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If you want to do well on Olympiad-style math contests (those requiring essay-type answers with full explanations and rigorous proofs), you had better do your homework. You'll learn some interesting mathematics in the process!

**Sources of problems**

**Olympiad books/booklets**

The [Mathematical Association of America](http://www.maa.org/) publishes two volumes of problems from the International Mathematical Olympiad (IMO) and one from the USA Mathematical Olympiad (USAMO). These three books are part of the MAA New Mathematical Library (NML) series.

However, the IMO books only cover problems up to 1985, and the USAMO book up to 1986. (I'm told subsequent books in each series are in the works, but don't expect them any time soon.) There are two ways to remedy this problem. First, the [American Mathematics Competitions](http://www.unl.edu/amc) (AMC) makes the problems of these missing Olympiads available on their Web site. Second and preferable for Olympiad preparation, the AMC also publishes one pamphlet for each year, containing the USAMO and IMO problems from that year with detailed solutions. See the AMC web site for order information.

Three collections of national olympiads are also available from AMC, covering 1995-1996, 1996-1997, and 1997-1998. Each book includes problems and solutions from the prior year, and problems from the latter year. When ordering, ask for "Mathematical Contests".

**Other problem books**

There are lots of other sources of Olympiad-style problems. The *USSR Olympiad Problem Book* by Shlarsky, Chentzov, Yaglom is but one example.

Perhaps more useful than books of problems are books that also include some comments on problem-solving. A good choice is the recent *A Mathematical Mosaic*, by former Canadian IMOer Ravi Vakil.

Before his death, Samuel Greitzer (founder of the USA IMO team) published a journal for students called the*Arbelos*, containing a mixture of problems and commentary. The AMC sells copies of this journal in 6 bound pamphlet.

**Journals with problem sections**

The journal [*Crux Mathematicorum*](http://camel.cecm.sfu.ca/CMS/CRUX/) is devoted entirely to Olympiad-style problem solving, and is read by many IMO hopefuls around the world.

Many other mathematics journals have a regular problem section, featuring problems and solutions submitted by readers. Two American journals whose problems are suitable for Olympiad participants are the MAA's*Mathematics Magazine* and the *American Mathematical Monthly*.

Don't forget, mathematics journals for high school students exist in many countries. For example, Bulgaria has*Matematika*, Hungary has *[Kömal](http://www.math.elte.hu/komal/index.e.html)*, and Russia has *Kvant* (also published in the U.S. as [*Quantum*](http://live.nsta.org/quantum/Default.html)).

**Background reading on particular topics**

While much of the material on this list is intended to be directly relevant to competitions, the suggestions should also be useful to those wishing to study these topics for their own sake.

**Algebra**

*Polynomials*, by Barbeau, is a good starting point.

If abstract algebra (groups, rings, fields, Galois theory) is what you're looking for, *Contemporary Abstract Algebra* by Gallian is a low-impact introduction to the subject. More sophisticated texts include *Algebra*, by Artin and *Topics in Algebra*, by Herstein.

**Combinatorics**

This subject is blessed by an abundance of well-written texts. A good source for enumerative combinatorics is Richard Stanley's book of the same name (2 volumes). For generating functions, look no further than*generatingfunctionology*, by Wilf. *Concrete Mathematics,* by Graham, Knuth and Patashnik, is not easy reading for the beginner, but includes a slew of problems.

**Game Theory**

The bible of this subject is *Winning Ways for your Mathematical Plays*, by Berlekamp, Conway and Guy (two volumes).

**Geometry**

The standard supplement for the American student underprepared in Euclidean geometry is *Geometry Revisited*, by Coxeter and Greitzer (part of the MAA's NML series). Additional reading could include*Geometric Transformations*, by Yaglom (NML, 3 volumes) and/or *A Course in Geometry*, by Eves (2 volumes).

For those who want to pursue geometry in some of its more modern incarnations, here are a couple of additional suggestions. A gentle introduction to hyperbolic geometry is *Journey into Geometries*, by Sved (MAA). For projective geometry, try Coxeter's book of the same name.

**Graph Theory**

Try *Pearls in Graph Theory* by Hartsfield and Ringel.

**Inequalities**

The bible of this subject is *Inequalities*, by Hardy, Littlewood and Pólya, but it makes for pretty tough reading. Better would be to start with my MOP 1998 notes (see the [resources for students](http://ohkawa.cc.it-hiroshima.ac.jp/AoPS.pdf/www.unl.edu/amc/a-activities/a4-for-students/s-index.html) page).

**Number Theory**

Try Vanden Eynden for beginners, Sierpinski for more advanced readers. The ambitious student might try Niven and Zuckerman.

For those who want to pursue the subject further, try *An Introduction to the Theory of Numbers*, by Hardy and Wright; *A Classical Introduction to Modern Number Theory*, by Ireland and Rosen, *The Theory of Algebraic Numbers,* by Diamond and Pollack; or *Number Fields*, by Marcus.

**Other stuff**

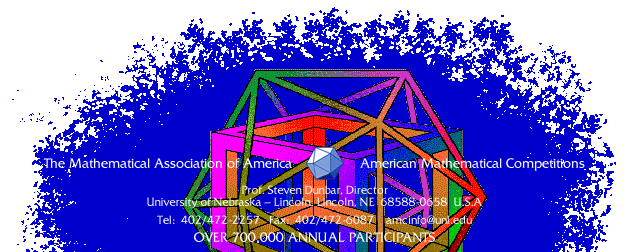
**TeX**

TeX (pronounced like the "tech" in "technology") is the standard system for typesetting mathematics. One constructs mathematical symbols and equations by describing what they say, rather than what they look like, in human-readable code that is easily transmitted over the Internet. TeX is much more powerful than most commercially available systems, and is freely available to boot!

There are lots of books about TeX (and LaTeX, an enhanced version of plain TeX) out there, and some are quite good. You might try *The LaTeX Companion*, by Goossens et al; or *LateX: A Document Preparation System*, by Lamport.

Maintained by [Kiran S. Kedlaya](http://www-math.mit.edu/~kedlaya) ([kedlaya@math.mit.edu](mailto:kedlaya@math.mit.edu)) for [American Mathematics Competitions](http://www.unl.edu/amc)  
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