



## *College Algebra with Trigonometry*

This course covers the topics shown below.

Students navigate learning paths based on their level of readiness.

Institutional users may customize the scope and sequence to meet curricular needs.

### Curriculum (556 topics)

- Algebra and Geometry Review (126 topics)
  - ◆ Real Numbers and Algebraic Expressions (14 topics)
    - ◇ Signed fraction addition or subtraction: Basic
    - ◇ Signed fraction subtraction involving double negation
    - ◇ Signed fraction multiplication: Basic
    - ◇ Signed fraction division
    - ◇ Computing the distance between two integers on a number line
    - ◇ Exponents and integers: Problem type 1
    - ◇ Exponents and signed fractions
    - ◇ Order of operations with integers
    - ◇ Evaluating a linear expression: Integer multiplication with addition or subtraction
    - ◇ Evaluating a quadratic expression: Integers
    - ◇ Evaluating a linear expression: Signed fraction multiplication with addition or subtraction
    - ◇ Distributive property: Integer coefficients
    - ◇ Using distribution and combining like terms to simplify: Univariate
    - ◇ Using distribution with double negation and combining like terms to simplify: Multivariate
  - ◆ Exponents (20 topics)
    - ◇ Introduction to the product rule of exponents
    - ◇ Product rule with positive exponents: Univariate
    - ◇ Product rule with positive exponents: Multivariate
    - ◇ Introduction to the power of a power rule of exponents
    - ◇ Introduction to the power of a product rule of exponents
    - ◇ Power rules with positive exponents: Multivariate products
    - ◇ Power rules with positive exponents: Multivariate quotients
    - ◇ Simplifying a ratio of multivariate monomials: Basic
    - ◇ Introduction to the quotient rule of exponents
    - ◇ Simplifying a ratio of univariate monomials
    - ◇ Quotient of expressions involving exponents
    - ◇ Evaluating expressions with exponents of zero
    - ◇ Evaluating an expression with a negative exponent: Whole number base
    - ◇ Evaluating an expression with a negative exponent: Positive fraction base
    - ◇ Evaluating an expression with a negative exponent: Negative integer base
    - ◇ Rewriting an algebraic expression without a negative exponent
    - ◇ Introduction to the product rule with negative exponents
    - ◇ Quotient rule with negative exponents: Problem type 1
    - ◇ Power of a power rule with negative exponents
    - ◇ Power rules with negative exponents
  - ◆ Polynomial Expressions (14 topics)
    - ◇ Degree and leading coefficient of a univariate polynomial

- ◇ Simplifying a sum or difference of two univariate polynomials
- ◇ Multiplying a univariate polynomial by a monomial with a positive coefficient
- ◇ Multiplying a univariate polynomial by a monomial with a negative coefficient
- ◇ Multiplying a multivariate polynomial by a monomial
- ◇ Multiplying binomials with leading coefficients of 1
- ◇ Multiplying binomials with leading coefficients greater than 1
- ◇ Multiplying binomials in two variables
- ◇ Multiplying conjugate binomials: Univariate
- ◇ Squaring a binomial: Univariate
- ◇ Squaring a binomial: Multivariate
- ◇ Multiplying binomials with negative coefficients
- ◇ Multiplication involving binomials and trinomials in one variable
- ◇ Multiplication involving binomials and trinomials in two variables
- ◆ Factoring Polynomials (16 topics)
  - ◇ Greatest common factor of 2 numbers
  - ◇ Factoring a linear binomial
  - ◇ Introduction to the GCF of two monomials
  - ◇ Greatest common factor of two multivariate monomials
  - ◇ Factoring out a monomial from a polynomial: Univariate
  - ◇ Factoring out a monomial from a polynomial: Multivariate
  - ◇ Factoring out a binomial from a polynomial: GCF factoring, basic
  - ◇ Factoring a univariate polynomial by grouping: Problem type 1
  - ◇ Factoring a quadratic with leading coefficient 1
  - ◇ Factoring out a constant before factoring a quadratic
  - ◇ Factoring a quadratic with leading coefficient greater than 1: Problem type 1
  - ◇ Factoring a quadratic with leading coefficient greater than 1: Problem type 2
  - ◇ Factoring a quadratic with a negative leading coefficient
  - ◇ Factoring a perfect square trinomial with leading coefficient 1
  - ◇ Factoring a difference of squares in one variable: Basic
  - ◇ Factoring a difference of squares in one variable: Advanced
- ◆ Rational Expressions (28 topics)
  - ◇ Restriction on a variable in a denominator: Linear
  - ◇ Simplifying a ratio of factored polynomials: Linear factors
  - ◇ Simplifying a ratio of polynomials using GCF factoring
  - ◇ Simplifying a ratio of polynomials by factoring a quadratic with leading coefficient 1
  - ◇ Simplifying a ratio of polynomials: Problem type 1
  - ◇ Multiplying rational expressions made up of linear expressions
  - ◇ Multiplying rational expressions involving quadratics with leading coefficients of 1
  - ◇ Dividing rational expressions involving linear expressions
  - ◇ Dividing rational expressions involving quadratics with leading coefficients of 1
  - ◇ Least common multiple of 2 numbers
  - ◇ Least common multiple of 3 numbers
  - ◇ Introduction to the LCM of two monomials
  - ◇ Finding the LCD of rational expressions with linear denominators: Relatively prime
  - ◇ Writing equivalent rational expressions with polynomial denominators
  - ◇ Introduction to adding fractions with variables and common denominators
  - ◇ Adding rational expressions with common denominators and monomial numerators
  - ◇ Adding rational expressions with common denominators and binomial numerators
  - ◇ Adding rational expressions with common denominators and GCF factoring
  - ◇ Adding rational expressions with common denominators and quadratic factoring
  - ◇ Adding rational expressions with different denominators and a single occurrence of a variable
  - ◇ Adding rational expressions with denominators  $ax$  and  $bx$ : Basic
  - ◇ Adding rational expressions with denominators  $ax$  and  $bx$ : Advanced

