

## Precalculus with Corequisite Support: A Targeted Review | Table of Contents

### Precalculus

#### Chapter 1: Prerequisites

##### 1.1 Algebra Essentials

- Sets and Venn Diagrams
  - Represent a set using a written description and the roster method
  - Identify subsets, universal sets, and empty sets
  - Illustrate two sets using a Venn diagram and set notation
- Set Operations
  - Determine the complement of a set using Venn diagrams or set notation
  - Determine the intersection of two sets using Venn diagrams and set notation
  - Determine the union of two sets using Venn diagrams or set notation
  - Perform operations on sets
- Properties of Real Numbers and Order of Operations
  - Distinguish between natural numbers, whole numbers, and integers
  - Distinguish between rational and irrational numbers
  - Perform calculations using order of operations
  - Use the inverse and identity properties of real numbers
  - Use the commutative, associative, and distributive properties of real numbers
- Evaluate and Simplify Algebraic Expressions
  - Evaluate algebraic expressions with a single variable
  - Evaluate algebraic expressions with two variables
  - Identify constants and variables
  - Use a formula
  - Simplify algebraic expressions
- Evaluate and Simplify Absolute Value Expressions
  - Understand absolute value and evaluate absolute value expressions with the order of operations
  - Evaluate algebraic expressions involving absolute value

##### 1.2 Exponents and Scientific Notation

- Product, Quotient, and Power Properties of Exponents
    - Understand exponent notation
    - Use the product rule of exponents
    - Use the quotient rule of exponents
    - Use the power rule of exponents
  - Negative Exponents and Simplifying Exponential Expressions
    - Use the negative and zero exponent rule
    - Find the power of a product
    - Find the power of a quotient
    - Simplify exponential expressions
      - Simplify complex exponential expressions with negative exponents
      - Simplify complex exponential expressions with positive exponents
  - Scientific Notation
    - Multiply and divide numbers in scientific notation
-

- Convert between standard and scientific notation

### 1.3 Radicals and Rational Exponents

- Simplify Radicals
  - Evaluate square roots
  - Use the product rule to simplify square roots
    - Use the product rule to simplify square root expressions
    - Use the product rule to simplify square roots (numbers only)
  - Use the quotient rule to simplify square roots
    - Use the quotient rule to simplify square root expressions
    - Use the quotient rule to simplify square roots (numbers only)
- Operations with Radicals
  - Add and subtract square roots
    - Add or subtract square roots (no variables)
    - Add or subtract square roots (with variables)
  - Rationalize denominators with a monomial denominator
  - Rationalize denominators using the conjugate
- Rational Exponents and Higher Order Radicals
  - Operations with  $n$ th roots
    - Add or subtract higher order radicals
    - Multiply and divide higher order radicals
    - Simplify higher order radicals with variable terms
  - Switch between radical and rational exponent form
  - Evaluate expressions with rational exponents
  - Simplify  $n$ th roots

### 1.4 Polynomials

- Properties of Polynomials
  - Identify the degree and leading coefficient of a polynomial
  - Identify monomials, binomials, and trinomials
- Operations on Polynomials
  - Multiply polynomials together
  - Perform operations with polynomials of several variables
  - Add and subtract polynomials
  - Multiply binomials together

### 1.5 Factoring Polynomials

- Factor Quadratics
    - Factor a trinomial
    - Factor a trinomial by grouping
      - Factor a trinomial with negative leading coefficient by grouping
      - Factor a trinomial with positive leading coefficient by grouping
      - Split the middle term of a trinomial for factoring by grouping
    - Factor the greatest common factor of a polynomial
      - Factor the greatest common factor of multivariable polynomials
      - Factor the greatest common factor of single variable polynomials
  - Factor Quadratics with Special Products
    - Factor a perfect square trinomial
-

- Factor a difference of squares
- Factor Cubics
  - Factor a cubic by grouping
  - Factor the sum and difference of cubes
- Factor Expressions with Fractional or Negative Exponents
  - Factor expressions using fractional or negative exponents
    - Factor expressions with two terms having both positive and negative fractional exponents
    - Factor expressions with two terms having only negative fractional exponents
    - Factor expressions with two terms having only positive fractional exponents
  - Factor expressions using greatest common factor and other technique

#### 1.6 Rational Expressions

- Multiply and Divide Rational Expressions
  - Multiply rational expressions
  - Simplify rational expressions
  - Divide rational expressions
- Add and Subtract Rational Expressions and Simplify Complex Rational Expressions
  - Add and subtract rational expressions
    - Add and Subtract Rational Expressions by finding LCD
    - Add and Subtract Rational Expressions by finding LCD involving factoring
    - Add and Subtract Rational Expressions with common denominators
  - Simplify complex rational expressions
    - Simplify complex rational expressions (multivariable)
    - Simplify complex rational expressions (single variable)

## **Chapter 2: Equations and Inequalities**

### 2.1 The Rectangular Coordinate Systems and Graphs

- Cartesian Coordinates and Distances
  - Use the distance formula, given two points
  - Use the midpoint formula
  - Plot ordered pairs in a Cartesian coordinate system
  - Graph equations by plotting points
    - Graph linear equations with fractional coefficients
    - Graph linear equations with integer coefficients

### 2.2 Linear and Rational Equations in One Variable

- Solve Linear Equations in One Variable
  - Solve equations in one variable algebraically, variable just on one side
    - Solve equations in one variable algebraically, variable just on one side (fractional coefficients)
    - Solve equations in one variable algebraically, variable just on one side (integer coefficients)
  - Solve equations in one variable algebraically, variable on both sides
  - Identify identity, conditional, and inconsistent equations
- Solve Rational Equations
  - Solve a rational equation, binomials in denominator

- Solve a rational equation, binomials in denominator on one side of the equation
- Solve a rational equation, same binomials in denominator on both sides of the equation
- Solve a rational equation, requires factoring to find least common denominator
- Solve a rational equation, monomials in denominator
- Identify Slopes and Intercepts
  - Understand the relationship between the slope and y-intercept of a line and its equation
  - Find x -intercepts and y -intercepts
  - Find the slope of a line given two points
- Find Linear Equations
  - Given slope and intercept, find the equation of a line and write it in standard form
  - Find the equation of vertical and horizontal lines
  - Find equation of a line, in slope-intercept form, given slope and one point (point-slope formula)
  - Find equation, in slope-intercept form, of a line passing through two given points
- Parallel and Perpendicular Lines
  - Write the equation of a line parallel to a given line
  - Write the equation of a line perpendicular to a given line
  - Given the equations of two lines, determine whether their graphs are parallel or perpendicular

### 2.3 Models and Applications

- Word Problems with Linear Equations
  - Translate verbal expressions into mathematical expressions
  - Use a formula to solve a real-world application
  - Set up a linear equation to solve a real-world application
- Problem Solving
  - Solve a formula for a specified variable
    - Solve a formula for a specified variable using addition/subtraction
    - Solve a formula for a specified variable using both addition/subtraction and multiplication/division
    - Solve a formula for a specified variable using multiplication/division
  - Use a formula to solve a geometric application
  - Solve simple interest applications
  - Use the Pythagorean theorem
    - Use the Pythagorean theorem - application problems
    - Use the Pythagorean theorem given the triangle

### 2.4 Complex Numbers

- Basics of Complex Numbers
    - Express the square root of a negative number as a multiple of  $i$
    - Simplify powers of  $i$
  - Operations on Complex Numbers
    - Add and subtract complex numbers
    - Multiply a complex number by a real number
    - Multiply two complex numbers
    - Divide two complex numbers
-

## 2.5 Quadratic Equations

- Solve Quadratic Equations by Factoring
  - Solve quadratic equations by factoring, leading coefficient 1
  - Solve quadratic equations by factoring, leading coefficient  $> 1$
- Complete the Square
  - Solve quadratic equations by the square root property
  - Solve quadratic equations by completing the square
- Quadratic Formula
  - Use the discriminant to classify the solutions of a quadratic equation
  - Solve quadratic equations by using the quadratic formula

## 2.6 Other Types of Equations

- Solve Higher Order Equations with Factoring
  - Solve equations by factoring out the greatest common factor
  - Solve equations by factoring with grouping
- Solve Equations Quadratic in Form by Factoring
  - Solve fourth-degree equation in quadratic form
  - Solve quadratic with binomial
- Solve Radical Equations
  - Solve radical equations with a single radical
  - Solve radical equations with two radicals
- Solve Other Types of Equations
  - Solve equations using reciprocal exponents
  - Solve equations involving rational exponents by factoring out the greatest common factor
  - Solve rational equation which leads to a quadratic

