

MATHEMATICS & OLYMPIADS

Getting Started with Olympiad Mathematics

Choose the right competition, build real proof-based thinking, and put together a training plan you can actually stick to — before you touch a single past paper.

SKILL LEVEL: BEGINNER **BUILD TIME:** ONGOING (3–12 MONTHS TO FIRST RESULTS) **EST. COST:** \$0–60 (BOOKS OPTIONAL)

Before you start: you need solid algebra and basic geometry, not advanced math. Olympiad mathematics rewards creative reasoning over memorized formulas — if you can solve a puzzle patiently, you have the right instinct already.

01 Objective

Most students who quit olympiad math don't quit because it's too hard — they quit because they started with the wrong competition, the wrong book, or no plan at all, and burned out on frustration that had nothing to do with ability. By the end of this blueprint, you'll know which competition track actually fits your level right now, understand what "proof-based thinking" means in practice, and have a concrete weekly training rhythm — the same structure that separates students who improve steadily from students who plateau after one contest.

02 Prerequisites

- Comfort with algebra and basic geometry (no calculus required to start)
- Willingness to spend real time stuck on one problem — this is the actual skill being trained, not a side effect
- A notebook you're willing to fill with messy, crossed-out attempts — olympiad math is not done cleanly on the first try

03 Recommended Resources

RESOURCE	LEVEL	NOTES
<i>The Art of Problem Solving</i> , Vol. 1	Beginner	~\$25 — the standard starting textbook, used worldwide
AoPS Online (artofproblemsolving.com)	All levels	Free forums and problem archives; paid classes optional
National/regional olympiad past papers	All levels	Usually free — published by your country's math federation or ministry of education
Engel, <i>Problem-Solving Strategies</i>	Intermediate–Advanced	~\$50 — dense but comprehensive once fundamentals are solid
Evan Chen's "Napkin" project / OTIS notes	Advanced	Free online — bridges olympiad and university-level math
Brilliant.org	Beginner–Intermediate	Subscription — good for building intuition through interactive problems

04 Tools Required

- A notebook and pencil — most of this work happens on paper, not a screen
- A timer, for practicing under contest conditions later

AVOID THE SOLUTION-LOOKUP TRAP

The single most common mistake at this stage is checking the solution too soon. If you look at a solution before you've genuinely stuck for at least 20–30 minutes, you're training pattern recognition, not problem-solving — and the two feel identical on easy problems but diverge completely on hard ones. Set a rule for yourself now, before frustration makes the decision for you.

05 The Olympiad Landscape

Not every competition is built for the same stage. Picking one that matches where you are now — rather than where you want to be in two years — is what keeps you in the sport long enough to actually improve.

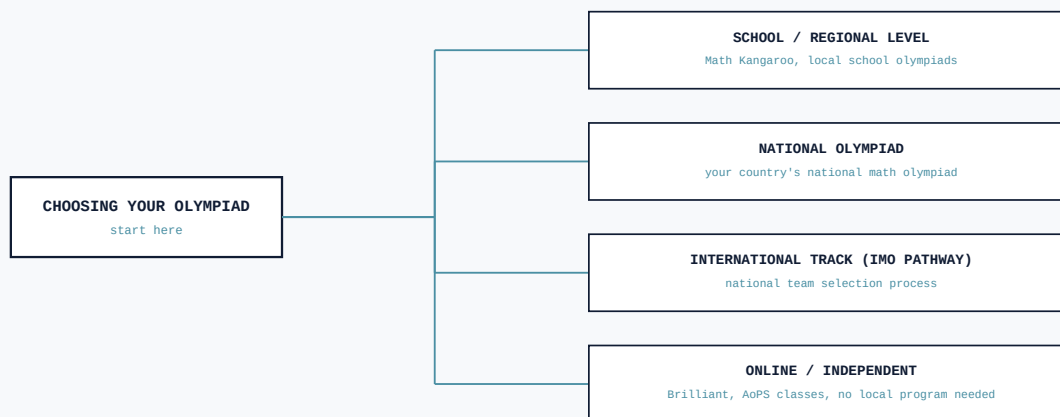


FIG. 1 — MATCHING A COMPETITION TRACK TO YOUR CURRENT STAGE

TRACK	ENTRY POINT	BEST FOR
School / Regional	Usually no prerequisite, open registration	First-time competitors, building contest experience
National Olympiad	Often requires qualifying through a regional round	Students with 1+ years of structured practice
International (IMO Pathway)	National team selection, by invitation or ranking	Students already placing well nationally
Online / Independent	Open to anyone, anytime	Students without a local olympiad program