- ◇ Adding rational expressions with linear denominators without common factors: Basic
- ◇ Complex fraction without variables: Problem type 1
- ◇ Complex fraction without variables: Problem type 2
- ◇ Complex fraction involving univariate monomials
- ◇ Complex fraction: GCF factoring
- ◇ Complex fraction made of sums involving rational expressions: Problem type 1
- ◆ Perfect Squares and nth Roots (7 topics)
  - ◇ Square root of a rational perfect square
  - ◇ Square roots of perfect squares with signs
  - ◇ Introduction to simplifying a radical expression with an even exponent
  - ◇ Square root of a perfect square monomial
  - ◇ Introduction to solving an absolute value equation
  - ◇ Cube root of an integer
  - ◇ Finding  $n^{\text{th}}$  roots of perfect  $n^{\text{th}}$  powers with signs
- ◆ Rational Exponents (4 topics)
  - ◇ Converting between radical form and exponent form
  - ◇ Rational exponents: Unit fraction exponents and whole number bases
  - ◇ Rational exponents: Non-unit fraction exponent with a whole number base
  - ◇ Rational exponents: Negative exponents and fractional bases
- ◆ Radical Expressions (19 topics)
  - ◇ Simplifying the square root of a whole number less than 100
  - ◇ Simplifying a radical expression with an even exponent
  - ◇ Introduction to simplifying a radical expression with an odd exponent
  - ◇ Simplifying a radical expression with an odd exponent
  - ◇ Simplifying a higher root of a whole number
  - ◇ Introduction to square root addition or subtraction
  - ◇ Square root addition or subtraction
  - ◇ Introduction to square root multiplication
  - ◇ Square root multiplication: Basic
  - ◇ Square root multiplication: Advanced
  - ◇ Introduction to simplifying a product of radical expressions: Univariate
  - ◇ Introduction to simplifying a product involving square roots using the distributive property
  - ◇ Simplifying a product involving square roots using the distributive property: Basic
  - ◇ Simplifying a product involving square roots using the distributive property: Advanced
  - ◇ Simplifying a quotient of square roots
  - ◇ Simplifying a quotient involving a sum or difference with a square root
  - ◇ Rationalizing a denominator: Quotient involving square roots
  - ◇ Rationalizing a denominator: Square root of a fraction
  - ◇ Rationalizing a denominator using conjugates: Integer numerator
- ◆ Geometry (4 topics)
  - ◇ Circumference of a circle
  - ◇ Volume of a rectangular prism
  - ◇ Introduction to the Pythagorean Theorem
  - ◇ Pythagorean Theorem
- Equations and Inequalities (83 topics)
  - ◆ Linear Equations and Applications (27 topics)
    - ◇ Additive property of equality with signed fractions
    - ◇ Multiplicative property of equality with signed fractions
    - ◇ Solving a multi-step equation given in fractional form
    - ◇ Solving a linear equation with several occurrences of the variable: Variables on the same side and distribution
    - ◇ Solving a linear equation with several occurrences of the variable: Variables on both sides and distribution

