

Syllabus for Mathematical Olympiad:

Any aspirant for the International Mathematical Olympiads such as IMO, EGMO, APMO and the domestic selection rounds (i.e RMO, INMO)

1. must be familiar with all the topics covered in NCERT Mathematics books of Class VIII, IX and X;
2. must note that in addition to the topics covered in point no. 1 above the following topics are to be given importance while preparing for the olympiad examinations;
3. must know that the major areas from which problems are posed are algebra, combinatorics, geometry and number theory and that the difficulty level increases from RMO to INMO to IMO.

Algebra

Inequalities, Progressions (A.P, G.P, H.P), Theory of indices, System of linear equations, Theory of equations, Binomial theorem and properties of binomial coefficients, Complex Numbers, Polynomials in one and two variables, Functional equations, Sequences.

Recommended Books:

1. Higher Algebra; H.S.Hall & S.R.Knight
2. Higher Algebra; Barnard & Child
3. Polynomials; Ed Barbeau
4. Functional Equations: A Problem Solving Approach; B.J.Venkatachala (Prism Books Pvt. Ltd., Bangalore)
5. Inequalities: An Approach Through Problems (texts & readings in mathematics); B.J.Venkatachala, (Hindustan Book Agency)

Plane Geometry

Triangles, quadrilaterals, circles and their properties; standard Euclidean constructions; concurrency and collinearity (Theorems of Ceva and Menelaus); basic trigonometric identities, compound angles, multiple and submultiple angles, general solutions, sine rule, cosine rule, properties of triangles and polygons, Coordinate Geometry (straight line, circle, conics, 3-D geometry), vectors.

Recommended Books:

1. Geometry Revisited; H.S.M Coxeter & S.L.Greitzer
2. Problems in Plane Geometry; I.F.Sharygin
3. Plane Trigonometry; S.L.Loney
4. The Elements of Coordinate Geometry; S.L.Loney

Combinatorics

Basic enumeration, pigeonhole principle and its applications, recursion, elementary graph theory.

Recommended Books:

1. Introductory Combinatorics; Richard A. Brualdi
2. Discrete Mathematics: Elementary and Beyond; László Lovász, József Pelikán, Katalin Vesztergombi
3. Combinatorial Techniques; S. S. Sane
4. Combinatorics For Mathematical Olympiad; S. Muralidharan

Number Theory

Divisibility theory in the Integers (The Division Algorithm, the Greatest Common Divisor, The Euclidean Algorithm, The Diophantine Equation $ax + by = c$), Fundamental Theorem of Arithmetic, Basic properties of congruence, Linear congruences, Chinese Remainder Theorem, Fermat's Little Theorem, Wilson's Theorem, Euler's Phi function and Euler's generalisation of Fermat's Theorem, Pythagorean triples (definition and properties), Diophantine equations.

Recommended Books:

1. Elementary Number Theory; David M. Burton
2. An Introduction to the Theory of Numbers; Niven, Zuckerman, Montgomery

In addition to the books listed above the the question papers of earlier years (which are available at <https://olympiads.hbcse.tifr.res.in/subjects/mathematics/previous-question-papers-and-solutions>) and the following books may also be found helpful while preparing for the mathematical olympiad:

1. Problem Primer for Olympiads
C. R. Pranesachar, B. J. Venkatachala and C. S. Yogananda (Prism Books Pvt. Ltd., Bangalore).
2. Challenge and Thrill of Pre-College Mathematics
V. Krishnamurthy, C. R. Pranesachar, K. N. Ranganathan and B. J. Venkatachala (New Age International Publishers, New Delhi).
3. An Excursion in Mathematics
Editors: M. R. Modak, S. A. Katre and V. V. Acharya and V. M. Sholapurkar (Bhaskaracharya Pratishthana, Pune).
4. Problem Solving Strategies
A Engel (Springer-Verlag, Germany).
5. Mathematical Circles
Fomin and others (University Press, Hyderabad).

Many other interesting references may also be found in the book An Excursion in Mathematics mentioned above.

It must be noted that the topics listed above do not constitute an exhaustive list. Problems asked in the RMO and INMO may include topics not explicitly stated above.