## 2.7 Linear Inequalities and Absolute Value Inequalities

- Interval Notation and Inequalities
    - Use interval notation
    - Use properties of inequalities
      - Solve inequalities using addition/subtraction
      - Solve inequalities using multiplication/division
    - Solve simple inequalities in one variable algebraically
    - Solve compound inequalities in one variable algebraically
  - Absolute Value Equations and Inequalities
    - Solve absolute value equations
      - Solving absolute value equations in simplified form
      - Solving absolute value equations that require simplification first
    - Solve absolute value inequalities
      - Solving absolute value inequalities - compound inequalities
      - Solving absolute value inequalities - greater than
      - Solving absolute value inequalities - less than
  - Applications with Linear Inequalities
    - Translate words to an inequality and solve applications with linear inequalities
      - Solve application problems with linear inequalities
      - Translate words to a linear inequality and solve
-

- Solve applications with compound inequalities
- Solve applications with absolute value

### 2.8 Inequalities Requiring Factoring

- Rational and Quadratic Inequalities
  - Solve quadratic inequalities in one variable, graph the solution set, and express the solution set using interval notation
  - Solve inequalities that involve rational expressions, graph the solution sets, and express the solution set using interval notation
    - Solve inequalities that involve rational expressions, graph the solution sets, and express the solution set using interval notation - no factoring
    - Solve inequalities that involve rational expressions, graph the solution sets, and express the solution set using interval notation requiring factoring

## Chapter 3: Functions

### 3.1 Functions and Function Notation

- Relations and Functions
  - Identify domain and range from a set of ordered pairs
  - Determine whether a relation represents a function
  - Use the vertical line test to identify functions
- One-to-One Functions
  - Determine whether a function is one-to-one
  - Use the horizontal line test to identify one-to-one functions
- Function Notation
  - Evaluate a function using function notation
  - Solve a function using function notation
  - Evaluate or solve a function from a table
  - Evaluate or solve a function from a graph

### 3.2 Absolute Value Functions and Other Toolkit Functions

- Graph Absolute Value Functions
  - Graph an absolute value function
- Toolkit Functions
  - Identify graphs of toolkit functions
    - Identify graphs of toolkit functions (absolute value)
    - Identify graphs of toolkit functions (cubic/cube root)
    - Identify graphs of toolkit functions (other functions)
    - Identify graphs of toolkit functions (square root/quadratic)

### 3.3 Domain and Range

- Domain and Range of Functions
    - Find the domain of a function defined by an equation
      - Find the domain of a function with square root in the denominator
      - Find the domain of a function with square root in the numerator
      - Find the domain of a rational function with factoring
      - Find the domain of rational function in factored form
    - Find the domain and range of a function defined by a graph
  - Piecewise Functions
-

- Graph piecewise-defined functions
- Evaluate piecewise-defined functions

### 3.4 Rates of Change and Behavior of Graphs

- Graphical Properties of Functions
  - Find the average rate of change of a function
  - Use a graph to determine intervals of increase and decrease
  - Use a graph to locate the absolute maximum and absolute minimum
  - Use a graph to determine local extrema
- Difference Quotients
  - Determine the difference quotient

### 3.5 Composition of Functions

- Combinations of Functions
  - Combine functions using algebraic operations
    - Combine functions by adding or subtracting
    - Combine functions by multiplying or dividing
  - Create a new function by composition of functions
- Evaluate Composite Functions
  - Evaluate composite functions given a table of values
  - Evaluate composite functions given the graph of functions
  - Evaluate composite functions given explicit functions
- Properties of Composite Functions
  - Find the domain of a composite function
  - Decompose a composite function into its component functions

### 3.6 Function Graphs and Transformations

- Transformations of Functions
  - Graph functions using vertical and horizontal shifts
  - Graph functions using reflections about the x-axis and the y-axis
  - Graph functions using compressions and stretches
  - Combine transformations
- Even and Odd Functions
  - Determine whether a function is even, odd, or neither from its graph
  - Determine whether a function is even, odd, or neither given algebraically

### 3.7 Inverse Functions

- Inverse Function Values
  - Verify inverse function ordered pairs
  - Given graph of a function, find value of inverse function
  - Given table of values of a function, find value of inverse function
- Find Inverse Functions
  - Verify inverse function pairs algebraically
  - Determine the domain and range of an inverse function, and restrict the domain of a function to make it one-to-one
  - Given function, find the inverse function
  - Use the graph of a one-to-one function to graph its inverse function on the same axes

### 3.8 Circles

- Graphs of Circles
-

- Given the equation of a circle not in standard form, determine the standard form by completing the square
- Determine the center and radius of a circle from the standard equation of a circle and sketch its graph

## **Chapter 4: Linear Functions and Modeling**

### 4.1 Linear Functions

- Interpretations of Linear Functions
  - Represent a linear function in table form
  - Determine whether a linear function is increasing, decreasing, or constant
  - Interpret slope as a rate of change
  - Represent a real-world application as a linear function
  - Graph linear functions

### 4.2 Modeling with Linear Functions

- Application of Linear Functions
  - Build linear models from verbal descriptions, given a y-intercept
  - Build linear models from verbal descriptions, given inputs and outputs
  - Use a diagram to build a model
  - Model a set of data with a linear function

### 4.3 Fitting Linear Models to Data

- Scatter Diagrams and Lines of Best Fit
  - Draw and interpret scatter diagrams
  - Distinguish between linear and nonlinear relations
- Linear Regressions
  - Find the line of best fit using a graphing utility
  - Use the line of best fit to make predictions

## **Chapter 5: Polynomial and Rational Functions**

### 5.1 Quadratic Functions

- Characteristics of Parabolas
    - Determine axis of symmetry and vertex of parabolas from a graph
    - Determine x- and y-intercepts of parabolas from a graph
    - Find the direction a parabola opens and its axis of symmetry and vertex from the general form of its equation
    - Identify the axis of symmetry and vertex of a parabola from its equation in standard form
  - Graphs of Quadratic Functions
    - Write the equation of a quadratic function given vertex and a point on a graph
    - Write the equation of a quadratic function given intercepts on a graph
    - Write the equation of a quadratic function in standard form given the equation in general form
  - Applications of Quadratic Functions
    - Find the domain and range of a quadratic function
    - Determine the maximum and minimum values of quadratic functions
    - Find the x- and y-intercepts of a quadratic function
-



- Use a quadratic function to model projectile motion
  - Use a quadratic function to model projectile motion - Find horizontal distance or time to reach ground
  - Use a quadratic function to model projectile motion - Find maximum height or time taken to reach max height
- Quadratic Regressions
  - Find the parabola of best fit using a graphing utility
  - Use the parabola of best fit to make predictions

## 5.2 Graphs of Polynomial and Power Functions

- End Behavior of Polynomial Functions
  - Identify power functions and polynomial functions
  - Identify if a graph is a polynomial function
  - Determine end behavior
- Local Behavior of Polynomial Functions
  - Identify intercepts of polynomial functions in factored form
  - Understand the relationship between degree, turning points, and x-intercepts
  - Understand the intermediate value theorem
  - Use factoring to find zeros of polynomial functions
    - Find zeros of polynomial functions (binomials and trinomials)
    - Find zeros of polynomial functions with four terms (factoring by grouping)
  - Identify zeros and their multiplicities from an equation or a graph
- Write and Graph Polynomial Functions
  - Draw conclusions about a polynomial function from a graph
  - Graph polynomial functions
  - Write a formula for a polynomial function from a graph
  - Determine equation of a polynomial given key information

## 5.3 Dividing Polynomials

- Long Division of Polynomials
  - Use long division to divide polynomials
  - Use polynomial division to solve application problems
- Synthetic Division and Remainder Theorem
  - Use synthetic division to divide polynomials
  - Evaluate a polynomial using the remainder theorem

## 5.4 Zeros of Polynomial Functions

- Rational Zeros of Polynomial Functions
  - Use the factor theorem to solve a polynomial equation
  - Use the rational zero theorem to find rational zeros
  - Solve real-world applications of polynomial equations
- Complex Zeros of Polynomial Functions
  - Find zeros of polynomial functions with complex zeros
  - Use the linear factorization theorem to find polynomials with given zeros
  - Use Descartes' rule of signs

