

## **Algebra 2**

**Prerequisite: Geometry**

A primary goal of Algebra 2 is for students to conceptualize, analyze, and identify relationships among functions. This course builds on concepts learned in Algebra 1 and Geometry by extending linear algebra and coordinate geometry concepts to other functions and systems of equations. Students will develop proficiency in analyzing and solving quadratic functions using complex numbers. Students will investigate and make conjectures about absolute value, radical, exponential, logarithmic and sine and cosine functions algebraically, numerically, and graphically, with and without a graphing calculator. Students will extend their algebraic skills to compute with rational expressions and rational exponents. Students will analyze statistical data and apply concepts of probability using permutations and combinations. Students will apply mathematical skills and make meaningful connections to life's experiences.

**Standard I: Students will use the language and operations of algebra to evaluate, analyze and solve problems.**

**Objective 1: Evaluate, analyze, and solve mathematical situations using algebraic properties and symbols.**

- a. Solve and graph first-degree absolute value equations of a single variable.
- b. Solve radical equations of a single variable, including those with extraneous roots.
- c. Solve absolute value and compound inequalities of a single variable.
- d. Add, subtract, multiply, and divide rational expressions and solve rational equations.
- e. Simplify algebraic expressions involving negative and rational exponents.

**Objective 2: Solve systems of equations and inequalities.**

- a. Solve systems of linear, absolute value, and quadratic equations algebraically and graphically.
- b. Graph the solutions of systems of linear, absolute value, and quadratic inequalities on the coordinate plane.
- c. Solve application problems involving systems of equations and inequalities.

**Objective 3: Represent and compute fluently with complex numbers.**

- a. Simplify numerical expressions, including those with rational exponents.
- b. Simplify expressions involving complex numbers and express them in standard form,  $a + bi$ .

**Objective 4: Model and solve quadratic equations and inequalities.**

- a. Model real-world situations using quadratic equations.
- b. Approximate the real solutions of quadratic equations graphically.
- c. Solve quadratic equations of a single variable over the set of complex numbers by factoring, completing the square, and using the quadratic formula.
- d. Solve quadratic inequalities of a single variable.
- e. Write a quadratic equation when given the solutions of the equation.

**Mathematical Language and Symbols Students Should Use**  
compound inequality, rational equation, system of equations, complex number,  
completing the square, quadratic formula

**Standard II: Students will understand and represent functions and analyze function behavior.**

**Objective 1: Represent mathematical situations using relations.**

- a. Model real-world relationships with functions.
- b. Describe a pattern using function notation.
- c. Determine when a relation is a function.
- d. Determine the domain and range of relations.

**Objective 2: Evaluate and analyze functions.**

- a. Find the value of a function at a given point.
- b. Compose functions when possible.
- c. Add, subtract, multiply, and divide functions.
- d. Determine whether or not a function has an inverse, and find the inverse when it exists.
- e. Identify the domain and range of a function resulting from the combination or composition of functions.

**Objective 3: Define and graph exponential functions and use them to model problems in mathematical and real-world contexts.**

- a. Define exponential functions as functions of the form  $y = ab^x, b > 0, b \neq 1$ .
- b. Model problems of growth and decay using exponential functions.
- c. Graph exponential functions.

**Objective 4: Define and graph logarithmic functions and use them to solve problems in mathematics and real-world contexts.**

- a. Relate logarithmic and exponential functions.
- b. Simplify logarithmic expressions.
- c. Convert logarithms between bases.
- d. Solve exponential and logarithmic equations.
- e. Graph logarithmic functions.
- f. Solve problems involving growth and decay.

**Mathematical Language and Symbols Students Should Use**  
function, relation, domain, range,  $f(x)$ ,  $f(g(x))$ ,  $f \circ g$ , one to one, inverse,  
exponential function, logarithm, base,  $e$

**Standard III: Students will use algebraic, spatial, and logical reasoning to solve geometry and measurement problems.**

**Objective 1: Examine the behavior of functions using coordinate geometry.**

- a. Identify the domain and range of the absolute value, quadratic, radical, sine, and cosine functions.
- b. Graph the absolute value, quadratic, radical, sine, and cosine functions.
- c. Graph functions using transformations of parent functions.
- d. Write an equation of a parabola in the form  $y = a(x - h)^2 + k$  when given a graph or an equation.

**Objective 2: Determine radian and degree measures for angles.**

- a. Convert angle measurements between radians and degrees.
- b. Find angle measures in degrees and radians using inverse trigonometric functions, including exact values for special triangles.

**Objective 3: Determine trigonometric measurements using appropriate techniques, tools, and formulas.**

- a. Define the sine, cosine, and tangent functions using the unit circle.
- b. Determine the exact values of the sine, cosine, and tangent functions for the special angles of the unit circle using reference angles.
- c. Find the length of an arc using radian measure.
- d. Find the area of a sector in a circle using radian measure.

<p style="text-align: center;"><b>Mathematical Language and Symbols Students Should Use</b></p>
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<p style="text-align: center;">transformation, parabola, radian, unit circle, reference angle</p>
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**Standard IV: Students will understand concepts from probability and statistics and apply statistical methods to solve problems.**

**Objective 1: Apply basic concepts of probability.**

- a. Distinguish between permutations and combinations and identify situations in which each is appropriate.
- b. Calculate probabilities using permutations and combinations to count events.
- c. Compute conditional and unconditional probabilities in various ways, including by definitions, the general multiplication rule, and probability trees.
- d. Define simple discrete random variables.

**Objective 2: Use percentiles and measures of variability to analyze data.**

- a. Compute different measures of spread, including the range, standard deviation, and interquartile range.
- b. Compare the effectiveness of different measures of spread, including the range, standard deviation, and interquartile range in specific situations.
- c. Use percentiles to summarize the distribution of a numerical variable.
- d. Use histograms to obtain percentiles.

**Mathematical Language and Symbols Students Should Use**

permutation, combination, conditional probability, discrete random variable, standard deviation, interquartile range, percentile