- ◇ Solving a linear equation with several occurrences of the variable: Variables on both sides and two distributions
- ◇ Solving a linear equation with several occurrences of the variable: Fractional forms with monomial numerators
- ◇ Solving a two–step equation with signed fractions
- ◇ Solving a linear equation with several occurrences of the variable: Variables on both sides and fractional coefficients
- ◇ Solving a linear equation with several occurrences of the variable: Fractional forms with binomial numerators
- ◇ Solving a proportion of the form  $(x+a)/b = c/d$
- ◇ Solving for a variable in terms of other variables using addition or subtraction: Basic
- ◇ Solving for a variable in terms of other variables using addition or subtraction: Advanced
- ◇ Solving for a variable in terms of other variables using multiplication or division: Basic
- ◇ Solving for a variable in terms of other variables using multiplication or division: Advanced
- ◇ Solving for a variable in terms of other variables using addition or subtraction with division
- ◇ Solving for a variable inside parentheses in terms of other variables
- ◇ Solving for a variable in terms of other variables in a linear equation with fractions
- ◇ Translating a sentence into a one–step equation
- ◇ Translating a sentence into a multi–step equation
- ◇ Solving a word problem with two unknowns using a linear equation
- ◇ Solving a decimal word problem using a linear equation of the form  $Ax + B = C$
- ◇ Solving a word problem with three unknowns using a linear equation
- ◇ Solving a one–step word problem using the formula  $d = rt$
- ◇ Solving a distance, rate, time problem using a linear equation
- ◇ Finding the perimeter or area of a rectangle given one of these values
- ◇ Finding the sale price given the original price and percent discount
- ◆ Absolute Value Equations (2 topics)
  - ◇ Solving an absolute value equation: Problem type 1
  - ◇ Solving an absolute value equation: Problem type 2
- ◆ Linear Inequalities and Applications (7 topics)
  - ◇ Graphing a linear inequality on the number line
  - ◇ Graphing a compound inequality on the number line
  - ◇ Set builder and interval notation
  - ◇ Identifying solutions to a two–step linear inequality in one variable
  - ◇ Solving a two–step linear inequality: Problem type 1
  - ◇ Solving a two–step linear inequality: Problem type 2
  - ◇ Solving a linear inequality with multiple occurrences of the variable: Problem type 1
- ◆ Rational Equations that Simplify to Linear (8 topics)
  - ◇ Solving a rational equation that simplifies to linear: Denominator  $x$
  - ◇ Solving a rational equation that simplifies to linear: Denominator  $x+a$
  - ◇ Solving a rational equation that simplifies to linear: Denominators  $a$ ,  $x$ , or  $ax$
  - ◇ Solving a rational equation that simplifies to linear: Denominators  $ax$  and  $bx$
  - ◇ Solving a rational equation that simplifies to linear: Like binomial denominators
  - ◇ Solving a rational equation that simplifies to linear: Unlike binomial denominators
  - ◇ Solving for a variable in terms of other variables in a rational equation: Problem type 1
  - ◇ Solving for a variable in terms of other variables in a rational equation: Problem type 2
- ◆ Complex Numbers (4 topics)
  - ◇ Using  $i$  to rewrite square roots of negative numbers
  - ◇ Adding or subtracting complex numbers
  - ◇ Multiplying complex numbers
  - ◇ Dividing complex numbers
- ◆ Quadratic Equations (20 topics)
  - ◇ Solving an equation written in factored form

- ◇ Finding the roots of a quadratic equation of the form  $ax^2 + bx = 0$
- ◇ Finding the roots of a quadratic equation with leading coefficient 1
- ◇ Finding the roots of a quadratic equation with leading coefficient greater than 1
- ◇ Solving a quadratic equation needing simplification
- ◇ Roots of a product of polynomials
- ◇ Writing a quadratic equation given the roots and the leading coefficient
- ◇ Solving a word problem using a quadratic equation with rational roots
- ◇ Solving an equation of the form  $x^2 = a$  using the square root property
- ◇ Solving a quadratic equation using the square root property: Exact answers, basic
- ◇ Solving a quadratic equation using the square root property: Exact answers, advanced
- ◇ Completing the square
- ◇ Solving a quadratic equation by completing the square: Exact answers
- ◇ Applying the quadratic formula: Exact answers
- ◇ Applying the quadratic formula: Decimal answers
- ◇ Solving a quadratic equation with complex roots
- ◇ Discriminant of a quadratic equation
- ◇ Solving a word problem using a quadratic equation with irrational roots
- ◇ Solving an equation using the odd–root property: Problem type 1
- ◇ Solving an equation using the odd–root property: Problem type 2
- ◆ Rational Equations that Simplify to Quadratic (5 topics)
  - ◇ Restriction on a variable in a denominator: Quadratic
  - ◇ Solving a rational equation that simplifies to linear: Factorable quadratic denominator
  - ◇ Solving a rational equation that simplifies to quadratic: Denominator  $x$
  - ◇ Solving a rational equation that simplifies to quadratic: Binomial denominators, constant numerators
  - ◇ Solving a rational equation that simplifies to quadratic: Binomial denominators and numerators
- ◆ Radical Equations (10 topics)
  - ◇ Introduction to solving a radical equation
  - ◇ Solving a radical equation that simplifies to a linear equation: One radical, basic
  - ◇ Solving a radical equation that simplifies to a linear equation: One radical, advanced
  - ◇ Solving a radical equation that simplifies to a linear equation: Two radicals
  - ◇ Solving a radical equation that simplifies to a quadratic equation: One radical, basic
  - ◇ Solving a radical equation that simplifies to a quadratic equation: One radical, advanced
  - ◇ Algebraic symbol manipulation with radicals
  - ◇ Solving an equation with a root index greater than 2: Problem type 1
  - ◇ Solving an equation with a root index greater than 2: Problem type 2
  - ◇ Solving an equation that can be written in quadratic form: Problem type 1
- Graphs and Functions (138 topics)
  - ◆ The Coordinate Plane, Distance, and Midpoint (9 topics)
    - ◇ Reading a point in the coordinate plane
    - ◇ Plotting a point in the coordinate plane
    - ◇ Naming the quadrant or axis of a point given its coordinates
    - ◇ Naming the quadrant or axis of a point given the signs of its coordinates
    - ◇ Table for a linear equation
    - ◇ Distance between two points in the plane: Exact answers
    - ◇ Midpoint of a line segment in the plane
    - ◇ Identifying solutions to a linear equation in two variables
    - ◇ Finding a solution to a linear equation in two variables
  - ◆ Graphs of Equations (16 topics)
    - ◇ Graphing a linear equation of the form  $y = mx$
    - ◇ Graphing a line given its equation in slope–intercept form: Integer slope
    - ◇ Graphing a line given its equation in slope–intercept form: Fractional slope
    - ◇ Graphing a line given its equation in standard form
    - ◇ Graphing a vertical or horizontal line

