HOMI BHABHA CENTRE FOR SCIENCE EDUCATION
TATA INSTITUTE OF FUNDAMENTAL RESEARCH
and
NATIONAL BOARD OF HIGHER MATHEMATICS
DEPARTMENT OF ATOMIC ENERGY

Mathematics Olympiad Programme in India

(Leading to participation in International Mathematical Olympiad)

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MATHEMATICS OLYMPIAD PROGRAMME IN INDIA AND RELATED ACTIVITIES

The Mathematics Olympiad Programme in India, which leads to participation of Indian students in the International Mathematical Olympiad (IMO) is organized by the Homi Bhabha Centre for Science Education (HBCSE) on behalf of the National Board of Higher Mathematics (NBHM) of the Department of Atomic Energy (DAE). This programme is one of the major initiatives undertaken by NBHM. Its main purpose is to spot mathematical talent among pre-university students in the country.

For the purpose of training and selection of students for the Olympiad contest, the country has been divided into about 24 regions. The Mathematics Olympiad programme consists of the following stages:

Stage 1: Regional Mathematical Olympiad (RMO): RMO is held on the first Sunday of October each year in different regions of the country. The Regional Coordinator of a region is given the responsibility of conducting RMO in the region. All school students from Class XI are eligible to appear for RMO. Students from Class XII may also appear for RMO, but the number of students selected from Class XII can be at most 6. Exceptionally brilliant students from lower standards may also take RMO at the discretion of the Regional Coordinator. RMO is a 3-hour written test containing 6 to 7 problems. On the basis of the performance in RMO, a certain number of students from each region is selected for the second stage. The Regional Coordinators may charge a nominal fee to meet the expenses for organizing the contest.

Stage 2: Indian National Mathematical Olympiad(INMO): INMO is held on the third Sunday of January each year at centres in the different regions. Only those students who are selected in RMO are eligible to appear for INMO. This contest is a 4-hour written test. The top 75 contestants in INMO receive Merit Certificates.

Stage 3: International Mathematical Olympiad Training Camp(IMOTC) : The top 30-35 INMO certificate awardees are invited to a month long training camp May/June each year. The training camp is organised at HBCSE, Mumbai.The number of students from Class XII who are selected for IMOTC is at most 6. In addition to these 35 students, a certain number of INMO awardees of the previous year who have satisfactorily gone through postal tuition throughout the year are also invited to a second round of training. On the basis of a number of selection tests conducted during the camp, a team of the best six students is selected from the combined pool of junior and senior batch participants to represent India in the International Mathematical Olympiad.

Stage 4: International Mathematical Olympiad(IMO): The six member team selected at the end of IMOTC, accompanied by a leader and a deputy leader represent India at IMO, that is normally held in July each year in some country. IMO consists of two 4-and-a-half hour tests held on two consecutive days. Travel to IMO venue and return takes about two weeks. The student members of the Indian team who win gold, silver and bronze medals at IMO receive from NBHM a cash prize of RS. 5000/-, Rs. 4000/- and Rs. 3000/- respectively. MHRD finances international travel of the 8-member Indian delegation to IMO, while NBHM(DAE) finances the entire in-country programme and takes care of other expenditure connected with the International participation. The six students who get into the Indian IMO team automatically qualify for Kishore Vaigyanik Protsahan Yojana (KVPY) scholarship (Rs 3000/- per month and some contingency) instituted by Department of Science and Technology, Government of India.

Syllabus for Mathematical Olympiad: The syllabus for Mathematical Olympiad (regional, national and international) is pre-degree college mathematics. The difficulty level increases from RMO to INMO to IMO. A broad syllabus for RMO and INMO is:

Algebra : Basic set theory, principle of mathematical induction, inequalities(AM-GM and Cauchy-Schwarz) , theory of equations(remainder theorem, relation between roots and coefficients, symmetric expressions in roots, statement of Fundamental theorem of algebra and its applications), functional equations;

Geometry: Similarity, congruence, concurrence, collinearity, parallelism and orthogonality, tangency, concyclicity, theorems of Appollonius, Ceva, Menelaus and Ptolemy, special points of a triangle such as circum-centre, in-centre, ex-centres, ortho-centre and centroid;

Combinatorics : Basic counting numbers such as factorial, number of permutations and combinations, cardinality of a power set, problems based on induction and bijection techniques, existence problems, pigeonhole principle;

Number theory: Divisibility, gcd and lcm, primes, fundamental theorem of arithmetic(canonical factorisation), congruences, Fermat's little theorem, Wilson's theorem, integer and fractional parts of a real number, Pythagorean triplets, polynomials with integer coefficients.

A good idea of what is expected of students in mathematical olympiad can be had from the previous question papers(see http://www.isid.ac.in/\~\:rbb/olympiads.html) and the following books:

1. *Problem Primer for Olympiads*
by C R Pranesachar, B J Venkatachala and C S Yogananda (Prism Books Pvt. Ltd., Bangalore).

2. *Challenge and Thrill of Pre-College Mathematics*
by V Krishnamurthy, C R Pranesachar, K N Ranganathan and B J Venkatachala (New Age InternationalPublishers, New Delhi).

3. *An Excursion in Mathematics*
Editors: M R Modak, S A Katre and V V Acharya (Bhaskaracharya Pratishthana, Pune).

4. *Problem Solving Strategies*
Arthur Engel (Springer-Verlag, Germany).

5. *Functional Equations*
B J Venkatachala (Prism Books Pvt. Ltd., Bangalore).

6. *Mathematical Circles*
Fomin and others (University Press, Hyderabad).

Reference to many other interesting books is available in *An Excursion in Mathematics*.

Nurture Programme: The INMO awardees who choose mathematics as one of the subjects in their undergraduate studies are eligible for a scholarship by NBHM (which is at present Rs 1500 per month) throughout their undergraduate studies. If they further pursue their studies to masters, they continue to get scholarship (enhanced). Even those who do not take up mathematics in their undergraduate studies are eligible for a novel Nurture Programme conducted by NBHM. Under this programme, each batch of students (selected from among the INMO awardees through their responses to a few sets of postal problems) is assigned to an institution. The coordinator in the institution gives reading material which the students can go through during their leisure time while pursuing their undergraduate studies. At the end of each year, during summer, they are invited to the institution for a contact programme with working mathematicians. Based on their performance, they may be recommended to a scholarship given by NBHM. This programme continues for four years. Thus, even those who pursue undergraduate studies in some other discipline than mathematics can continue to learn Mathematics and use it in their further pursuit of knowledge.

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Mathematics Olympiad Programme

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Information in this brochure
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