

# FREQUENTLY ASKED QUESTIONS ON OLYMPIADS

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ABSTRACT. Here, I list some questions that I have been asked regarding Mathematical Olympiads in India and preparing for them. I have tried to both present all available facts and given my opinions in response to some of the questions.

## 1. THE WHAT OF OLYMPIADS

1.1. **The standard path.** Roughly speaking, there are four stages on the math Olympiad route in India:

- (1) The **Regional Mathematical Olympiad**: There are 15 regions, each of which conducts the Olympiad in November-December. Students of standards 11 and below can give the examination in open competition. For students of Standard 12, there is a limit on the number of people who can qualify for the next stage. A total of about 30 students qualify from every region. Further details are available at:

[http://en.wikipedia.org/wiki/Regional\\_Mathematical\\_Olympiad](http://en.wikipedia.org/wiki/Regional_Mathematical_Olympiad)

- (2) The **Indian National Mathematical Olympiad**: The approximately 500 people who qualify the Regional Mathematical Olympiad from across all regions write this examination in the first week of February. Around 30 are selected to the next stage. Again, there is bound on the number of selected students from 12th. Further details are available at:

[http://en.wikipedia.org/wiki/Indian\\_National\\_Mathematical\\_Olympiad](http://en.wikipedia.org/wiki/Indian_National_Mathematical_Olympiad)

- (3) The **International Mathematical Olympiad Training Camp**: The students who qualify the Indian National Mathematical Olympiad in the current year, as well as people who qualified in previous years, are invited to this camp. Here, through a series of five selection tests, the six-member team for the International Mathematical Olympiad is selected. Further details are available at:

[http://en.wikipedia.org/wiki/International\\_Mathematical\\_Olympiad\\_Training\\_Camp](http://en.wikipedia.org/wiki/International_Mathematical_Olympiad_Training_Camp)

- (4) The **International Mathematical Olympiad**: This is an international competition with over 85 countries participating, and each country can send at most 6 members. Contestants have to write 6 problems on 2 days, with 3 problems in 4.5 hours each day. Further details are available at:

[http://en.wikipedia.org/wiki/International\\_Mathematical\\_Olympiad](http://en.wikipedia.org/wiki/International_Mathematical_Olympiad)

1.2. **Other Olympiads.** Different regions conduct their own Olympiads. Each region has the option of either using an RMO given to it by the center, or conducting its own examination as RMO. In addition, the regions may conduct further Olympiads to spread awareness and given problem-solving practice to students.

Private bodies are also often involved in conducting Olympiads. While these Olympiads have their own value in spreading awareness and giving students exposure to Olympiad problems, they should *not* be confused as precursors to the standard path for Olympiads.

## 2. THE USEFULNESS OF OLYMPIAD PREPARATION

2.1. **Relevance to a career in mathematics.** Mathematicians have often attributed great significance to their Olympiad years as the time which got them started on their mathematical lives. As such, Olympiad mathematics looks very different from real mathematics: in Olympiad mathematics, one typically has to solve a problem in a short time (1-2 hours) whereas real mathematics requires days, months and years to struggle with problems. Real mathematics involves a deep familiarity and an ability to manipulate mathematical constructs.

Nonetheless, Olympiad mathematics is at least *partly* like real mathematics – the time, focus and attention needed for an *individual* problem in Olympiad mathematics is far more than in the routine school exercises. Further, people sincerely preparing for Olympiads often get to appreciate the importance of *abstracting the common principles* and *converting tricks to methods and methods to theories*.

Apart from this, many of the subjects covered in Olympiad mathematics prepare a foundation for higher mathematics. For instance, number theory for Olympiads helps not only in higher number theory, but also in abstract algebra, particularly group theory. The study of polynomials also lays the foundation for ring theory and commutative algebra. While Euclidean geometry does not play a direct role in higher mathematics, it does help equip one better for studying both algebraic and differential geometry.

**2.2. Conflict with IIT-JEE preparation.** I have most often been asked the following question (or some variant thereof): Does Olympiad preparation help with IIT-JEE preparation?

The standard (perhaps somewhat cliched) answer is that Olympiad problems help cultivate a kind of analytical thinking that will be useful in any examination, be it IIT-JEE or a school examination.