- ◇ Finding x- and y-intercepts given the graph of a line on a grid
- ◇ Finding x- and y-intercepts of a line given the equation: Basic
- ◇ Finding x- and y-intercepts of a line given the equation: Advanced
- ◇ Graphing a line by first finding its x- and y-intercepts
- ◇ Finding intercepts of a nonlinear function given its graph
- ◇ Finding x- and y-intercepts of the graph of a nonlinear equation
- ◇ Graphing an absolute value equation of the form  $y = A|x|$
- ◇ Graphing a parabola of the form  $y = ax^2$
- ◇ Graphing a parabola of the form  $y = ax^2 + c$
- ◇ Graphing a cubic function of the form  $y = ax^3$
- ◇ Determining if graphs have symmetry with respect to the x-axis, y-axis, or origin
- ◆ Slope and Equations of Lines (17 topics)
  - ◇ Finding slope given the graph of a line on a grid
  - ◇ Finding slope given two points on the line
  - ◇ Finding the slope of horizontal and vertical lines
  - ◇ Graphing a line given its slope and y-intercept
  - ◇ Finding the slope and y-intercept of a line given its equation in the form  $y = mx + b$
  - ◇ Finding the slope and y-intercept of a line given its equation in the form  $Ax + By = C$
  - ◇ Graphing a line by first finding its slope and y-intercept
  - ◇ Writing an equation of a line given its slope and y-intercept
  - ◇ Writing an equation in slope-intercept form given the slope and a point
  - ◇ Finding the slope and a point on a line given its equation in point-slope form
  - ◇ Writing an equation in point-slope form given the slope and a point
  - ◇ Writing an equation of a line given the y-intercept and another point
  - ◇ Writing the equation of the line through two given points
  - ◇ Writing the equations of vertical and horizontal lines through a given point
  - ◇ Finding slopes of lines parallel and perpendicular to a line given in slope-intercept form
  - ◇ Finding slopes of lines parallel and perpendicular to a line given in the form  $Ax + By = C$
  - ◇ Writing equations of lines parallel and perpendicular to a given line through a point
- ◆ Linear Applications (5 topics)
  - ◇ Writing and evaluating a function that models a real-world situation: Advanced
  - ◇ Writing an equation and drawing its graph to model a real-world situation: Advanced
  - ◇ Finding the initial amount and rate of change given a graph of a linear function
  - ◇ Interpreting the parameters of a linear function that models a real-world situation
  - ◇ Application problem with a linear function: Finding a coordinate given two points
- ◆ Circles (6 topics)
  - ◇ Identifying the center and radius to graph a circle given its equation in standard form
  - ◇ Identifying the center and radius to graph a circle given its equation in general form: Basic
  - ◇ Writing the equation of a circle centered at the origin given its radius or a point on the circle
  - ◇ Writing an equation of a circle given its center and radius or diameter
  - ◇ Writing an equation of a circle given its center and a point on the circle
  - ◇ Writing an equation of a circle given the endpoints of a diameter
- ◆ Functions (26 topics)
  - ◇ Identifying functions from relations
  - ◇ Vertical line test
  - ◇ Table for a linear function
  - ◇ Evaluating functions: Linear and quadratic or cubic
  - ◇ Evaluating a rational function: Problem type 1
  - ◇ Evaluating a rational function: Problem type 2
  - ◇ Table for a square root function
  - ◇ Evaluating a cube root function
  - ◇ Evaluating functions: Absolute value, rational, radical
  - ◇ Evaluating a piecewise-defined function