## 5.5 Rational Functions

- Asymptotic Behavior of Rational Functions
    - Use arrow notation to describe local behavior and end behavior of rational functions
-

- Identify removable discontinuities of rational functions
- Identify slant asymptotes of rational functions
- Identify vertical asymptotes of rational functions
- Identify horizontal asymptotes rational functions
- Graphs and Applications of Rational Functions
  - Solve applied problems involving rational functions
  - Find the intercepts of a rational function
  - Graph rational functions
  - Find the equation of a rational function from a graph

### 5.6 Inverses and Radical Functions

- Inverses of Polynomial Functions
  - Find the inverse of an invertible polynomial function
  - Restrict the domain to find the inverse of a polynomial function
  - Solve an application with the inverse of a function
- Inverses of Radical and Rational Functions
  - Find the inverse of a radical function
  - Find the inverse of a square root function
  - Find the inverse of a cube root function
  - Find the domain of a radical function composed with a rational function
    - Find the domain of a radical function composed with a rational function (linear terms in both numerator and denominator)
    - Find the domain of a radical function composed with a rational function (quadratic terms in numerator or denominator)
  - Find the inverse of a rational function

### 5.7 Modeling Using Variation

- Direct and Inverse Variation
  - Solve direct variation problems
  - Solve inverse variation problems
  - Solve problems involving joint variation

## **Chapter 6: Exponential and Logarithmic Functions**

### 6.1 Exponential Functions

- Evaluate and Write Exponential Functions
  - Identify exponential functions
  - Evaluate exponential functions
  - Find the equation of an exponential function given the initial value and a point
  - Find the equation of an exponential function when the initial value is not known
- Applications of Exponential Functions and Base  $e$ 
  - Find the equation of an exponential function in a word problem context
  - Calculate compound interest
  - Evaluate exponential functions with base  $e$
  - Calculate continuous growth and decay

### 6.2 Graphs of Exponential Functions

- Exponential Function Graphs
    - Graph exponential functions
-

- Graph exponential functions using transformations
- Find the equation of an exponential function given a graph
- Write an exponential function from a description

### 6.3 Logarithmic Functions

- Relate Logarithms and Exponents
  - Convert from logarithmic to exponential form
  - Convert from exponential to logarithmic form
- Evaluate Logarithmic Expressions
  - Evaluate logarithms with positive integer solutions
  - Evaluate logarithms with negative integer solutions
  - Use common logarithms
  - Use natural logarithms

### 6.4 Graphs of Logarithmic Functions

- Logarithmic Function Graphs
  - Identify the domain of a logarithmic function
  - Graph logarithmic functions
  - Graph transformations of logarithmic functions
  - Write a logarithmic function from a description

### 6.5 Logarithmic Properties

- Basic Properties of Logarithms
  - Understand the basic properties of logarithms
  - Use the product rule for logarithms
    - Use the product rule for logarithms to condense into single logarithm
    - Use the product rule for logarithms to expand logarithmic expressions
  - Use the quotient rule for logarithms
    - Use the quotient rule for logarithms to condense into single logarithm
    - Use the quotient rule for logarithms to expand logarithmic expressions
  - Use the power rule for logarithms
- Rewrite Logarithmic Expressions Using Properties
  - Expand logarithmic expressions
  - Condense logarithmic expressions
  - Use the change-of-base formula for logarithms

### 6.6 Exponential and Logarithmic Equations

- Solve Exponential Equations
  - Use like bases to solve exponential equations
  - Rewrite equations so all powers have the same base and solve exponential equations
  - Use logarithms to solve exponential equations
  - Solve an equation with a base  $e$  using natural logarithms
- Solve Logarithmic Equations
  - Use the definition of a logarithm to solve logarithmic equations
  - Use logarithm properties and the definition of the logarithm to solve logarithmic equations
  - Use the one-to-one property of logarithms to solve logarithmic equations

### 6.7 Exponential and Logarithmic Models

- Applications of Exponential and Logarithmic Functions
-

- Model exponential growth
- Model exponential decay
- Applied logarithmic models
  - Calculate the output of a log model given input values
  - Solve applied log models by rewriting in exponential form
- Choose an appropriate model for data
- Express an exponential model in base  $e$

#### 6.8 Fitting Exponential Models to Data

- Exponential and Logarithmic Regressions
  - Build an exponential model from data using a graphing utility
  - Build a logarithmic model from data using a graphing utility
- Logistic Growth Models
  - Use logistic growth models
  - Build a logistic model from data using a graphing utility

### **Chapter 7: Right Triangle Trigonometry and the Unit Circle**

#### 7.1 Vocabulary of Angles and Triangles

- Types of Angles
  - Understand supplementary and complementary angles
  - Identify right, acute, obtuse, and straight angles
- Angles, Triangles, and the Pythagorean Theorem
  - Use properties of similar triangles to solve for a missing side
  - Find the measures of angles of a triangle using properties

#### 7.2 Angles as Rotations and Arc Length

- Angles as Rotations and Radian Measures
  - Identify the measure of positive and negative angles in standard position and the quadrant of the terminal side
  - Convert between degree and radian measure of an angle
  - Understand when two angles are coterminal
- Arc Length and Area of a Sector
  - Find the length of an arc
  - Find the area of a sector of a circle
  - Understand the relationship between linear and angular speed

#### 7.3 Right Triangle Trigonometry

- The Six Trigonometric Ratios
  - Use right triangles to evaluate sine, cosine, and tangent functions
  - Evaluate reciprocal trig functions using right triangles or a sine, cosine, or tangent function
  - Evaluate trigonometric functions of angles not in standard position
- Use Right Triangle Trigonometry in Solving Problems
  - Find missing side lengths using trig ratios
  - Use right triangle trigonometry to solve applied problems

#### 7.4 The Unit Circle

- Sine and Cosine Values in the First Quadrant
    - Understand sine and cosine values on the unit circle
-

- Find exact sine and cosine values for angles in the first quadrant of the unit circle
- Sine and Cosine Values with Reference Angles
  - Find the reference angle for a given angle
  - Use reference angles to evaluate sine and cosine functions
  - Use reference angles to find coordinates on the unit circle
  - Evaluate sine and cosine functions with a calculator

## 7.5 The Other Trigonometric Functions

- The Other Trigonometric Ratios on the Unit Circle
  - Find the secant, cosecant, tangent, and cotangent values for angles in the first quadrant of the unit circle
    - Find the secant, cosecant, tangent, and cotangent values for non-standard angles in the first quadrant of the unit circle
    - Find the secant, cosecant, tangent, and cotangent values for standard angles in the first quadrant of the unit circle
  - Use reference angles to evaluate secant, cosecant, tangent, and cotangent functions
  - Evaluate trigonometric functions with a calculator
- Use Given Trigonometric Ratios to Find Other Ratios
  - Understand the relationship between the quadrant in which an angle falls and the signs of the trig functions of that angle
  - Use the Pythagorean identity
  - Find the values of all trigonometric functions given coordinates on a unit circle
  - Find the values of all trigonometric functions given the value of one trigonometric function

## Chapter 8: Periodic Functions

### 8.1 Sine and Cosine Graphs

- Characteristics of Sine and Cosine Graphs
  - Graph the sine function and understand its properties
  - Graph the cosine function and understand its properties
- Transformations of Sine and Cosine Graphs
  - Determine the period and amplitude of a sinusoidal function
  - Determine the phase shift and vertical shift of a sinusoidal function
    - Determine the phase shift and vertical shift given the equation of a sinusoidal function
    - Graph sinusoidal Function with phase shifts and vertical shifts
    - Write the equation of a sinusoidal function with phase shift and vertical shift
- Graph Sine and Cosine Functions
  - Find the equation of a sinusoidal function given a graph
  - Find the graph of a sinusoidal function given equation
  - Use sinusoidal functions to solve real-world applications

### 8.2 Graphs of Other Trigonometric Functions

- Characteristics of Tangent and Cotangent Graphs
    - Graph tangent functions
    - Graph cotangent functions
  - Transformations of Tangent and Cotangent Functions
-