While this answer is correct, I would like to point out some very important differences between the Olympiad situation and the IIT-JEE situation:

- Olympiad problems require a lot of thought *per problem*. The typical Olympiad paper comprises anywhere between 3 and 6 problems to be solved in 3 hours or more. Clearly, each problem requires the development of a train of thought specific to that problem.

IIT-JEE problems on the other hand, require *speed* and *efficiency*. Even if the problems require thought, it is expected that the person writing the examination has put in the thought *already* before coming to the examination.

- Olympiad problems are completely unpredictable. In general, those setting the Olympiad, while they do have some clue as to the difficulty level of the problem, do not understand clearly how each contestant will participate. Their performance of a participant is much more contingent on uncontrollable factors than in a standard examination like IIT-JEE.

Further, those setting the Olympiad problems are not usually trying to be either fair or comprehensive. On the other hand, those setting a paper like the IIT-JEE have a responsibility to ensure a fair and comprehensive distribution of questions across the syllabus, across difficulty levels and across question types.

- There is as yet no systematic tool for “cracking” the Olympiads, while there is a plethora of tools (with different degrees of effectiveness) for the IIT-JEE.

In my view, Olympiad preparation does help make one faster in thinking and this *might* positively impact IIT-JEE preparation. However, the extent of this impact may be too indirect and it is likely that the time expended hoping for such indirect gains could have been better utilized in direct preparation. Further, too much synchronization with Olympiad mathematics may in fact prove detrimental to the mindset needed for IIT-JEE, which requires quick and sharp responses.

In one sense, though, Olympiads are very important and that is that they help one appreciate and enjoy the connections in mathematics. This is useful in making preparation for examinations like IIT-JEE much more pleasant, and is also helpful throughout later life in the study of mathematics and related subjects.

### 3. THE USEFULNESS OF OLYMPIAD SELECTION

**3.1. For undergraduate admissions (math).** Within India, there are two leading institutes for mathematics education:

- (1) **Chennai Mathematical Institute**<sup>1</sup>: This gives direct admission for its B.Sc. (Hons) Mathematics programme to students who have qualified the Indian National Mathematical Olympiad.
- (2) **Indian Statistical Institute, Bangalore**<sup>2</sup>: This does not have any special policy with regard to Olympiads.

For applying to foreign universities, particularly those in the United States, good performance in the Olympiads at the international level can be a major boost to one’s application. This is partly because the worth of the International Mathematical Olympiad is recognized and appreciated even by people from other countries.

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<sup>1</sup><http://www.cmi.ac.in>

<sup>2</sup><http://www.isibang.ac.in>

Even going for the International Mathematical Olympiad Training Camp is a booster, though much less so. Some of my acquaintances at the IMO Training Camp applied to and were successfully admitted to undergraduate programmes in universities in the United States.

**3.2. For postgraduate admissions (math/C.S.).** The main role of good performance in Olympiads for postgraduate admissions is that it provides an indication of talent at a young age. However, this in itself does not guarantee admission. A Graduate School, while considering a student's application for admission, is looking at the student's *just completed* stage of life (undergraduate studies) and the achievements, initiatives and background acquired in this most recent stage.

Nonetheless, it is my view that *good performance in Olympiads* is a far more valuable criterion for future admissions than marks in high school (tenth standard and twelfth standard).

#### 4. THE HOW OF OLYMPIAD PREPARATION

**4.1. Full details.** Full details are available at:

[http://www.cmi.ac.in/~vipul/olymp\\_resources/preparingforolympiads.pdf](http://www.cmi.ac.in/~vipul/olymp_resources/preparingforolympiads.pdf)

Here, I shall address some specific questions that I have often been asked.

**4.2. When to begin.** When it comes to Olympiad preparation, it is *never too early* and it is *never too late*.

It is true that starting off early (in standards 7th and 8th) on the Olympiad route provides a distinct advantage because it is possible to *systematically* cover the Olympiad texts in a relaxed manner and to get a thorough foundation. However, people starting early need to keep in mind the follow:

- They should not expect the same rate of progress as people starting later, because their background (particularly in degree of comfort with algebraic notation and symbols) is likely to be poorer. In some areas, they may progress just as fast as older people; in some areas, a younger student may progress faster as well. However, there may be areas where older students are progressing faster. This should not be a cause for discouragement – the younger student has more time to grasp the same concept, so being a little slower is not a huge problem.
- They should not try too hard to optimize the immediate regional levels at the cost of good foundations. The performance with respect to others at the regional level, while important insofar as it is necessary for selection to the next level, should not be taken as the sole measure of one's potential for higher levels.