- ◇ Variable expressions as inputs of functions: Problem type 1
- ◇ Variable expressions as inputs of functions: Problem type 2
- ◇ Variable expressions as inputs of functions: Problem type 3
- ◇ Domain and range from ordered pairs
- ◇ Domain of a rational function: Excluded values
- ◇ Domain of a rational function: Interval notation
- ◇ Domain of a square root function: Basic
- ◇ Domain of a square root function: Advanced
- ◇ Finding the domain of a fractional function involving radicals
- ◇ Determining whether an equation defines a function: Basic
- ◇ Determining whether an equation defines a function: Advanced
- ◇ Finding outputs of a one–step function that models a real–world situation: Function notation
- ◇ Finding outputs of a two–step function with decimals that models a real–world situation: Function notation
- ◇ Finding inputs and outputs of a two–step function that models a real–world situation: Function notation
- ◇ Finding a difference quotient for a linear or quadratic function
- ◇ Finding a difference quotient for a rational function
- ◆ Graphs of Functions (27 topics)
  - ◇ Finding an output of a function from its graph
  - ◇ Finding inputs and outputs of a function from its graph
  - ◇ Domain and range from the graph of a continuous function
  - ◇ Domain and range from the graph of a piecewise function
  - ◇ Finding where a function is increasing, decreasing, or constant given the graph
  - ◇ Finding where a function is increasing, decreasing, or constant given the graph: Interval notation
  - ◇ Finding local maxima and minima of a function given the graph
  - ◇ Finding the absolute maximum and minimum of a function given the graph
  - ◇ Finding values and intervals where the graph of a function is zero, positive, or negative
  - ◇ Graphing a function of the form  $f(x) = ax + b$ : Integer slope
  - ◇ Graphing a function of the form  $f(x) = ax + b$ : Fractional slope
  - ◇ Graphing an absolute value equation in the plane: Basic
  - ◇ Graphing an absolute value equation in the plane: Advanced
  - ◇ Graphing a function of the form  $f(x) = ax^2$
  - ◇ Graphing a function of the form  $f(x) = ax^2 + c$
  - ◇ Graphing a parabola of the form  $y = (x-h)^2 + k$
  - ◇ Graphing a square root function: Problem type 1
  - ◇ Graphing a square root function: Problem type 2
  - ◇ Matching parent graphs with their equations
  - ◇ Graphing a piecewise–defined function: Problem type 1
  - ◇ Graphing a piecewise–defined function: Problem type 2
  - ◇ Graphing a piecewise–defined function: Problem type 3
  - ◇ Even and odd functions: Problem type 1
  - ◇ Even and odd functions: Problem type 2
  - ◇ Finding the average rate of change of a function
  - ◇ Finding the average rate of change of a function given its graph
  - ◇ Word problem involving average rate of change
- ◆ Transformations (13 topics)
  - ◇ Translating the graph of a parabola: One step
  - ◇ Translating the graph of a parabola: Two steps
  - ◇ How the leading coefficient affects the shape of a parabola
  - ◇ Translating the graph of an absolute value function: One step
  - ◇ Translating the graph of an absolute value function: Two steps
  - ◇ Writing an equation for a function after a vertical translation

- ◇ Translating the graph of a function: One step
- ◇ Translating the graph of a function: Two steps
- ◇ Transforming the graph of a function by reflecting over an axis
- ◇ Transforming the graph of a function by shrinking or stretching
- ◇ Transforming the graph of a function using more than one transformation
- ◇ Transforming the graph of a quadratic, cubic, square root, or absolute value function
- ◇ Writing an equation for a function after a vertical and horizontal translation
- ◆ Combining Functions; Composite Functions; Inverse Functions (19 topics)
  - ◇ Sum, difference, and product of two functions
  - ◇ Quotient of two functions: Basic
  - ◇ Quotient of two functions: Advanced
  - ◇ Combining functions: Advanced
  - ◇ Introduction to the composition of two functions
  - ◇ Composition of two functions: Basic
  - ◇ Composition of a function with itself
  - ◇ Expressing a function as a composition of two functions
  - ◇ Composition of two functions: Advanced
  - ◇ Composition of two rational functions
  - ◇ Word problem involving composition of two functions
  - ◇ Horizontal line test
  - ◇ Determining whether two functions are inverses of each other
  - ◇ Inverse functions: Linear, discrete
  - ◇ Inverse functions: Quadratic, square root
  - ◇ Inverse functions: Cubic, cube root
  - ◇ Inverse functions: Rational
  - ◇ Graphing the inverse of a function given its graph
  - ◇ Finding, evaluating, and interpreting an inverse function for a given linear relationship
- Polynomial and Rational Functions (64 topics)
  - ◆ Quadratic Functions (16 topics)
    - ◇ Finding the vertex, intercepts, and axis of symmetry from the graph of a parabola
    - ◇ Graphing a parabola of the form  $y = x^2 + bx + c$
    - ◇ Graphing a parabola of the form  $y = a(x-h)^2 + k$
    - ◇ Graphing a parabola of the form  $y = ax^2 + bx + c$ : Integer coefficients
    - ◇ Finding the zeros of a quadratic function given its equation
    - ◇ Using a graphing calculator to find the zeros of a quadratic function
    - ◇ Writing a quadratic function given its zeros
    - ◇ Finding the x-intercept(s) and the vertex of a parabola
    - ◇ Using a graphing calculator to find the x-intercept(s) and vertex of a quadratic function
    - ◇ Rewriting a quadratic function to find its vertex and sketch its graph
    - ◇ Finding the maximum or minimum of a quadratic function
    - ◇ Word problem involving the maximum or minimum of a quadratic function
    - ◇ Word problem involving optimizing area by using a quadratic function
    - ◇ Domain and range from the graph of a quadratic function
    - ◇ Range of a quadratic function
    - ◇ Writing the equation of a quadratic function given its graph
  - ◆ Polynomial Functions (10 topics)
    - ◇ Finding zeros of a polynomial function written in factored form
    - ◇ Finding zeros and their multiplicities given a polynomial function written in factored form
    - ◇ Finding a polynomial of a given degree with given zeros: Real zeros
    - ◇ Finding x- and y-intercepts given a polynomial function
    - ◇ Determining the end behavior of the graph of a polynomial function
    - ◇ Determining end behavior and intercepts to graph a polynomial function
    - ◇ Matching graphs with polynomial functions



