
The Excel Math Competition

Test Standards & Topic Guide



Student & Parent Copy — Revised 2026

This guide lists the standards each of our four tests may draw on — a study reference and a fairness guarantee that no test will require a skill outside its list. Choosing a test? Read Section 1 first.

1. How to Use This Guide

Each test is organized into thematic standards, shown in bold italics (e.g. “*Demonstrate understanding of quadratics*”), each followed by the specific, testable skills it covers. Every problem must fit under one or more of these bullets.

The Introductory and Advanced Algebra Tests share one topic list (Section 3); the difference is depth, not subject matter. Introductory problems are direct and single-step, aimed at students new to competition; Advanced problems on those same standards are harder, less routine, and more likely to combine several standards.

More generally, the same skill can appear as an easy warm-up on one test and a hard, late question on the next. **Calculators are not permitted on any test**; every standard below is testable without one.

2. Elementary Math Test

Who it’s for: students who have completed a standard elementary arithmetic curriculum and have not yet studied formal algebra.

Demonstrate fluency with whole numbers, fractions, decimals, and percents.

- Perform the four basic operations on whole numbers, including multi-digit multiplication and long division.
- Perform the four basic operations on fractions and mixed numbers, including simplifying answers to lowest terms.
- Perform the four basic operations on decimals.
- Convert fluently between fractions, decimals, and percents.
- Apply the order of operations to multi-step numerical expressions.
- Solve percent problems, including percent of a number, percent increase/decrease, and simple discount or markup.

Demonstrate understanding of number properties.

- Identify all factors and the first several multiples of a given whole number.
- Determine the greatest common factor (GCF) and least common multiple (LCM) of two or more numbers.
- Identify prime and composite numbers, and find the prime factorization of a whole number.
- Apply divisibility rules for 2, 3, 4, 5, 6, 8, 9, and 10.

Apply ratio, rate, and proportional reasoning.

- Set up and solve a proportion.
- Solve unit-rate problems and convert units within the customary or metric system using a given conversion factor.
- Solve real-world problems involving ratios and rates, including scaling a recipe, reading a scale drawing or map, and comparing two rates.

Demonstrate understanding of measurement and basic geometry.

- Calculate the perimeter and area of rectangles, triangles, parallelograms, trapezoids, and circles.
- Calculate the volume and surface area of rectangular prisms and cylinders.
- Apply relationships among complementary, supplementary, and vertical angles, and the angle sum of a triangle or polygon.
- Identify and apply basic properties of triangles (by side and angle classification), quadrilaterals, and circles (radius, diameter, circumference).

Interpret and analyze data.

- Calculate the mean, median, mode, and range of a data set.
- Read and interpret data presented in tables, bar graphs, line graphs, and pictographs.
- Solve basic counting problems using an organized list or a simple tree diagram.
- Determine the probability of a single event as a fraction of favorable outcomes over total outcomes.

Recognize patterns and use the coordinate plane.

- Identify and extend a numeric pattern or simple sequence, and state a rule for it.
- Plot and read ordered pairs on a coordinate grid, primarily in the first quadrant.

Apply problem-solving strategies.

- Translate a word problem into a single numeric expression or a one-step equation using a blank or box for the unknown quantity.
- Solve a multi-step word problem that combines two or more of the skills listed above.

3. Algebra Standards (Introductory & Advanced Algebra)

These standards are shared by both algebra tests — see Section 4 and Section 5 for how the two tests differ in applying them.

Demonstrate fluency with the real number system.

- Identify and apply the properties of real numbers (commutative, associative, distributive, identity, inverse) to simplify an expression.
- Perform operations with signed numbers, including expressions involving absolute value.
- Simplify expressions involving integer exponents using the laws of exponents.
- Simplify and evaluate expressions involving square roots, including simplifying non-perfect-square radicals.

Demonstrate understanding of algebraic procedures and symbolism.

