

Algebra

Students will extend their knowledge of polynomials and equations in algebra I. Students learn to work with tables, graphs variables, perform operations with real numbers, solve linear equations and inequalities, factor polynomials, simplify rational expressions and work with radicals. Students will simplify polynomials and begin to study quadratic relationships. Students will use technology to investigate and explore mathematical relationships and develop multiple strategies for analyzing such relationships. Students will analyze mathematical relationships verbally, numerically, graphically and symbolically. Students will apply mathematical skills and reasoning to problem solving.

Standard 1: Students will expand number sense to understand, perform operations, and solve problems with real numbers.

Objective 1: Represent real numbers as points on the number line and distinguish rational numbers from irrational numbers.

- a. Define a rational number as a point on the number line that can be expressed as the ratio of two integers, and points that cannot be so expressed as irrational.
- b. Classify numbers as rational or irrational, knowing that rational numbers can be expressed as terminating or repeating decimals and irrational numbers can be expressed as non-terminating, non-repeating decimals.
- c. Classify π and square roots of non-perfect square numbers as irrational.
- d. Place rational and irrational numbers on a number line between two integers.

Objective 2: Compute fluently and make reasonable estimates with rational and irrational numbers.

- a. Simplify, add, subtract, multiply, and divide expressions with real numbers.
- b. Evaluate and simplify numerical expressions containing rational numbers and square roots using the order of operations.
- c. Compute solutions to problems, represent answers in exact form, and determine the reasonableness of answers.
- d. Calculate the measures of the sides of a right triangle using the Pythagorean Theorem.

Standard 2: Students will extend concepts of proportion to represent and analyze linear relations.

Objective 1: Represent and analyze the slope of a line.

- a. Identify the slope of a line when given points, a graph, or an equation.
- b. Identify horizontal and vertical lines given the equations or slopes.
- c. Determine the effect of changes in slope or y-intercept in $y = mx + b$.
- d. Determine and explain the meaning of slopes and intercepts using real-world examples.

Objective 2: Represent and analyze linear relationships using algebraic equations, expressions, and graphs.

- a. Write the equation of a line when given two points or the slope and a point on the line.
- b. Approximate the equation of a line given the graph of a line.

- c. Represent linear equations in slope-intercept form, $y = mx + b$, and standard form, $Ax + By = C$.
- d. Identify the x- and y-intercepts from an equation or graph of a line or a table of values.
- e. Graph linear relations and inequalities by plotting points, by finding x- and y-intercepts, or by using the slope and any point on the line.

Standard 3: Students will develop fluency with the language and operations of algebra to analyze and represent relationships.

Objective 1: Simplify polynomials and the quotient of monomials.

- a. Simplify and evaluate monomial expressions and formulas.
- b. Solve real-world problems involving constant rates of change.
- c. Solve equations for a specified variable.
- d. Multiply binomials.
- e. Simplify the quotient of monomials using positive exponents.

Objective 2: Solve and interpret linear equations and inequalities in various situations including real-world problems.

- a. Solve single-variable linear equations and inequalities algebraically and graphically.
- b. Solve problems using the distance formula.
- c. Solve problems for areas and perimeters.
- d. Solve proportions that include algebraic first-degree expressions.

Objective 3: Solve and interpret pairs of linear equations and inequalities.

- a. Solve systems of two linear equations graphically and algebraically with and without technology.
- b. Determine the number of possible solutions for a system of two linear equations.
- c. Graph a system of linear inequalities and identify the solution.

Objective 4: Factor polynomials with common monomial factors and factor simple quadratic expressions.

- a. Find the greatest common monomial factor of a polynomial.
- b. Factor trinomials with integer coefficients of the form $x^2 + bx + c$.
- c. Factor the difference of two squares and perfect square trinomials.

Objective 5: Solve quadratic equations using factoring or by taking square roots.

- a. Solve quadratic equations that can be simplified to the form $x^2 = a$ where $a \geq 0$ by taking square roots.
- b. Solve quadratic equations using factoring.
- c. Write a quadratic equation when given the solutions.
- d. Solve quadratic equations using graphing, completing the square and the quadratic formula.

Geometry

This year long course covers the three key aspects of geometry: measuring, reasoning and applying geometrical concepts. Students will learn geometric properties for polygons, triangles, circles, area and volume of polygons and solids, similarity and congruence, trigonometry, constructions, as well as the development of a logical proof. Students will develop a Euclidean geometric structure and apply the resulting theorems and formulas to meaningful problems. Students will use experimentation and inductive reasoning to construct geometric concepts, discover geometric relationships, and formulate conjectures. Students will employ deductive logic to prove theorems and justify conclusions. Students will use geometry software, compass and straightedge, and other tools to investigate and explore mathematical ideas and relationships and develop multiple strategies for analyzing geometric problems

Standard 1: Students will use algebraic, spatial, and logical reasoning to solve geometry problems.