- ◇ Inferring properties of a polynomial function from its graph
- ◇ Using a graphing calculator to find local extrema of a polynomial function
- ◇ Using a graphing calculator to solve a word problem involving a local extremum of a polynomial function
- ◆ Division of Polynomials; Remainder and Factor Theorems (6 topics)
  - ◇ Polynomial long division: Problem type 1
  - ◇ Polynomial long division: Problem type 2
  - ◇ Polynomial long division: Problem type 3
  - ◇ Synthetic division
  - ◇ Using the remainder theorem to evaluate a polynomial
  - ◇ The Factor Theorem
- ◆ Real Zeros of Polynomial Functions (7 topics)
  - ◇ Using a given zero to write a polynomial as a product of linear factors: Real zeros
  - ◇ Finding all possible rational zeros using the rational zeros theorem: Problem type 1
  - ◇ Finding all possible rational zeros using the rational zeros theorem: Problem type 2
  - ◇ Using the rational zeros theorem to find all zeros of a polynomial: Rational zeros
  - ◇ Using the rational zeros theorem to find all zeros of a polynomial: Irrational zeros
  - ◇ Using a graphing calculator to find zeros of a polynomial function
  - ◇ Using a graphing calculator to solve a word problem involving a polynomial of degree 3
- ◆ Complex Zeros of Polynomials Functions (4 topics)
  - ◇ Multiplying expressions involving complex conjugates
  - ◇ Finding a polynomial of a given degree with given zeros: Complex zeros
  - ◇ Using a given zero to write a polynomial as a product of linear factors: Complex zeros
  - ◇ Using the rational zeros theorem to find all zeros of a polynomial: Complex zeros
- ◆ Rational Functions (13 topics)
  - ◇ Finding the intercepts, asymptotes, domain, and range from the graph of a rational function
  - ◇ Finding the asymptotes of a rational function: Constant over linear
  - ◇ Finding the asymptotes of a rational function: Linear over linear
  - ◇ Finding horizontal and vertical asymptotes of a rational function: Quadratic numerator or denominator
  - ◇ Finding the asymptotes of a rational function: Quadratic over linear
  - ◇ Graphing a rational function: Constant over linear
  - ◇ Graphing a rational function: Linear over linear
  - ◇ Transforming the graph of a rational function
  - ◇ Graphing a rational function: Quadratic over linear
  - ◇ Graphing rational functions with holes
  - ◇ Matching graphs with rational functions: Two vertical asymptotes
  - ◇ Graphing a rational function with more than one vertical asymptote
  - ◇ Using a graphing calculator to solve a word problem involving a local extremum of a rational function
- ◆ Polynomial and Rational Inequalities (8 topics)
  - ◇ Solving a quadratic inequality written in factored form
  - ◇ Solving a quadratic inequality
  - ◇ Solving a polynomial inequality: Problem type 1
  - ◇ Solving a polynomial inequality: Problem type 2
  - ◇ Solving a polynomial inequality: Problem type 3
  - ◇ Solving a polynomial inequality: Problem type 4
  - ◇ Solving a rational inequality: Problem type 1
  - ◇ Solving a rational inequality: Problem type 2
- Exponential and Logarithmic Functions (50 topics)
  - ◆ Graphing Exponential Functions (8 topics)
    - ◇ Table for an exponential function
    - ◇ Graphing an exponential function and its asymptote:  $f(x)=b^x$

