Suggested Topics and Books For RMO/INMO/IMO

1. It is expected that the student should know all the topics he or she has studied upto the 10th standard.

2. Topics from the 11^{th} standard syllabus : trigonometry, geometry, surds, complex numbers, quadratic equations, permutations and combinations, Binomial theorem, A.P., G.P., H.P., and induction.

3. *NUMBER THEORY:*
Properties of divisibility of integers, division algorithm, Euclid's division algorithm to find the G.C.D. of two integers, Expressing the G.C.D. of two integers as linear combination of the two. There are infinitely many prime numbers. The fundamental theorem of arithmetic. Arbitrarily large gaps in the sequence of primes. Representation of positive integers in any base. Congruence, Chinese Remainder Theorem. The Euler's function ϕ (n). Fermat's last theorem. Greatest integer function, arithmetic function ~(n), σ (n), σ (n).
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If p is a prime then the largest exponent e such that $p^e/n!$ is given by
$e=\sum_{i=o}^{\infty}$ [n/p] General solutions of $x^2+y^2=z^2$, Pythagorian triplets.

RECOMMENDED BOOKS:
1. Introduction of the theory of numbers; *Nivan and Zuckerman*
2. Elementary number theory : *David Burton*
3. Higher Algebra : *Hall and Knight* (Chapter on Number theory)

4. ALGEBRA : Factorisation theorem, Reminder theorem. A polynomial of degree n has almost n roots. Relations between roots and coefficients of polynomials of degree n. Symmetric functions of roots. De moivre's theorem and its applications. Inequalities :

(1) (Generalised G.M.) ≤ (Generalised A.M.) : if $a_1, a_2 \ldots\ldots\ldots\ldots a_n > O$ then

$$(a_1.a_2\ldots a_n)^{1/n} \leq \frac{(a_1+a_2+\ldots a_n)}{n}$$

(2) Cauchy-Schwartz Inequality : If a_i., b_i. are real numbers for i = 1, . . . , n then

$$\left(\sum_{i=1}^{n} a_i b_i\right)^2 \leq \left(\sum_{i=1}^{n} a_i^2\right) \left(\sum_{i=1}^{n} b_i^2\right).$$

Let $x_1, x_2 \ldots x_n$ be variables and c be a positve real number. If
$x_1+x_2 \ldots +x_n = c$ then $x_1, x_2, x_3 \ldots x_n$ is maximum when $x_1 = x_2, \ldots = x = c/n$
If $x_1 x_2 \ldots x_n = c$ then $x_1 + x_2 + \ldots + x_n$ is minimum when $x_1 = x_2 \ldots = x_n (c)^{1/n}$

RECOMMENDED BOOKS:
1. Higher Algebra ; Barnard and Child.
2. Higher Algebra : Hall and Knight.
3. Inequalities : Koravkin (Mir Publication).
4. Algebra : J.W. Arthbold

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5. GEOMETRY : Euler line. Nine-Point circle Ptolemy's theorem. Ceva's theorem. Mehelau's theorem.

Constructions :Construct the triangle if (a) lengths of two of its medians one of its altitudes are given, (b) lengths of all of its medians are given, (c) lengths of all of its altitudes are given, (d) lengths of median, an altitude and an angle bisector all drawn from a single vertex are given.

Inscribe a square PQRS in a given triangle ABC such that P is on AB, S is on AC, Q and R are on BC. Inscribe an equilateral triangle in a given triangle. Construct circle touching given two intersecting lines and also touching a given circle.

Construct a square whose area is equal to the area of given rectangle using unmarked rules and compass only. Bisect a given line segment using compass only. Construct the common tangents to the two given circles.

Recommended but
1. College Geometry: ~~H~~ Eves (Narosa

6. *GEOMETRIC INEQUALITIES :* if a, b, c are the lengths of the sides of a triangle and p, q, r are the *lengths* of the medians then,

$p+q+r \leq a+b+c$; $3(a+b+c) \leq 4(p+q+r)$.

To find the point P in triangle ABC such that PA+PB+PC is minimum. Prove that among the triangles with given perimeter equilateral triangle has the maximum area. If L is a line and A, B are points not on L then find a point P on L such that PA_PB is minimum. Show that the pedal triangle has the least perimeter among all the triangles inscribed in a given acute angled triangle.

RECOMMENDED BOOKS :

1. High School Mathematics Part II : Mir Publication
2. Problems in place Geometry : Sharygin (Mir).
3. Any book on plane geometry which covers theorems mentioned above, for example, Plane Geometry for F.Y. (Old) students by Agashe.
4. Geometric inequalities (Mathematical association of America).
5. Geometry by A. Pogorelov Chapter XVII.

7. COMBINATORICS : Pigeonhole principle,Inclusion exclusion principle, Recurrence relations, basic combinatorial numbers and their identities.

RECOMMENDED BOOKS :

1. Introduction to combinatorics : Richard Brualdi.
2. Applied Combinatories : Alan Tucker (wiley) Chapters 5 and 8, Appendix A1, A2, A4.

OTHER RECOMMENDED BOOKS : 1. A Problem book in Algebra : Krechmar (Mir), 2. Selected problems and theorems in Elementary mathematics : Yaglom and others (Mir), 3. Method of Mathematical Induction : Sominsky (Mir), 4. International Mathematical Olympiads 1959-1977 by Smnel L Greitzer, Published by Mathematical Association of India, C-766, New Friends Colony, New Delhi - 110006, 5. International Mathematical Olympiads 1978-1985 by Samuel L. Greitzer, 6. U.S.A. Mathematical Olympiads 1972-1986 by Murray S. Klamkin, Published by Mathematical Association of India, C-766, New Friends Colony, New Delhi - 110006.