06 Step-by-Step Training Plan

1. **Assess your current level honestly.** Attempt an easy past paper from your target competition, untimed. Don't worry about finishing — note which topics feel solid and which feel foreign.
2. **Pick one book and finish it before starting a second.** Jumping between resources feels productive but fragments your foundation — *AoPS Vol. 1* cover-to-cover beats five books skimmed.
3. **Build a daily habit, not a marathon.** 30–45 focused minutes a day beats a single 4-hour weekend session — consistency is what actually builds pattern intuition.
4. **Write full proofs weekly, not just final answers.** Olympiad grading rewards rigorous justification, not correct numbers — practice writing the argument, not just finding it.
5. **Sit a full mock contest monthly, under real time pressure.** This is the only way to train contest stamina and pacing, which are separate skills from solving problems untimed.
6. **Join a community.** The AoPS forums or a local math circle expose you to different solution approaches — seeing three ways to solve one problem teaches more than solving three separate problems.
7. **Keep a mistake journal.** After every mock or past paper, write one sentence on why you missed each problem — "didn't try a substitution" or "misread the constraint" are patterns you can train against directly.

07 Problem Walkthrough

Here's how a structured proof attempt actually looks on paper — not a flash of insight, but a sequence of deliberate moves. This is the habit worth building from day one.

PROBLEM: Prove that for any positive integers a , b , the number $a^2 + b^2$ is never of the form $4k + 3$ for any integer k .

STEP 1 – Reduce to a smaller case.
Any integer's square depends only on the integer mod 4.
So check every residue: 0, 1, 2, 3 (mod 4).

STEP 2 – Work out the pattern.
 $0^2 = 0 \equiv 0 \pmod{4}$
 $1^2 = 1 \equiv 1 \pmod{4}$

$$2^2 = 4 \equiv 0 \pmod{4}$$
$$3^2 = 9 \equiv 1 \pmod{4}$$

→ every perfect square is $\equiv 0$ or $1 \pmod{4}$. Never 2 or 3.

STEP 3 – Combine two squares.

$a^2 + b^2 \pmod{4}$ can only be: $0+0$, $0+1$, $1+0$, or $1+1$

→ possible sums $\pmod{4}$: 0, 1, 1, 2

→ $3 \pmod{4}$ is never reachable.

STEP 4 – State the conclusion clearly.

Since $a^2 + b^2 \pmod{4} \in \{0, 1, 2\}$, it can never equal $3 \pmod{4}$.

Therefore $a^2 + b^2$ is never of the form $4k + 3$. ■

Notice the shape: reduce to a finite case, work it out exhaustively, combine, conclude. This four-move pattern reappears constantly in number theory problems.

08 Common Mistakes

MISTAKE	WHY IT HURTS	FIX
Memorizing solutions instead of methods	Feels like progress but doesn't transfer to new problems	After solving, ask "what general technique did I just use?" and write it down
Skipping proof-writing practice	Contests are graded on justification, not just the answer	Write full solutions weekly, even for problems you solved easily
Comparing your pace to others online	Everyone's timeline is different; this mostly causes burnout	Track your own progress against your own mistake journal, not a forum thread
Avoiding number theory or combinatorics	These topics reward technique over memorized formulas and are heavily tested	Deliberately schedule weak-topic practice, not just what feels comfortable
Never reviewing wrong answers	The same 3–4 error patterns repeat for most students	Spend as much time reviewing mistakes as solving new problems

09 Where This Goes Next

FROM OLYMPIAD TRAINING TO BROADER PROBLEM-SOLVING

The habits you're building here — structured reasoning, comfort with being stuck, writing rigorous justification — are the exact same skills that make competitive programmers and researchers effective. If algorithmic thinking also appeals to you, pair this blueprint with **PO-001 (Getting Started with Competitive Programming)**, which channels the same problem-solving instinct into a different format. See The University & Scholarship Playbook module for how olympiad results translate into applications.