- Graph tangent or cotangent functions over different periods
- Graph transformations of tangent and cotangent functions
- Characteristics of Secant and Cosecant Graphs
  - Graph cosecant functions
  - Graph secant functions
- Graph Secant and Cosecant Functions
  - Graph transformations of cosecant functions
  - Graph transformations of secant functions
  - Find the equation of a cosecant function from a graph
  - Find the equation of a secant function from a graph

### 8.3 Inverse Trigonometric Functions

- Introduction to Inverse Trigonometric Functions
  - Understand inverse sine, cosine, and tangent functions
  - Understand inverse secant, cosecant, and cotangent functions
  - Use a calculator to evaluate inverse trigonometric functions
- Solve Triangles with Inverse Trigonometric Functions
  - Find an angle given two sides of a right triangle
  - Solve right triangle problems
- Compose Functions with Inverse Trigonometric Functions
  - Evaluate composite functions with inverse trigonometric functions in the form  $f(f^{-1}(x))$  or  $f(g^{-1}(x))$ 
    - Evaluate composite functions with inverse trigonometric functions in the form  $f(f^{-1}(x))$  or  $f(g^{-1}(x))$  where  $x$  is a known/standard angle
    - Evaluate composite functions with inverse trigonometric functions in the form  $f(f^{-1}(x))$  or  $f(g^{-1}(x))$  where  $x$  is not a standard angle
  - Evaluate composite functions with inverse trigonometric functions in the form  $f^{-1}(f(x))$  or  $f^{-1}(g(x))$ 
    - Evaluate composite functions with inverse trigonometric functions in the form  $f^{-1}(f(x))$
    - Evaluate composite functions with inverse trigonometric functions in the form  $f^{-1}(g(x))$

## Chapter 9: Trigonometric Identities and Equations

### 9.1 Fundamental Trigonometric Identities

- Simplify Expressions with Basic Trigonometric Identities
    - Understand quotient and reciprocal identities
    - Use even and odd identities in simplifying trigonometric expressions
  - Use Pythagorean and Cofunction Identities
    - Understand all forms of the Pythagorean identity
    - Use the cofunction identities
  - Verify Trigonometric Identities
    - Use all identities to simplify trigonometric expressions
      - Use  $1 + \cot^2(x) = \csc^2(x)$  to simplify trigonometric expressions
      - Use  $1 + \tan^2(x) = \sec^2(x)$  to simplify trigonometric expressions
      - Use  $\sin^2(x) + \cos^2(x) = 1$  to simplify trigonometric expressions
-

- Use algebraic techniques to simplify trigonometric expressions

## 9.2 Sum and Difference Identities

- Sum and Difference Formulas
  - Use the sum and difference formula for cosine
    - Apply the sum and difference formula for cosine
    - Use the sum and difference formula to find the cosine of a given angle
  - Use the sum and difference formula for sine
    - Apply the sum and difference formula for sine
    - Use the sum and difference formula to find the sine of a given angle
  - Use the sum and difference formula for tangent
    - Apply the sum and difference formula for tangent
    - Use the sum and difference formula to find the tangent of a given angle
- Use the sum and difference formulas to simplify trigonometric expressions

## 9.3 Double-Angle, Half-Angle, and Reduction Formulas

- Double-Angle Formulas
  - Use double-angle formulas to find values of trigonometric functions
  - Use double-angle formulas to simplify trigonometric expressions
- Half-Angle and Power-Reduction Formulas
  - Use reduction formulas to simplify an expression
  - Use half-angle formulas to find values of trigonometric functions
    - Use half-angle formulas to find values of trigonometric functions at half angles given one trig function at an angle
    - Use half-angle formulas to find values of trigonometric functions at unknown angles

## 9.4 Sum-to-Product and Product-to-Sum Formulas

- Sum-to-Product and Product-to-Sum Formulas
  - Express the product of trigonometric functions as a sum
  - Express sums of trigonometric functions as a product

## 9.5 Solving Trigonometric Equations

- Trigonometric Equations in Sine and Cosine
    - Solve linear trigonometric equations in sine
      - Solve multi-step linear trigonometric equations in sine
      - Solve one step linear trigonometric equations in sine (for example  $\sin(\theta) = 1/2$ )
    - Solve linear trigonometric equations in cosine
  - Trigonometric Equations Involving a Single Trigonometric Function
    - Solve linear trigonometric equations in secant and cosecant
      - Solve multi-step linear trigonometric equations in secant and cosecant
      - Solve one step linear trigonometric equations in secant and cosecant
    - Solve linear trigonometric equations in tangent and cotangent
      - Solve multi-step linear trigonometric equations in tangent and cotangent
      - Solve one step linear trigonometric equations in sine (for example  $\sin(\theta) = 1/2$ )
      - Solve one step linear trigonometric equations in tangent and cotangent
  - Solve trigonometric equations using a calculator
-

- Trigonometric Equations in Quadratic Form or Requiring Factoring
  - Solve equations with a single trigonometric function
  - Solve factorable trigonometric equations in quadratic form
  - Solve trigonometric equations in quadratic form requiring the quadratic formula
- Trigonometric Equations Requiring Identities or Multiple Angles
  - Solve trigonometric equations using fundamental identities
    - Solve trigonometric equations using the double angle formula
    - Solve trigonometric equations using the Pythagorean theorem and odd-even identity
  - Solve trigonometric equations with multiple angles
  - Solve trigonometric equations using cofunction identities

## **Chapter 10: Further Applications of Trigonometry**

### 10.1 Non-right Triangles - Law of Sines

- Law of Sines
  - Use the law of sines to solve ASA or AAS triangles
  - Use the law of sines to solve SSA triangles
    - Use the law of sines to solve SSA triangles for measure of angle or unknown side
    - Use the law of sines to solve SSA triangles for number of possible triangles
  - Solve applied problems with the law of sines

### 10.2 Non-right Triangles - Law of Cosines and Area of Oblique Triangles

- Law of Cosines
  - Use the law of cosines to solve SAS triangles
  - Use the law of cosines to solve SSS triangles
  - Solve applied problems with the law of cosines
- Area of Oblique Triangles
  - Find the area of an oblique triangle using the sine function
  - Use Heron's formula to find the area of a triangle

### 10.3 Polar Coordinates

- Convert Coordinates Between Rectangular and Polar Forms
  - Plot points using polar coordinates
  - Convert from polar coordinates to rectangular coordinates
  - Convert from rectangular coordinates to polar coordinates
- Convert Equations Between Rectangular and Polar Forms
  - Write a cartesian equation in polar form
  - Write a polar equation in cartesian form

### 10.4 Graphs in Polar Coordinates

- Introductions to Graphing Polar Equations
    - Test a polar equation for symmetry
    - Find zeros and maximum values for a polar equation and graph polar equations by plotting points
    - Graph a circle or a line from a polar equation
  - Graph Classic Polar Curves
    - Graph a cardioid from a polar equation
    - Graph a limaçon from a polar equation
-



- Graph a lemniscate from a polar equation
- Graph a rose curve from a polar equation

#### 10.5 Polar Form of Complex Numbers

- Write Complex Numbers in Polar Form
  - Plot complex numbers
  - Find the absolute value of a complex number
  - Write complex numbers in polar form
  - Convert a complex number from polar to rectangular form
- Product and Quotient of Complex Numbers in Polar Form
  - Find the product of complex numbers in polar form
  - Find the quotient of complex numbers in polar form
- Powers and Roots of Complex Numbers in Polar Form
  - Find powers of complex numbers in polar form
  - Find roots of complex numbers in polar form

#### 10.6 Parametric Equations

- Write Parametric Equations
  - Parameterize a curve
  - Find the parametric equations for a line segment given an orientation
- Eliminate the Parameter
  - Eliminate the parameter in linear equations
  - Eliminate the parameter in polynomial and radical equations
  - Eliminate the parameter in exponential and logarithmic equations
  - Eliminate the parameter in trigonometric parametric equations

#### 10.7 Graphs with Parametric Equations

- Graph Parametric Equations
  - Graph parametric equations by plotting points
  - Graph trigonometric parametric equations by plotting points
  - Use parametric equations in applications

#### 10.8 Vectors

- Properties of Vectors
    - Understand properties of vectors and find the position vector
    - Find magnitude and direction of a vector
  - Vector Additions and Scalar Multiplication
    - Add or subtract vectors
    - Multiply a vector by a scalar
    - Use vector addition and scalar multiplication to find a new vector
  - The Unit Vector
    - Write a vector in terms of  $i$  and  $j$
    - Find the unit vector
    - Perform operations on vectors in terms of  $i$  and  $j$
    - Write a vector in terms of magnitude and direction
  - The Dot Product and Vector Applications
    - Find the dot product of two vectors
    - Find the angle between two vectors
    - Use vectors in applications
-