- Translate between word phrases/sentences and algebraic expressions, equations, and/or inequalities.
- Perform operations (add, subtract, multiply, divide) on polynomials.
- Factor polynomials using the greatest common factor, difference of squares, and trinomial factoring (leading coefficient of 1 or greater).
- Solve linear equations and inequalities in one variable, including equations with variables on both sides and those requiring distribution.
- Solve absolute value equations in one variable.
- Solve a system of two linear equations in two variables using substitution, elimination, or graphing.

Use algebraic strategies to solve problems.

- Solve real-world and mathematical problems using first-degree equations and inequalities in one variable.
- Solve real-world and mathematical problems using a system of two linear equations in two variables.
- Solve the following types of word problems: mixture, percent, work, distance/rate/time, coin, and age.

Demonstrate understanding of linear functions and their graphs.

- Determine the slope, x -intercept, and y -intercept of a linear equation, and graph the corresponding line in the Cartesian plane.
- Write the equation of a line given two points, a point and a slope, or a graph.
- Determine whether a relation is a function using ordered pairs, a mapping diagram, a table, or the vertical line test.
- Evaluate a function given in function notation for a specified input.
- Graph a linear inequality in two variables and identify the correct half-plane.
- Determine the solution to a system of two linear equations by graphing.

Demonstrate understanding of quadratics.

- Solve a quadratic equation in one variable by factoring, completing the square, or the quadratic formula.

- Identify the vertex, axis of symmetry, and intercepts of a parabola from its equation or its graph.
- Compare the real solutions of a quadratic equation with the x -intercepts of the corresponding graph.

Demonstrate understanding of sequences, series, sets, and counting.

- Identify and extend an arithmetic sequence, and find a specified term using the explicit formula.
- Identify and extend a geometric sequence, and find the sum of a finite arithmetic or finite/infinite geometric series.
- Use sigma notation to represent or evaluate a series.
- Represent relationships between sets using Venn diagrams.
- Apply the fundamental counting principle, introductory permutations and combinations, and the binomial theorem.

Demonstrate understanding of exponential and logarithmic functions.

- Apply the laws of exponents, including to rational (fractional) exponents.
- Convert an expression between exponential and logarithmic form, and evaluate a simple logarithm (for example, $\log_2 8$) directly from that definition.
- Apply the properties of logarithms (product, quotient, and power rules) to simplify or expand an expression.
- Solve exponential and logarithmic equations.
- Model and solve real-world exponential growth and decay problems.

Demonstrate understanding of trigonometry.

- Apply right-triangle trigonometry (sine, cosine, tangent) to solve for a missing side or angle.
- Define the six trigonometric functions using the unit circle, and evaluate them at standard angles.
- Convert between degree and radian measure.
- Apply the Pythagorean identity and the reciprocal identities to simplify an expression or verify an identity.
- Solve a basic trigonometric equation over a stated domain.

Demonstrate understanding of complex numbers.

- Simplify powers of i and perform the four basic operations with complex numbers.
- Represent a complex number in the complex plane and determine its magnitude.
- Solve a quadratic equation whose solutions are complex.

Demonstrate understanding of conic sections.

- Identify the type of conic section (circle, parabola, ellipse, or hyperbola) from its standard-form equation, and identify its key features (center, radius, vertex, focus, as appropriate).

- Graph a circle, ellipse, parabola, or hyperbola from its standard-form equation.
- Convert a conic section's equation from general form to standard form by completing the square.

Demonstrate understanding of polynomial theory.

- Apply the remainder theorem and the factor theorem to evaluate or factor a polynomial.
- Apply the rational root theorem to list the possible rational roots of a polynomial.
- Apply Vieta's formulas to relate a polynomial's coefficients to the sums and products of its roots.
- Solve a polynomial or rational inequality.

Demonstrate understanding of functions.

- Determine the composition of two functions.
- Determine the inverse of a function, algebraically or from its graph.
- Identify the effect of a transformation (shift, stretch, or reflection) on the graph of a function.

Demonstrate understanding of introductory number theory and matrices.