- ◇ Graphing an exponential function and its asymptote:  $f(x) = a(b)^x$
- ◇ Graphing an exponential function and its asymptote:  $f(x) = b^{-x}$  or  $f(x) = -b^{ax}$
- ◇ Translating the graph of an exponential function
- ◇ The graph, domain, and range of an exponential function
- ◇ Transforming the graph of a natural exponential function
- ◇ Graphing an exponential function and its asymptote:  $f(x) = a(e)^{x-b} + c$
- ◆ Applications of Exponential Functions (7 topics)
  - ◇ Using a calculator to evaluate exponential expressions
  - ◇ Evaluating an exponential function that models a real-world situation
  - ◇ Using a calculator to evaluate exponential expressions involving base  $e$
  - ◇ Evaluating an exponential function with base  $e$  that models a real-world situation
  - ◇ Introduction to compound interest
  - ◇ Finding a final amount in a word problem on exponential growth or decay
  - ◇ Finding the final amount in a word problem on compound interest
- ◆ Logarithmic Functions (9 topics)
  - ◇ Using a calculator to evaluate natural and common logarithmic expressions
  - ◇ Converting between logarithmic and exponential equations
  - ◇ Converting between natural logarithmic and exponential equations
  - ◇ Evaluating logarithmic expressions
  - ◇ Solving an equation of the form  $\log_b a = c$
  - ◇ Translating the graph of a logarithmic function
  - ◇ Graphing a logarithmic function: Basic
  - ◇ The graph, domain, and range of a logarithmic function
  - ◇ Domain of a logarithmic function: Advanced
- ◆ Properties of Logarithms (6 topics)
  - ◇ Basic properties of logarithms
  - ◇ Using properties of logarithms to evaluate expressions
  - ◇ Expanding a logarithmic expression: Problem type 1
  - ◇ Expanding a logarithmic expression: Problem type 2
  - ◇ Writing an expression as a single logarithm
  - ◇ Change of base for logarithms: Problem type 1
- ◆ Logarithmic and Exponential Equations (10 topics)
  - ◇ Solving a multi-step equation involving a single logarithm: Problem type 1
  - ◇ Solving a multi-step equation involving a single logarithm: Problem type 2
  - ◇ Solving a multi-step equation involving natural logarithms
  - ◇ Solving an equation involving logarithms on both sides: Problem type 1
  - ◇ Solving an equation involving logarithms on both sides: Problem type 2
  - ◇ Solving an exponential equation by finding common bases: Linear exponents
  - ◇ Solving an exponential equation by using logarithms: Decimal answers, basic
  - ◇ Solving an exponential equation by using natural logarithms: Decimal answers
  - ◇ Solving an exponential equation by using logarithms: Decimal answers, advanced
  - ◇ Solving an exponential equation by using logarithms: Exact answers in logarithmic form
- ◆ Applications (10 topics)
  - ◇ Finding the time to reach a limit in a word problem on exponential growth or decay
  - ◇ Finding the time in a word problem on compound interest
  - ◇ Finding the time given an exponential function with base  $e$  that models a real-world situation
  - ◇ Finding the final amount in a word problem on continuous compound interest
  - ◇ Finding the initial amount in a word problem on continuous compound interest
  - ◇ Finding the final amount in a word problem on continuous exponential growth or decay
  - ◇ Finding the rate or time in a word problem on continuous exponential growth or decay
  - ◇ Finding half-life or doubling time
  - ◇ Writing and evaluating a function modeling continuous exponential growth or decay given doubling time or half-life

- ◇ Writing and evaluating a function modeling continuous exponential growth or decay given two outputs
- Trigonometric Functions (58 topics)
  - ◆ Angles and Their Measure (5 topics)
    - ◇ Converting between degree and radian measure: Problem type 1
    - ◇ Converting between degree and radian measure: Problem type 2
    - ◇ Sketching an angle in standard position
    - ◇ Coterminal angles
    - ◇ Arc length and central angle measure
  - ◆ The Unit Circle and Evaluating Trigonometric Functions (9 topics)
    - ◇ Finding coordinates on the unit circle for special angles
    - ◇ Trigonometric functions and special angles: Problem type 1
    - ◇ Finding trigonometric ratios from a point on the unit circle
    - ◇ Trigonometric functions and special angles: Problem type 2
    - ◇ Trigonometric functions and special angles: Problem type 3
    - ◇ Evaluating expressions involving sine and cosine
    - ◇ Even and odd properties of trigonometric functions
    - ◇ Using a calculator to approximate sine, cosine, and tangent values
    - ◇ Evaluating a sinusoidal function that models a real-world situation
  - ◆ Right Triangle Trigonometry (9 topics)
    - ◇ Sine, cosine, and tangent ratios: Variables for side lengths
    - ◇ Using the Pythagorean Theorem to find a trigonometric ratio
    - ◇ Finding trigonometric ratios given a right triangle
    - ◇ Using a trigonometric ratio to find a side length in a right triangle
    - ◇ Using trigonometry to find a length in a word problem with one right triangle
    - ◇ Using a trigonometric ratio to find an angle measure in a right triangle
    - ◇ Using trigonometry to find angles of elevation or depression in a word problem
    - ◇ Solving a right triangle
    - ◇ Using trigonometry to find a length in a word problem with two right triangles
  - ◆ Trigonometric Functions of Angles (7 topics)
    - ◇ Reference angles: Problem type 1
    - ◇ Reference angles: Problem type 2
    - ◇ Determining the location of a terminal point given the signs of trigonometric values
    - ◇ Finding values of trigonometric functions given information about an angle: Problem type 1
    - ◇ Finding values of trigonometric functions given information about an angle: Problem type 2
    - ◇ Finding values of trigonometric functions given information about an angle: Problem type 3
    - ◇ Finding values of trigonometric functions given information about an angle: Problem type 4
  - ◆ Graphs of Sine and Cosine Functions (14 topics)
    - ◇ Sketching the graph of  $y = a \sin(x)$  or  $y = a \cos(x)$
    - ◇ Sketching the graph of  $y = \sin(bx)$  or  $y = \cos(bx)$
    - ◇ Sketching the graph of  $y = \sin(x) + d$  or  $y = \cos(x) + d$
    - ◇ Sketching the graph of  $y = \sin(x+c)$  or  $y = \cos(x+c)$
    - ◇ Sketching the graph of  $y = a \sin(x+c)$  or  $y = a \cos(x+c)$
    - ◇ Sketching the graph of  $y = a \sin(bx)$  or  $y = a \cos(bx)$
    - ◇ Sketching the graph of  $y = a \sin(bx+c)$  or  $y = a \cos(bx+c)$
    - ◇ Sketching the graph of  $y = a \sin(bx) + d$  or  $y = a \cos(bx) + d$
    - ◇ Amplitude and period of sine and cosine functions
    - ◇ Amplitude, period, and phase shift of sine and cosine functions
    - ◇ Writing the equation of a sine or cosine function given its graph: Problem type 1
    - ◇ Writing the equation of a sine or cosine function given its graph: Problem type 2
    - ◇ Word problem involving a sine or cosine function: Problem type 1
    - ◇ Word problem involving a sine or cosine function: Problem type 2
  - ◆ Graphs of Other Trigonometric Functions (6 topics)