## **Chapter 11: Systems of Equations and Inequalities**

### 11.1 Systems of Linear Equations in Two Variables

- Graphing Systems of Linear Equations
  - Determine whether an ordered pair is a solution to a system of equations
  - Solve systems of equations in two variables by graphing
- Solving Systems of Linear Equations
  - Solve systems of equations in two variables by substitution
  - Solve systems of equations in two variables by addition
  - Identify inconsistent and dependent systems of equations containing two variables, and express the solution of dependent equations
- Applications of Systems of Linear Equations
  - Use systems of equations to investigate profits
  - Write and solve a system of equations in two variables from a word problem
- Linear Inequalities in Two Variables
  - Solve a linear inequality in two variables by graphing
  - Solve a linear system of inequalities by graphing

### 11.2 Systems of Linear Equations in Three Variables

- Systems of Linear Equations in Three Variables
  - Determine whether an ordered triple is a solution to a system
  - Solve systems of three equations in three variables
  - Identify inconsistent and dependent systems of equations containing three variables, and express the solution of a system of dependent equations

### 11.3 Systems of Nonlinear Equations in Two Variables

- Systems of Two Nonlinear Equations
  - Solve a system of nonlinear equations representing a parabola and a line
  - Solve a system of nonlinear equations representing a circle and a line
  - Solve a system of nonlinear equations in two variables using elimination
- Graphing Nonlinear Inequalities and Systems of Inequalities
  - Graph a nonlinear inequality
  - Graph a system of nonlinear inequalities

### 11.4 Partial Fractions

- Partial Fraction Decomposition with Linear Factors
  - Decompose a rational expression where the denominator has only nonrepeated linear factors
  - Decompose a rational expression where the denominator has repeated linear factors
- Partial Fraction Decomposition with Quadratic Factors
  - Decompose a rational expression where the denominator has a nonrepeated irreducible quadratic factor
  - Decompose a rational expression where the denominator has a repeated irreducible quadratic factor

### 11.5 Matrices and Matrix Operations

- Introduction to Matrices
    - Determine the order of a matrix and describe elements within a matrix
    - Add or subtract matrices
-

- Matrix Multiplication
  - Multiply a matrix by a scalar
  - Find the sum or difference of scalar multiples
  - Multiply two matrices

#### 11.6 Augmented Matrices and Gaussian Elimination

- Solving Systems with Gaussian Eliminations
  - Convert between a system of equations and its corresponding augmented matrix
  - Use row operations to solve a system of linear equations in two variables
  - Use row operations to solve a system of linear equations in three variables
  - Use matrices to solve applications of systems of linear equations
- Solving Systems with Gauss-Jordan Elimination
  - Use Gauss-Jordan elimination to solve a system of linear equations

#### 11.7 Determinants of Matrices and the Inverse Matrix

- Finding Determinants of Matrices
  - Find the determinant of a 2x2 matrix
  - Find the determinant of a 3x3 matrix
- Inverse and Identity Matrices
  - Understand the identity matrix and how it relates to the inverse matrix
  - Determine if a matrix is invertible using the determinant
  - Find the inverse of a 2x2 matrix
  - Find the inverse of a 3x3 matrix
- Solving Systems with Inverses
  - Solve a system of linear equations using the inverse of a 2x2 matrix
  - Solve a system of linear equations using the inverse of a 3x3 matrix

#### 11.8 Cramer's Rule

- Solving Systems with Cramer's Rule
  - Use Cramer's rule to solve a system of two equations in two variables
  - Use Cramer's rule to solve a system of three equations in three variables
  - Use Cramer's rule to solve inconsistent or dependent systems

#### 11.9 Linear Programming

- Using Linear Programming
  - Graph a feasible region given a set of constraints
  - Find the maximum value of an objective function given constraints by graphing
  - Solve application problems using linear programming

### **Chapter 12: Conic Sections**

#### 12.1 Ellipses

- Ellipses Centered at the Origin
    - Identify key points and axes of ellipses from a graph
    - Identify key points and axes of ellipses from an equation
    - Write the equation in standard form of an ellipse centered at the origin
    - Graph an ellipse centered at the origin from an equation in standard form
  - Ellipses Not Centered at the Origin
    - Graph an ellipse not centered at the origin
    - Write the equation in standard form of an ellipse not centered at the origin
-

- Identify key points and axes of ellipses not centered at the origin
- Ellipses Not in Standard Form and Applications of Ellipses
  - Use ellipses in applications
  - Convert an equation of an ellipse into standard form
  - Graph an ellipse where the equation is not given in standard form

## 12.2 Hyperbolas

- Hyperbolas Centered at the Origin
  - Locate the vertices and foci of a hyperbola from a graph
  - Identify vertices, foci, and asymptotes of a hyperbola from an equation
  - Write the equation of a hyperbola centered at the origin in standard form
  - Graph a hyperbola centered at the origin from an equation in standard form
- Hyperbolas Not Centered at the Origin
  - Identify vertices, foci, and asymptotes of a hyperbola not centered at the origin
  - Write the equation of a hyperbola not centered at the origin
  - Graph a hyperbola not centered at the origin from an equation in standard form
- Hyperbolas Not in Standard Form and Applications of Hyperbolas
  - Convert an equation of a hyperbola into standard form
  - Graph a hyperbola from an equation given in general form
  - Use hyperbolas in applications

## 12.3 Parabolas

- Parabolas Centered at the Origin
  - Identify key components of a parabola from a graph
  - Identify key components of a parabola from an equation
  - Graph a parabola centered at the origin
  - Write the equation of a parabola centered at the origin in standard form
- Parabolas Not Centered at the Origin
  - Identify key components of a parabola not centered at the origin
  - Graph a parabola not centered at the origin
  - Write the equation of a parabola not centered at the origin in standard form
- Parabolas Not in Standard Form and Applications of Parabolas
  - Convert an equation of a parabola into standard form
  - Graph a parabola from an equation given in general form
  - Use parabolas in applications

## 12.4 Rotation of Axes

- Conics in General Form and Rotation of Conics
  - Identify a conic from its general form
  - Find the location of a point after a rotation of axes

## 12.5 Conic Sections in Polar Coordinates

- Conic Sections in Polar Coordinates
  - Identify the type of conic from its polar equation
  - Find the polar equation of a conic given its focus, eccentricity, and directrix

## **Chapter 13: Sequences, Probability, and Counting Theory**

### 13.1 Sequences

- Introduction to Sequences
-

- Write the terms of a sequence defined by an explicit formula
- Write the terms of a sequence defined by a piecewise explicit formula
- Recursive Sequences
  - Write the terms of a sequence defined by a recursive formula
  - Write the terms of a sequence defined by a recursive formula with more than one initial term

### 13.2 Arithmetic Sequences

- Arithmetic Sequences
  - Write a recursive formula for an arithmetic sequence
  - Write an explicit formula for an arithmetic sequence
  - Find the common difference of an arithmetic sequence
  - Write terms of an arithmetic sequence
- Applications of Arithmetic Sequences
  - Find specific terms of an arithmetic sequence given other terms
  - Solve application problems with arithmetic sequences

### 13.3 Geometric Sequences

- Geometric Sequences
  - Write a recursive formula for a geometric sequence
  - Write an explicit formula for a geometric sequence
  - Find the common ratio of a geometric sequence
  - Write terms of a geometric sequence
- Applications of Geometric Sequences
  - Write an explicit formula for the  $n$ th term of a sequence
  - Solve application problems with geometric sequences
  - Solve geometric sequence problems

### 13.4 Series

- Summation Notation and Arithmetic Series
  - Evaluate expressions using summation notation
  - Find the sum of a finite arithmetic series
- Finite and Infinite Geometric Series
  - Find the sum of a finite geometric series
  - Determine if the sum of an infinite series is defined
  - Find the sum of an infinite geometric series
- Applications of Series
  - Solve application problems with arithmetic series
  - Solve application problems with geometric series
  - Find the equivalent fraction for a repeating decimal
  - Solve an annuity problem