Objective 1: Use inductive and deductive reasoning to develop mathematical arguments.

- a. Write conditional statements, converses, and inverses
- b. Formulate conjectures using inductive reasoning.
- c. Prove a statement false by using a counterexample.

Objective 2: Analyze characteristics and properties of angles.

- a. Use accepted geometric notation for lines, segments, rays, angles, similarity, and congruence.
- b. Identify and determine relationships in adjacent, complementary, supplementary, or vertical angles and linear pairs.
- c. Classify angle pairs formed by two lines and a transversal.
- d. Prove relationships in angle pairs.
- e. Prove lines parallel or perpendicular using slope or angle relationships.

Objective 3: Analyze characteristics and properties of triangles.

- a. Prove congruency and similarity of triangles using postulates and theorems.
- c. Use the Pythagorean Theorem in multiple ways, find missing sides of right triangles using the Pythagorean Theorem, and determine whether a triangle is a right triangle using the converse of the Pythagorean Theorem.
- c. Prove and apply theorems involving isosceles triangles.
- d. Apply triangle inequality theorems.
- e. Identify medians, altitudes, and angle bisectors of a triangle, and the perpendicular bisectors of the sides of a triangle.

Objective 4: Analyze characteristics and properties of polygons and circles.

- a. Use examples to classify subsets of quadrilaterals.
- b. Investigate properties of quadrilaterals using triangle congruence relationships, postulates, and theorems.
- c. Derive, justify, and use formulas for the number of diagonals, lines of symmetry, angle measures, perimeter, and area of regular polygons.

- d. Define radius, diameter, chord, secant, arc, sector, central angle, inscribed angle, and tangent of a circle, and solve problems using their properties.
- e. Show the relationship between intercepted arcs and inscribed or central angles, and find their measures.

Objective 5: Perform basic geometric constructions, describing and justifying the procedures used.

- a. Investigate geometric relationships using constructions.
- b. Copy and bisect angles and segments.
- c. Construct perpendicular and parallel lines.
- d. Demonstrate correct procedures used to construct geometric figures.
- e. Discover and investigate conjectures about geometric properties using constructions.

Objective 6: Analyze characteristics and properties of three-dimensional figures.

- a. Identify and classify prisms, pyramids, cylinders and cones based on the shape of their base(s).
- b. Identify three-dimensional objects from different perspectives using nets, cross-sections, and two-dimensional views of platonic solids.
- c. Describe relationships between the faces, edges, and vertices of polyhedra.

Standard 2: Students will use the language and operations of algebra to explore relationships with coordinate geometry and trigonometry.

Objective 1: Describe the properties and attributes of lines and line segments using coordinate geometry.

- a. Verify the classifications of geometric figures using coordinate geometry to find lengths and slopes.
- b. Find the distance between two given points and find the coordinates of the midpoint.
- c. Write an equation of a line perpendicular or a line parallel to a line through a given point.
- d. Students will extend concepts of proportion and similarity to trigonometric ratios.

Objective 2: Use triangle relationships to solve problems.

- a. Solve problems using the properties of special right triangles, e.g., 30° , 60° , 90° or 45° , 45° , 90° .
- b. Identify the trigonometric relationships of sine, cosine, and tangent with the appropriate ratio of sides of a right triangle.
- c. Express trigonometric relationships using exact values and approximations.

Objective 3: Use the trigonometric ratios of sine, cosine, and tangent to represent and solve for missing parts of triangles.

- a. Find the angle measure in degrees when given the trigonometric ratio.
- b. Find the trigonometric ratio given the angle measure in degrees, using a calculator.
- c. Find unknown measures of right triangles using sine, cosine, and tangent functions and their inverse trigonometric functions.

Standard 3: Students will use measurement tools, formulas, and techniques to explore geometric relationships and solve problems.

Objective 1: Find measurements of plane and solid figures.

- a. Develop surface area and volume formulas for polyhedra, cones, and cylinders.
- b. Determine perimeter, area, surface area, lateral area, and volume for prisms, cylinders, pyramids, cones, and spheres when given the formulas.
- c. Calculate or estimate the area of an irregular region.
- d. Find the length of an arc and the area of a sector when given the angle measure and radius.
- e. Create a solid using both one and two point perspective.

Intermediate Algebra/Algebra 2.

Students will conceptualize, analyze, and identify relationships among functions. 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 technology. Students will extend their algebraic skills to compute with rational expressions and rational exponents. Students will work with and build an understanding of complex numbers and systems of equations and inequalities. Students will use technology such as graphing calculators. Students will analyze situations verbally, numerically, graphically, and symbolically.

Standard 1: 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.
- d. Solve systems of equations using matrices and augmented matrices.

Objective 3: Simplify expressions 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. Solve quadratic equations of a single variable over the set of complex numbers by graphing, factoring, completing the square, and using the quadratic formula.
- c. Solve quadratic inequalities of a single variable.
- d. Write a quadratic equation when given the solutions of the equation.