- Apply basic modular arithmetic.
- Set up a matrix from a given context, and identify its dimensions and entries.
- Perform addition, scalar multiplication, and multiplication on matrices no larger than 3×3 .

4. Introductory Algebra Test

Who it's for: students who have completed, or are currently completing, a first course in algebra — especially students who are new to math competitions and want an accessible way to make their first jump into competitive algebra.

This test draws on every standard in Section 3, including logarithms, trigonometry, complex numbers, conic sections, and matrices — but only at the level of a single definition or procedure (e.g. simplify $(3+2i)-(1-4i)$, or identify a circle's center and radius from its equation), never combined into a multi-step problem.

5. Advanced Algebra Test

Who it's for: students who already have some math competition experience and are ready for a harder, more creative test.

This test covers the exact same standards as the Introductory Algebra Test (Section 3) — no new topics, just more depth: multi-step problems, less routine setups, and creative combinations of standards rather than single-step recall.

6. Calculus Test

Who it's for: students who have completed, or are currently completing, a first course in single-variable calculus.

Every standard in Section 3 is assumed as prerequisite knowledge and may support a calculus problem, though precalculus skills alone won't be the primary subject. The standards below are specific to Calculus.

Demonstrate understanding of limits and continuity.

- Evaluate a limit using direct substitution, factoring, or rationalizing.
- Evaluate a one-sided limit and a limit at infinity.
- Evaluate a limit involving an indeterminate form, including by L'Hôpital's Rule.
- Determine whether a function is continuous at a point or on an interval, and apply the Intermediate Value Theorem.

Demonstrate understanding of differentiation.

- Apply the definition of the derivative as a limit.
- Apply the power, product, quotient, and chain rules to differentiate a function.
- Differentiate trigonometric, exponential, and logarithmic functions.
- Apply implicit differentiation to find the derivative of an implicitly defined relation.
- Solve a related rates problem.

Apply derivatives to analyze functions and solve problems.

- Determine intervals of increase/decrease and concavity using the first and second derivative.
- Find and classify critical points, local extrema, and inflection points.
- Solve an optimization problem using derivatives.
- Apply derivatives to a motion problem (position, velocity, acceleration).
- Apply the Mean Value Theorem and the Extreme Value Theorem.

Demonstrate understanding of integration.

- Determine an antiderivative or indefinite integral of a polynomial, trigonometric, exponential, or logarithmic function.
- Apply the Fundamental Theorem of Calculus to evaluate a definite integral.
- Apply u -substitution to evaluate an integral.
- Apply basic integration by parts.

Apply integrals to solve problems.

- Determine the area between two curves.
- Determine the volume of a solid of revolution using the disk, washer, or shell method.
- Solve an accumulation or net-change problem using a definite integral.

Demonstrate understanding of sequences and series.

- Determine whether a sequence converges or diverges, and find its limit if it converges.

- Determine whether a series converges or diverges using an appropriate test (the n th-term test, geometric series test, p -series test, ratio test, root test, integral test, alternating series test, or a comparison test).
- Determine whether a convergent series converges absolutely or conditionally.
- Find the radius and interval of convergence of a power series.
- Represent a function as a Taylor or Maclaurin series, and use it to approximate a function value or evaluate a limit.
- Find a Taylor polynomial of a specified degree and estimate its error using the Lagrange error bound.

Demonstrate understanding of differential equations.

- Solve a separable differential equation, including real-world applications.
- Solve a first-order linear differential equation using an integrating factor.
- Solve a second-order linear homogeneous differential equation with constant coefficients, including cases with real, repeated, or complex characteristic roots.
- Use a slope field to sketch a solution curve and analyze the qualitative behavior of a differential equation.
- Model and interpret a real-world situation (population growth, cooling, mixing, and similar) with a differential equation and its solution.

7. Questions About Scope

A problem you believe falls outside a test's standards is handled like any other scoring dispute: raise it during the dispute period, not during the test. Organizers will confirm whether it was in scope.

These standards may be revised between competition cycles; the version distributed with a given competition's materials is the one in effect.