### 13.5 Counting Theory

- The Addition and Multiplication Principles
    - Solve counting problems using the addition principle
    - Solve counting problems using the multiplication principle
    - Evaluate an expression with factorials
  - Permutations
    - Find the number of permutations of  $n$  distinct objects using the multiplication principle
-

- Find the number of permutations of  $n$  distinct objects using a formula
- Find the number of permutations of  $n$  non-distinct objects
- Combinations
  - Find the number of combinations using the formula
  - Find the number of subsets of a set

### 13.6 Binomial Theorem

- Binomial Expansion
  - Find a binomial coefficient
  - Expand a binomial using the binomial theorem
  - Use the binomial theorem to find a single term

### 13.7 Probability

- Basic Probability
  - Compute the probability of equally likely outcomes
  - Compute the probability of the union of two events
  - Use the complement rule to compute probabilities
  - Compute probability using counting theory
- Binomial Probability
  - Identify a binomial experiment
  - Determine the binomial probability of success in an experiment performed multiple times

## **Chapter 14: Limits and Continuity**

### 14.1 Finding Limits Using Numerical and Graphical Approaches

- Limits From a Graph or Table
  - Understand the limit of a function and evaluate a limit from a table
  - Evaluate limits graphically
  - Understand the properties of limits

### 14.2 Finding Limits Analytically

- Limits Analytically for Continuous and Piecewise Functions
    - Evaluate two-sided limits analytically for continuous functions
    - Evaluate limits analytically for piecewise functions
    - Evaluate limits analytically for absolute value functions
  - Limits Analytically for Functions with Removable Discontinuities
    - Evaluate two-sided limits analytically for rational functions with removable discontinuities by factoring
    - Evaluate two-sided limits analytically for rational functions with removable discontinuities through expansion
    - Evaluate two-sided limits analytically for complex fractions with removable discontinuities
    - Evaluate two-sided limits analytically for rational functions that contain radicals with removable discontinuities
  - Limits Analytically for Trigonometric Functions
    - Evaluate trigonometric limits using direct substitution
    - Evaluate trigonometric limits using special limits
    - Evaluate trigonometric limits using identities
  - Infinite Limits
-

- Evaluate limits analytically for functions with essential discontinuities
- Evaluate limits analytically for trigonometric functions with essential discontinuities
- Limits at Infinity
  - Evaluate limits of polynomial functions at infinity
  - Evaluate limits of rational functions at infinity
  - Evaluate limits of trigonometric functions at infinity
  - Evaluate limits of radical and exponential functions at infinity

#### 14.3 Continuity

- Continuity and the Intermediate Value Theorem
  - Understand the definition of continuity
  - Distinguish between types of discontinuity
  - Understand and apply the intermediate value theorem
- Continuity of Piecewise Functions
  - Determine whether a piecewise function is continuous
  - Determine the value that makes a piecewise function continuous

#### 14.4 Derivatives

- The Average Rate of Change
  - Find the average rate of change given a function and variable intervals
  - Find the average rate of change given a function
- Derivatives Using the Limit Definition
  - Use the limit definition to find the derivative of a function with a radical
  - Use the limit definition to find the derivative of a rational function
  - Use the limit definition to find the derivative of a polynomial function
  - Find the derivative of a function at a point using limits
    - Find the derivative of a quadratic function at a point using limits
    - Find the derivative of an exponential function at a point using limits
- Instantaneous Rates of Change
  - Use instantaneous rates of change in applications
  - Estimate the derivative at a point on the graph of a function
  - Determine the sign of the slope of a line tangent to a function at a given point
- Differentiability
  - Determine where a function is differentiable from a graph

#### 14.5 Formal Limits

- Precise Definition of a Limit
  - Determine a delta for an arbitrary epsilon given a quadratic function
  - Determine a delta for an arbitrary epsilon given a linear function
  - Understand the notation in finding the formal definition of a limit

### **Corequisite Support: A Targeted Review**

#### **Chapter 1: Foundations**

##### 1.1 Introduction to Whole Numbers

- Place Values and Rounding
    - Identify the place value of a digit and write a whole number using words or digits
-

- Round whole numbers
- Prime Factorization and Least Common Multiples
  - Identify multiples and apply divisibility tests
  - Find the prime factorization of a number
  - Find the least common multiple of two numbers

### 1.2 Use the Language of Algebra

- Use Variables and Algebraic Symbols
  - Translate algebraic expressions, equations, and inequalities into English and recognize expressions and equations
  - Evaluate a whole number raised to a power and understand the terminology
- Order of Operations and Simplifying Expressions
  - Simplify an expression using order of operations
  - Evaluate an expression
  - Identify coefficients and identify and combine like terms
- Rewrite English Phrases into Algebraic Expressions
  - Translate an English phrase to an algebraic expression
  - Translate English phrases from applications into algebraic expressions

### 1.3 Add and Subtract Integers

- Introduction to Integers and Absolute Value
  - Order integers using inequality symbols and determine the opposite of integers or variables
  - Evaluate an absolute value expression
  - Simplify an expression involving absolute value using order of operations
- Adding and Subtracting Integers
  - Add integers
  - Subtract integers
  - Add and subtract integers using order of operations

### 1.4 Multiply and Divide Integers

- Multiplying and Dividing Integers
  - Multiply integers
  - Divide integers
  - Divide whole numbers using long division where there may be a remainder
- Simplifying Expressions with Integers
  - Simplify expressions with integers using order of operations
  - Evaluate a variable expression with integers
- Algebraic Expressions and Applications with Integers
  - Translate an English phrase to an algebraic expression with integers
  - Use integers in applications

### 1.5 Visualize Fractions

- Simplifying Fractions
    - Identify when fractions are equivalent
    - Simplify a fraction
  - Multiplying and Dividing Fractions
    - Multiply fractions
-



- Divide fractions
- Simplify complex fractions
- Understanding Expressions with Fractions
  - Simplify expressions written with a fraction bar
  - Translate an English phrase to an expression with fractions

#### 1.6 Add and Subtract Fractions

- Adding and Subtracting Fractions
  - Add or subtract fractions with a common denominator
  - Add or subtract fractions with different denominators
- Algebraic Expressions with Fractions
  - Use the order of operations to simplify complex fractions and expressions with multiple operations
  - Evaluate variable expressions with fractions

#### 1.7 Decimals

- Understanding and Rounding Decimals
  - Name and write decimals
  - Round decimals
- Operations with Decimals
  - Add and subtract decimals
  - Multiply decimals
  - Divide decimals
- Decimals, Fractions, and Percents
  - Convert between fractions and decimals
  - Simplify expressions with fractions and decimals
  - Convert between decimals and percents

#### 1.8 Square Roots and the Real Number System

- Square Roots and the Real Number System
  - Evaluate a square root
  - Identify rational and irrational numbers
  - Identify real numbers
- Fractions and Decimals on the Number Line
  - Locate fractions on a number line and write inequality statements involving fractions
  - Locate decimals on a number line and write inequality statements involving decimals

#### 1.9 Properties of Real Numbers

- Properties of the Real Number System
  - Use the commutative and associative properties
  - Identify additive and multiplicative inverses of a number
  - Understand the multiplication and division properties of zero
  - Simplify expressions using properties of identities, inverses, and zero
- The Distributive Property
  - Simplify expressions using the distributive property
  - Simplify expressions by distributing a negative number

#### 1.10 Systems of Measurements

- Unit Conversion in the US System
-

- Make unit conversions in the US system
- Use mixed units of measurement in the US system
- Unit Conversion in the Metric System
  - Make unit conversions in the metric system
  - Use mixed units of measurement in the metric system
- Unit Conversion Between Systems
  - Convert between the US and metric systems of measurement
  - Convert between Fahrenheit and Celsius temperatures

## **Chapter 2: Solving Linear Equations and Inequalities**

### 2.1 Solve Equations Using the Subtraction and Addition Properties of Equality

- Solve Equations with the Subtraction and Addition Properties of Equality
  - Verify a solution of an equation
  - Solve an equation using the subtraction and addition properties of equality
  - Solve an equation involving fractions or decimals using the subtraction and addition properties of equality
  - Solve an equation that requires simplification using the subtraction and addition properties of equality
- Application Problems and the Subtraction and Addition Properties of Equality
  - Translate an English sentence to an algebraic equation and solve using the subtraction and addition properties of equality
  - Use the subtraction and addition properties of equality to solve application problems

