the *Olympiad Level 1* program and hence lose interest/drop off from the program after a few weeks.
- Hence from this year onwards, a **screening test** will be taken for **all** students who wish to enrol in the *Olympiad Level 1* program. The only purpose of this test is to gauge whether these students have indeed understood the topics taught in the *Foundation* batch.
- The test will be an open-book one – so there is no need for students to memorise anything.

A problem set will be shared on the web site of Bhaskaracharya Pratishthana on 4th April. Further instructions would be given.

Students are expected to be thoroughly conversant with the following topics and be able to solve problems (**numerical** as well as **non-numerical**) based on the same.

Number Theory

0. Natural numbers, composite and prime numbers, integers, addition and multiplication operations, commutative and associative properties of these two operations, closure property of integers under addition and multiplication, distributive property, exponentiation and factorial notations, exponentiation properties, absolute value (modulus).
1. Well Ordering Principle
2. Mathematical Induction
3. Divisibility of integers and various divisibility properties
4. Division Algorithm and Addition/Multiplication Properties of Remainders
5. Greatest Common Divisor, Linear Combinations of Integers and Bézout's identity
6. Relatively Prime integers, necessary and sufficient condition for relatively prime integers, divisibility properties related to relatively prime integers, Euclid's Lemma
7. Euclidean Algorithm, Extended Euclidean Algorithm, Least Common Multiple
8. Linear Diophantine Equations in two unknowns

Tip: Students should also be acquainted with the proofs of the various results/theorems/properties mentioned above – since the techniques used therein are useful to solve non-numerical problems as well.

Combinatorics

0. Factorial notation
1. Basic counting principles, addition principle and multiplication principle
2. Arrangement of n distinct objects, arrangement of r out of n distinct objects – with and without repetition.
3. Selection of r objects out of n objects
4. Permutations and combinations
5. nP_r and nC_r notations; simple results/properties related to these notations
6. Circular arrangement of n objects

Algebra

1. Simultaneous Linear Equations.
2. Quadratic Equations. Basics.
3. Arithmetic and Geometric Progression.
4. Polynomials degree, and operations addition, subtraction, multiplication and division of polynomials.

Geometry

1. Angle properties related to circles: inscribed angle theorem, tangent-secant theorem, cyclic quadrilaterals, etc.
2. Angle properties related to parallel lines: corresponding and alternate angles
3. Other misc. angle properties: vertex opposite angles, exterior angle theorem etc.
4. Congruence and similarity of triangles, basic proportionality theorem, midpoint theorem
5. Pythagoras theorem, its extension to acute/obtuse triangles, Apollonius' theorem
6. Simple area formulae (with proof) for triangles, parallelograms, trapeziums etc.
7. Concept of locus, for simple examples such as perpendicular bisector and angle bisector
8. Constructions using ruler and compass, based on triangle congruence tests (SSS, ASA, RHS etc.)