- ◇ Domains and ranges of trigonometric functions
- ◇ Matching graphs and equations for secant, cosecant, tangent, and cotangent functions
- ◇ Sketching the graph of a secant or cosecant function: Problem type 1
- ◇ Sketching the graph of a secant or cosecant function: Problem type 2
- ◇ Sketching the graph of a tangent or cotangent function: Problem type 1
- ◇ Sketching the graph of a tangent or cotangent function: Problem type 2
- ◆ Inverse Trigonometric Functions (8 topics)
  - ◇ Values of inverse trigonometric functions
  - ◇ Composition of a trigonometric function with its inverse trigonometric function: Problem type 1
  - ◇ Composition of a trigonometric function with its inverse trigonometric function: Problem type 2
  - ◇ Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 1
  - ◇ Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 2
  - ◇ Composition of a trigonometric function with the inverse of another trigonometric function: Problem type 3
  - ◇ Composition of trigonometric functions with variable expressions as inputs: Problem type 1
  - ◇ Using a calculator to approximate inverse trigonometric values
- Trigonometric Identities and Equations (32 topics)
  - ◆ Verifying Trigonometric Identities (6 topics)
    - ◇ Simplifying trigonometric expressions
    - ◇ Using cofunction identities
    - ◇ Verifying a trigonometric identity
    - ◇ Proving trigonometric identities: Problem type 1
    - ◇ Proving trigonometric identities: Problem type 2
    - ◇ Proving trigonometric identities: Problem type 3
  - ◆ Sum and Difference Formulas (6 topics)
    - ◇ Sum and difference identities: Problem type 1
    - ◇ Sum and difference identities: Problem type 2
    - ◇ Sum and difference identities: Problem type 3
    - ◇ Sum and difference identities: Problem type 4
    - ◇ Proving trigonometric identities using sum and difference properties: Problem type 1
    - ◇ Proving trigonometric identities using sum and difference properties: Problem type 2
  - ◆ Double–Angle, Half–Angle, Product–to–Sum, and Power Reducing Formulas (8 topics)
    - ◇ Double–angle identities: Problem type 1
    - ◇ Double–angle identities: Problem type 2
    - ◇ Power–reducing identities
    - ◇ Half–angle identities: Problem type 1
    - ◇ Half–angle identities: Problem type 2
    - ◇ Product–to–sum and sum–to–product identities: Problem type 1
    - ◇ Product–to–sum and sum–to–product identities: Problem type 2
    - ◇ Proving trigonometric identities using double–angle properties
  - ◆ Trigonometric Equations (12 topics)
    - ◇ Finding solutions in an interval for a basic equation involving sine or cosine
    - ◇ Finding solutions in an interval for a basic tangent, cotangent, secant, or cosecant equation
    - ◇ Solving a basic trigonometric equation using a calculator
    - ◇ Solving a basic trigonometric equation involving sine or cosine
    - ◇ Solving a basic trigonometric equation involving tangent, cotangent, secant, or cosecant
    - ◇ Finding solutions in an interval for a trigonometric equation in factored form
    - ◇ Finding solutions in an interval for a trigonometric equation with a squared function: Problem type 1
    - ◇ Finding solutions in an interval for a trigonometric equation with a squared function: Problem type 2
    - ◇ Finding solutions in an interval for a trigonometric equation using Pythagorean identities: Problem type 1

- ◇ Finding solutions in an interval for an equation with sine and cosine using double–angle identities
- ◇ Solving a trigonometric equation modeling a real–world situation
- ◇ Finding solutions in an interval for a trigonometric equation with an angle multiplied by a constant
- Additional Topics in Trigonometry (5 topics)
  - ◆ Laws of Sines and Cosines (5 topics)
    - ◇ Solving a triangle with the law of sines: Problem type 1
    - ◇ Solving a triangle with the law of sines: Problem type 2
    - ◇ Solving a word problem using the law of sines
    - ◇ Solving a triangle with the law of cosines
    - ◇ Solving a word problem using the law of cosines