Regional coordinators typically set the regional examinations at a level where people with only a school background can solve the problems, and thus, at the regional examination, the speed at solving school-level problems plays a role in performance. The national level contest and the selection tests, on the other hand, are more turned to Olympiad material.

Thus, a student who is keen for a grand success in the long-term should focus on developing good foundations.

**4.3. Is tutoring necessary?** This is a difficult question. In most places, tutors for Olympiads are not readily available, and so the question does not even arise. However, there are some places where both organizations and individuals are involved with training for the Olympiads.

Attending formal tutoring or coaching for the Olympiads could have the following advantages:

- General guidance on the directions in which to work; an overall framework within which to direct one's efforts
- Interaction with other students who are also keen on preparing for the Olympiads
- Easier understanding of concepts; doubt resolution in specific areas

On the other hand, it needs to be remembered that Olympiad tutoring (as far as it exists now) is very different from IIT-JEE coaching or coaching for school examinations. Most coaching centers for school examinations have a fully chalked, tried and tested programme which has been running for several years and students are encouraged to faithfully adhere to that programme for best results. In the case of Olympiad coaching, the coaching/tutoring only provides guidance/motivation/peer environment and does *not* lay out a full-fledged programme and schedule.

Further, there is no implicit guarantee of being “tried-and-tested” because the vagaries in Olympiad mathematics are inherently far greater.

**4.4. Does school/IIT-JEE coaching play a role?** School environment is helpful in spreading basic awareness about the Olympiads. Some schools from where students have gone for Olympiads in the past have greater awareness about the Olympiads and this may encourage more students. Since the schools are also more aware, they may also be able to get the student in contact with Olympiad instructors etc.

However, it is unlikely that the quality of teaching in school will help in Olympiad preparation. The kind of teaching orientation needed to equip students for Olympiad mathematics, is, as far as I am aware, not provided by any school.

IIT-JEE coaching institutes, even if they claim to *also* prepare for Olympiads, are likely to be of very little use for Olympiad preparation. There are two ways in which they may help:

- (1) They may help with certain topics and certain ways of thinking and formulating problems. This, however, is limited to the narrow intersection of Olympiad mathematics and IIT-JEE mathematics.
- (2) They may provide a peer environment of people who have an ability and interest in thinking about challenging mathematical problems

## 5. OLYMPIADS IN OTHER SUBJECTS

**5.1. Physics, chemistry Olympiads.** The mathematics Olympiad differs in many important respects from the Olympiads in physics and chemistry. Some of the points of difference:

- (1) The syllabus for the Physics and Chemistry Olympiad is very closely related to the syllabus for school and engineering entrance examinations. For the Mathematics Olympiad, on the other hand, there is a whole range of topics that is not covered at all in school or engineering entrance examinations.

There is in fact a heavy intersection between people doing well on the IIT-JEE and people doing well in the Physics and Chemistry Olympiad. Most of the team members are in the top 200-300 in the IIT-JEE.

- (2) Most of the students who qualify the Regional and National levels for the Physics Olympiad are people finishing 12th class. Hence, most people get only one opportunity at the International Physics Olympiad Training Camp or International Chemistry Olympiad Training Camp.

Typically the camps contain at most 2-3 people from 11th class and so far, nobody from 11th class has made it to the team.

- (3) There is no formal or informal training for the physics and chemistry Olympiads outside of the Training Camps. Even within the Training Camps, the focus is more on testing and brushing up than on teaching.

I am not too knowledgeable about the Biology Olympiad, though I believe that it is similar to the Physics and Chemistry Olympiads

**5.2. Informatics Olympiad.** The Olympiad in Informatics is somewhat more similar to the mathematics Olympiad, in the following respects:

- (1) In both, the syllabus for the Olympiads is very different from what is usually covered in school. In the case of the Informatics Olympiad, there is no parallel with school coverage because programming is not even a compulsory part of school curricula.
- (2) In both, students qualify at all years. There have been students who have qualified for the Training Camp and even for the international Olympiad in ninth standard.
- (3) In both, the intersection with students doing well in entrance examinations such as IIT-JEE is extremely low.