### 2.2 Solve Equations Using the Division and Multiplication Properties of Equality

- Solve Equations with the Division and Multiplication Properties of Equality
  - Solve an equation using the division and multiplication properties of equality
  - Solve an equation involving fractions or decimals using the division and multiplication properties of equality
  - Solve an equation that require simplification using the division and multiplication properties of equality
- Application Problems and the Division and Multiplication Properties of Equality
  - Translate an English sentence to an algebraic equation and solve using the division and multiplication properties of equality
  - Use the division and multiplication properties of equality to solve application problems

### 2.3 Solve Equations with Variables and Constants on Both Sides

- Solving Linear Equations
  - Solve an equation with constants on both sides
  - Solve an equation with variables on both sides
  - Solve an equation with constants and variables on both sides

### 2.4 Use a General Strategy to Solve Linear Equations

- General Strategies for Solving Linear Equations
  - Solve an equation using the distributive property with variables on one side
  - Solve an equation using the distributive property with variables on both sides
  - Classify equations as conditional, identity, or a contradiction

### 2.5 Solve Equations with Fractions or Decimals

---

- Solving Linear Equations with Fractions
  - Solve an equation involving fractions with variables on both sides
  - Solve an equation involving fractions by eliminating the fractions
  - Solve an equation involving fractions by eliminating the fractions and other steps
- Solve Linear Equations with Decimals
  - Solve an equation involving decimals with variables on both sides
  - Solve an equation involving decimals by clearing the decimals

#### 2.6 Solve a Formula for a Specific Variable

- Distance, Rate, and Time and Literal Equations
  - Use the distance, rate, and time formula
  - Solve a formula for a specific variable

#### 2.7 Solve Linear Inequalities

- Inequalities, the Number Line, and Interval Notation
  - Graph an inequality on the number line
  - Express an inequality using interval notation
- Solving One-Step Linear Inequalities
  - Solve an inequality using the subtraction and addition properties of inequality
  - Solve an inequality using the division and multiplication properties of inequality
- Solving Linear Inequalities
  - Solve an inequality that requires simplification
  - Classify an inequality as conditional, identity, or contradiction
  - Translate an English sentence into an inequality and solve

### **Chapter 3: Math Models**

#### 3.1 Use a Problem-Solving Strategy

- An Introduction to Problem Solving
  - Use a problem-solving strategy for word problems
  - Solve a number problem
  - Solve a number problem involving consecutive integers

#### 3.2 Solve Percent Applications

- Percent Problems and Percent Increase and Decrease
  - Translate and solve basic percent equations
  - Solve basic applications of percent
  - Find percent increase or percent decrease
- Simple Interest and Discounts
  - Solve applications involving the simple interest formula
  - Solve applications with discount or mark-up

#### 3.3 Solve Mixture Applications

- Solve Mixture Word Problems
  - Solve coin word problems
  - Solve ticket and stamp word problems
  - Use the mixture model to solve word problems

#### 3.4 Solve Geometry Applications - Triangles, Rectangles, and the Pythagorean Theorem

- Triangles and the Pythagorean Theorem
-

- Solve problems involving the perimeter, area, and interior angles of triangles
  - Solve triangle problems where angles or sides are given in terms of other angles or sides
  - Solve triangle problems using the Pythagorean Theorem
  - Area and Perimeter of Rectangles
    - Solve problems involving the perimeter and area of rectangles
    - Solve rectangle problems when the width is given in terms of the length
- 3.5 Solve Uniform Motion Applications
- Uniform Motion
    - Solve uniform motion applications
- 3.6 Solve Applications with Linear Inequalities
- Problem Solving with Linear Inequalities
    - Solve one-step applications with linear inequalities
    - Solve applications with linear inequalities

## **Chapter 4: Graphs**

### 4.1 Use the Rectangular Coordinate System

- Reading Graphs and the Rectangular Coordinate System
  - Plot points on a rectangular coordinate system
  - Verify the solution to an equation in two variables
  - Complete a table of solutions to a linear equation in two variables
  - Find solutions to a linear equation

### 4.2 Graph Linear Equations in Two Variables

- Graphing Linear Equations
  - Recognize the relationship between the solutions of an equation and its graph
  - Graph a linear equation by plotting points
  - Graph a linear equation in standard form by plotting points
  - Graph vertical and horizontal lines

### 4.3 Graph with Intercepts

- Intercepts on the Coordinate Plane
  - Identify the x- and y-intercepts on a graph
  - Find the x- and y-intercepts from an equation of a line
  - Graph a line using the x- and y-intercepts

### 4.4 Understand Slope of a Line

- Understanding Slope
  - Use a geoboard to model slope
  - Use the relationship between rise and run to find the slope of a line from its graph
  - Find the slope of horizontal and vertical lines
- The Slope Formula
  - Use the slope formula to find the slope of a line between two points
  - Graph a line given a point and the slope
  - Determine the slope in applications

### 4.5 Use the Slope-Intercept Form of an Equation of a Line

- Slope-Intercept Form
-

- Identify the slope and y-intercept from an equation of a line and relate a graph to the equation
- Graph a line given its equation using its slope and y-intercept
- Graph lines using a variety of methods
- Graph and interpret applications of slope-intercept
- Parallel and Perpendicular Lines
  - Use slopes to identify parallel lines
  - Use slopes to identify perpendicular lines

#### 4.6 Find the Equation of a Line

- Equations of Lines
  - Find an equation of the line given the slope and y-intercept
  - Find an equation of the line given the slope and a point
  - Find an equation of the line given two points
- Equations of Parallel and Perpendicular Lines
  - Find an equation of a line parallel to a given line
  - Find an equation of a line perpendicular to a given line

#### 4.7 Graphs of Linear Inequalities

- Graphing Linear Inequalities
  - Verify solutions to an inequality in two variables
  - Recognize the relationship between the solutions of an inequality and its graph
  - Graph a linear inequality

### **Chapter 5: Systems of Linear Equations**

#### 5.1 Solve Systems of Equations by Graphing

- Solving Systems of Linear Equations by Graphing
  - Determine whether an ordered pair is a solution of a system of linear equations
  - Solve a system of linear equations by graphing
  - Determine the number of solutions of a linear system
  - Solve applications of systems of linear equations by graphing

#### 5.2 Solve Systems of Equations by Substitution

- Solving Systems of Linear Equations by Substitution
  - Solve a system of linear equations by substitution
  - Solve applications of systems of linear equations by substitution

#### 5.3 Solve Systems of Equations by Elimination

- Solving Systems of Linear Equations by Elimination
  - Solve a system of linear equations by elimination
  - Solve applications of systems of equations by elimination
  - Solve a system of linear equations using a variety of methods

#### 5.4 Solve Applications with Systems of Equations

- Systems of Linear Equations and Problem Solving
    - Translate a word problem to a system of equations
    - Solve a word problem using a system of equations
    - Solve an application in geometry using a system of equations
    - Solve uniform motion applications using a system of equations
-

## 5.5 Solve Mixture Applications with Systems of Equations

- Mixture Problems and Systems of Equations
  - Solve mixture applications involving tickets or money with a system of equations
  - Solve mixture applications involving concentrations using a system of equations
  - Solve interest applications using a system of equations

## 5.6 Graphing Systems of Linear Inequalities

- Solving Systems of Linear Inequalities
  - Determine whether an ordered pair is a solution of a system of linear inequalities
  - Solve a system of linear inequalities by graphing
  - Solve applications of systems of linear inequalities

## **Chapter 6: Polynomials**

### 6.1 Add and Subtract Polynomials

- Adding and Subtracting Polynomials
  - Identify the types and degrees of polynomials
  - Add and subtract monomials
  - Perform addition and subtraction on polynomials
  - Evaluate a polynomial for a given value

### 6.2 Use Multiplication Properties of Exponents

- Product Properties of Exponents
  - Simplify numerical expressions containing exponents
  - Simplify expressions using the product property for exponents
  - Simplify expressions using the power property for exponents or the product to a power property for exponents
  - Simplify expressions by applying several properties

### 6.3 Multiply Polynomials

- Multiplying Polynomials
  - Multiply monomials
  - Multiply a polynomial by a monomial
  - Multiply a binomial by a binomial
  - Multiply a trinomial by a binomial

### 6.4 Special Products

- Special Products of Binomials
  - Square a binomial using the binomial squares pattern
  - Multiply conjugates using the product of conjugates pattern
  - Recognize and use the appropriate special product pattern