Standard 2: Students will understand and represent functions and analyze function behavior.

Objective 1: Evaluate and analyze functions and relations using correct function notation.

- a. Find the value of a function at a given point.
- b. Composition of functions.
- 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.
- f. Describe a pattern using function notation.
- f. Determine when a relation is a function.
- g. Determine the domain and range of relations.

Objective 2: 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 3: 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.

Objective 4: Solve problems involving the geometric properties of conic sections.

- a. Write equations of conic sections in standard form.
- b. Solve equations of conic sections.
- c. Graph conic sections.
- d. Identify the geometric properties of conic sections (i.e., vertex, foci, lines of symmetry, directrix, major and minor axes, and asymptotes).

Pre-Calculus

Students will gain a deeper understanding of the fundamental concepts and relationships of functions. Students will expand their knowledge of quadratic, exponential, and logarithmic functions to include power, polynomial, rational, piece-wise, and trigonometric functions. Students will investigate and explore mathematical ideas, develop multiple strategies for analyzing complex situations, and use graphing calculators and mathematical software to build understanding, make connections between representations, and provide support in solving problems. Students will analyze various representations of functions, sequences, and series. Pre-calculus is highly recommended for students who plan to continue their formal education at the college level.

Standard 1: Students will use the language and operations of algebra to evaluate, analyze and solve problems.

Objective 1: Compute with matrices and use matrices to solve problems.

- a. Represent real-world situations with matrices.
- b. Add, subtract, and multiply (including scalar multiplication) matrices using paper and pencil, and computer programs or calculators.
- c. Demonstrate that matrix multiplication is associative and distributive, but not commutative.
- d. Determine additive and multiplicative identities and inverses of a matrix when they exist.
- e. Solve systems of linear equations with up to three variables using matrices.

Objective 2: Analyze the behavior of sequences and series.

- a. Describe a sequence as a function where the domain is the set of natural numbers.
- b. Represent sequences and series using various notations.
- c. Identify arithmetic and geometric sequences and series.
- d. Apply the formula for a finite arithmetic series.
- e. Apply the formulas for finite and infinite geometric series.

Standard 2: Students will understand and represent functions and analyze function behavior.

Objective 1: Analyze and solve problems using polynomial functions.

- a. Expand a polynomial using the Binomial Theorem and Pascal's Triangle.
- b. Determine the number and nature of solutions to polynomial equations with real coefficients over the complex numbers.
- c. Factor polynomials to solve equations and real-world applications.
- d. Understand the relationships among the solutions of a polynomial equation, the zeros of a function, the x-intercepts of a graph, and the factors of a polynomial.
- e. Write an equation with given solutions.

Objective 2: Model and graph functions and transformations of functions.

- a. Model real-world relationships with functions.
- b. Graph rational, piece-wise, power, exponential, and logarithmic functions.

c. Identify the effects of changing the parameter a in $y = af(x)$, $y = f(ax)$, $y = f(x - a)$, and $y = f(x) + a$, given the graph of $y = f(x)$.

Objective 3: Analyze the behavior of functions.

- a. Identify the domain, range, and other attributes of families of functions and their inverses.
- b. Identify and analyze continuity, end behavior, asymptotes, symmetry (odd and even functions), and limits, and connect these concepts to graphs of functions.
- c. Determine intervals over which a function is increasing or decreasing, and describe the intervals using interval notation.
- d. Relate the graphical representation of discontinuities and end behavior to the concept of limit.

Standard 3: Students will use algebraic, spatial, and logical reasoning to solve and graph trigonometric functions.

Objective 1: Solve problems using trigonometry.

- a. Define the six trigonometric functions using the unit circle.
- b. Prove trigonometric identities using definitions, the Pythagorean Theorem, or other relationships.
- c. Simplify trigonometric expressions and solve trigonometric equations using identities.
- d. Solve problems using the Law of Sines and the Law of Cosines.
- e. Construct the graphs of the trigonometric functions and their inverses, and describe their behavior, including periodicity and amplitude.

Objective 2: Examine the behavior of functions.

- 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 equation.

Objective 3: 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 4: 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.

Objective 5: Graph curves using polar and parametric equations.

- a. Define and use polar coordinates and relate them to Cartesian coordinates.

- b. Represent complex numbers in rectangular and polar form, and convert between rectangular and polar form.
- c. Translate equations in Cartesian coordinates into polar coordinates and graph them in the polar coordinate plane.
- d. Multiply complex numbers in polar form and use DeMoivre's Theorem to find roots of complex numbers.
- e. Define a curve parametrically and draw parametric graphs.

High School Curricula

Algebra I

Geometry

Intermediate Algebra/Algebra II

Pre-Calculus

Calculus - Advanced Placement curriculum