### 6.5 Divide Monomials

- Quotient Properties of Exponents and Dividing Monomials
  - Simplify expressions using the quotient property for exponents and the exponent of zero
  - Simplify expressions using the quotient to a power property
  - Simplify expressions by applying several quotient properties of exponents
  - Divide monomials

### 6.6 Divide Polynomials

- Dividing Polynomials
-

- Divide a polynomial by a monomial
- Divide a polynomial by a binomial using polynomial long division

#### 6.7 Integer Exponents and Scientific Notation

- Negative Exponents
  - Use the definition of a negative exponent
  - Simplify expressions with integer exponents
- Scientific Notation
  - Convert from decimal notation to scientific notation
  - Convert from scientific notation to decimal notation
  - Multiply and divide using scientific notation

### **Chapter 7: Factoring**

#### 7.1 Greatest Common Factor and Factor by Grouping

- The Greatest Common Factor and Factoring by Grouping
  - Find the greatest common factor of two or more expressions
  - Factor the greatest common factor from a polynomial
  - Factor a polynomial by grouping

#### 7.2 Factor Quadratic Trinomials with Leading Coefficient 1

- Factoring Trinomials with a Leading Coefficient of 1
  - Factor a trinomial of the form  $x^2+bx+c$  where  $c$  is positive
  - Factor a trinomial of the form  $x^2+bx+c$  where  $c$  is negative
  - Factor a trinomial of the form  $x^2+bxy+cy^2$

#### 7.3 Factor Quadratic Trinomials with Leading Coefficient Other than 1

- Factoring Trinomials with a Leading Coefficient Other than 1
  - Factor a trinomial of the form  $ax^2+bx+c$  with a GCF
  - Factor a trinomial using trial and error
  - Factor a trinomial using the 'ac' method

#### 7.4 Factor Special Products

- Factoring Special Products
  - Express a perfect square trinomial in factored form
  - Express a difference of squares in factored form
  - Factor sums and differences of cubes

#### 7.5 General Strategy for Factoring Polynomials

- Choosing a Factoring Strategy
  - Recognize and use the appropriate method to factor a polynomial completely

#### 7.6 Quadratic Equations

- Solving Quadratic Equations by Factoring
  - Solve a factored quadratic equation using the zero product property
  - Solve a quadratic equation by factoring
  - Solve applications modeled by quadratic equations

### **Chapter 8: Rational Expressions and Equations**

#### 8.1 Simplify Rational Expressions

---

- Domain of Rational Expressions and Simplifying Rational Expressions
  - Determine the values for which a rational expression is undefined
  - Evaluate a rational expression
  - Simplify a rational expression
  - Simplify a rational expression with opposite factors

## 8.2 Multiply and Divide Rational Expressions

- Multiplying and Dividing Rational Expressions
  - Find the product of rational expressions
  - Find the quotient of rational expressions
  - Multiply or divide more than two rational expressions

## 8.3 Add and Subtract Rational Expressions with a Common Denominator

- Adding and Subtracting Rational Expressions with a Common Denominator
  - Add rational expressions with a common denominator
  - Subtract rational expressions with a common denominator
  - Add and subtract rational expressions whose denominators are opposites

## 8.4 Add and Subtract Rational Expressions with Unlike Denominators

- Adding and Subtracting Rational Expressions with Unlike Denominators
  - Find the least common denominator of rational expressions
  - Find equivalent rational expressions
  - Add rational expressions with different denominators
  - Subtract rational expressions with different denominators

## 8.5 Simplify Complex Rational Expressions

- Simplifying Complex Fractions
  - Simplify a complex rational expression by writing it as division
  - Simplify a complex rational expression by using the LCD

## 8.6 Solve Rational Equations

- Solving Rational Equations
  - Solve a rational equation that results in a linear equation
  - Solve a rational equation that results in a quadratic equation
  - Solve a rational equation for a specific variable

## 8.7 Solve Proportion and Similar Figure Applications

- Proportions and Problem Solving with Rational Equations
  - Solve proportions
  - Solve applications with proportions
  - Solve similar figure applications

## 8.8 Solve Uniform Motion and Work Applications

- Uniform Motion, Work, and Problem Solving
  - Solve uniform motion applications involving rational equations
  - Solve problems involving rates of work using rational equations

## 8.9 Use Direct and Inverse Variation

- Variation and Problem Solving
    - Solve problems that involve direct variation
    - Solve problems that involve inverse variation
-



## **Chapter 9: Roots and Radicals**

### 9.1 Simplify and Use Square Roots

- Understanding Square Roots
  - Simplify expressions with square roots
  - Estimate square roots and approximate square roots
  - Simplify variable expressions with square roots

### 9.2 Simplify Square Roots

- Simplifying Square Root Expressions
  - Use the product property to simplify square roots
  - Use the quotient property to simplify a perfect square fraction
  - Use the quotient property to simplify square roots

### 9.3 Add and Subtract Square Roots

- Adding and Subtracting Square Root Expressions
  - Add and subtract like square roots
  - Add and subtract square roots that need simplification

### 9.4 Multiply Square Roots

- Multiplying Square Root Expressions
  - Multiply square roots
  - Use polynomial multiplication to multiply square roots
  - Use special product formulas to multiply square roots

### 9.5 Divide Square Roots

- Dividing Square Root Expressions and Rationalizing Denominators
  - Divide square roots
  - Rationalize a one-term denominator
  - Rationalize a two-term denominator

### 9.6 Solve Equations with Square Roots

- Solving Radical Equations
  - Solve a square root equation with a single radical
  - Solve a square root equation with two radicals
  - Use square roots in applications

### 9.7 Higher Roots

- Understanding Higher Roots
  - Simplify numerical expressions with higher roots
  - Simplify expressions with higher roots
- Simplifying Higher Roots and Operations on Higher Roots
  - Use the product property to simplify expressions with higher roots
  - Use the quotient property to simplify expressions with higher roots
  - Add and subtract higher roots

### 9.8 Rational Exponents

- Simplifying Expressions with Rational Exponents
  - Simplify expressions with rational exponents and a numerator of 1
  - Simplify expressions with rational exponents and a numerator greater than 1
  - Use the laws of exponents to simplify expressions with rational exponents

### 9.9 Use Radicals in Functions

---

- Radical Functions
  - Evaluate a radical function
  - Find the domain of a radical function
  - Graph a radical function by plotting points and determine its range

## **Chapter 10: Quadratic Equations**

### 10.1 Solve Quadratic Equations Using the Square Root Property

- Solving Quadratic Equations Using the Square Root Property
  - Solve a quadratic equation using the square root property
  - Solve a quadratic equation with a binomial as the quadratic term using the square root property
  - Solve a quadratic equation where factoring results in a perfect square binomial

### 10.2 Solve Quadratic Equations by Completing the Square

- Solving Quadratic Equations by Completing the Square
  - Complete the square of a binomial expression
  - Solve a quadratic equation with a leading coefficient of 1 by completing the square
  - Solve a quadratic equation with a leading coefficient greater than 1 by completing the square

### 10.3 Solve Quadratic Equations Using the Quadratic Formula

- Solving Quadratic Equations with the Quadratic Formula
  - Solve a quadratic equation using the quadratic formula with 2 real solutions
  - Solve a quadratic equation using the quadratic formula with 1 or 0 real solutions
  - Use the discriminant to predict the number of solutions of a quadratic equation

### 10.4 Solve Applications Modeled by Quadratic Equations

- Problem Solving with Quadratic Equations
  - Solve applications modeled by quadratic equations that may require the quadratic formula
  - Solve geometric applications that may require the quadratic formula

### 10.5 Graphing Quadratic Equations

- Parabolas and Their Properties
  - Graph a quadratic equation by plotting points and recognize the direction a parabola opens
  - Find the axis of symmetry and vertex of a parabola
  - Find the intercepts of a parabola
- Graphing Quadratic Equations
  - Graph a quadratic equation in two variables by using key points
  - Find the maximum or minimum of a quadratic equation and use it in applications

### 10.6 Graph Quadratic Functions Using Transformations

- Transformations of Parabolas
    - Graph a quadratic function using a vertical translation
    - Graph a quadratic function using a horizontal translation
    - Graph a quadratic function by compression, stretching, or reflecting
  - Graphing Quadratic Functions Using Transformations
    - Rewrite a quadratic in vertex form and graph it using transformations
-

- Find a quadratic function given its graph
-