

## Algebra and Trigonometry | Table of Contents

### Chapter 1: Prerequisites

#### 1.1 Algebra Essentials

- Properties of Real Numbers and Order of Operations
  - Distinguish between natural numbers, whole numbers, and integers (40)
  - Distinguish between rational and irrational numbers (40)
  - Perform calculations using order of operations (40)
  - Use the inverse and identity properties of real numbers
  - Use the commutative, associative, and distributive properties of real numbers (6)
- Evaluate and Simplify Algebraic Expressions
  - Evaluate algebraic expressions with a single variable (20)
  - Evaluate algebraic expressions with two variables (40)
  - Identify constants and variables (40)
  - Use a formula (40)
  - Simplify algebraic expressions (40)
- Set Operations and Venn Diagrams
  - Represent a set using a written description and the roster method (5)
  - Identify subsets, universal sets, and empty sets
  - Illustrate two sets using a Venn diagram and set notation (5)
- 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 (5)
- 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 (6)
    - Use the product rule of exponents (6)
    - Use the quotient rule of exponents (40)
    - Use the power rule of exponents (40)
  - Negative Exponents and Simplifying Exponential Expressions
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    - Find the power of a quotient (6)
    - Simplify exponential expressions (40)
  - Scientific Notation
    - Convert between standard and scientific notation (40)
    - Multiply and divide numbers in scientific notation (40)
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### 1.3 Radicals and Rational Exponents

- Simplify Radicals
  - Evaluate square roots (40)
  - Use the product rule to simplify square roots (40)
  - Use the quotient rule to simplify square roots
- Operations with Radicals
  - Add and subtract square roots (40)
  - Rationalize denominators with a monomial denominator
  - Rationalize denominators using the conjugate (6)
- Rational Exponents and Higher Order Radicals
  - Simplify nth roots (5)
  - Operations with nth roots
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### 1.4 Polynomials

- Properties of Polynomials
  - Identify the degree and leading coefficient of a polynomial (20)
  - Identify monomials, binomials, and trinomials (20)
- Operations on Polynomials
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  - Multiply binomials together (20)
  - Multiply polynomials together (20)
  - Perform operations with polynomials of several variables

### 1.5 Factoring Polynomials

- Factor Quadratics
  - Factor the greatest common factor of a polynomial (20)
  - Factor a trinomial (20)
  - Factor a trinomial by grouping (5)
- Factor Quadratics with Special Products
  - Factor a perfect square trinomial (20)
  - Factor a difference of squares (20)
- Factor Cubics
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  - Factor the sum and difference of cubes (20, 20)
- Factor Expressions with Fractional or Negative Exponents
  - Factor expressions using fractional or negative exponents
  - Factor expressions using greatest common factor and other technique (6)

### 1.6 Rational Expressions

- Multiply and Divide Rational Expressions
    - Simplify rational expressions (5)
    - Multiply rational expressions (6)
    - Divide rational expressions (6)
  - Add and Subtract Rational Expressions and Simplify Complex Rational Expressions
    - Add and subtract rational expressions (40)
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- Simplify complex rational expressions

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

### 2.1 The Rectangular Coordinate Systems and Graphs

- Cartesian Coordinates and Distances
  - Plot ordered pairs in a Cartesian coordinate system (5)
  - Graph equations by plotting points
  - Use the distance formula, given two points (20)
  - Use the midpoint formula (20)

### 2.2 Linear and Rational Equations in One Variable

- Solve Linear Equations in One Variable
  - Identify identity, conditional, and inconsistent equations
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  - Solve equations in one variable algebraically, variable on both sides (40)
- Solve Rational Equations
  - Solve a rational equation, monomials in denominator (6)
  - Solve a rational equation, binomials in denominator
  - Solve a rational equation, requires factoring to find least common denominator (5)
- Identify Slopes and Intercepts
  - Find the slope of a line given two points (5)
  - Understand the relationship between the slope and y-intercept of a line and its equation (40)
  - Find x -intercepts and y -intercepts (6)
- Find Linear Equations
  - Find equation of a line, in slope-intercept form, given slope and one point (point-slope formula) (40)
  - Find equation, in slope-intercept form, of a line passing through two given points (5)
  - Given slope and intercept, find the equation of a line and write it in standard form (20)
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- Parallel and Perpendicular Lines
  - Given the equations of two lines, determine whether their graphs are parallel or perpendicular (40)
  - Write the equation of a line parallel to a given line (40)
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### 2.3 Models and Applications

- Word Problems with Linear Equations
    - Set up a linear equation to solve a real-world application (40)
    - Translate verbal expressions into mathematical expressions (40)
    - Use a formula to solve a real-world application (40)
  - Problem Solving
    - Solve simple interest applications
    - Solve a formula for a specified variable
    - Use a formula to solve a geometric application
    - Use the Pythagorean theorem (5)
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## 2.4 Complex Numbers

- Basics of Complex Numbers
  - Express the square root of a negative number as a multiple of  $i$  (6)
  - Simplify powers of  $i$  (20)
- Operations on Complex Numbers
  - Add and subtract complex numbers (40)
  - Multiply a complex number by a real number (20)
  - Multiply two complex numbers (20)
  - Divide two complex numbers (20)

## 2.5 Quadratic Equations

- Solve Quadratic Equations by Factoring
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  - Solve quadratic equations by factoring, leading coefficient  $> 1$  (5)
- Complete the Square
  - Solve quadratic equations by the square root property (20)
  - Solve quadratic equations by completing the square (5)
- Quadratic Formula
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  - Solve quadratic equations by using the quadratic formula (20)

## 2.6 Other Types of Equations

- Solve Higher Order Equations with Factoring
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  - Solve equations by factoring with grouping (6)
- Solve Equations Quadratic in Form by Factoring
  - Solve fourth-degree equation in quadratic form (5)
  - Solve quadratic with binomial (5)
- Solve Radical Equations
  - Solve radical equations with a single radical (20)
  - Solve radical equations with two radicals (20)
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  - Solve equations using reciprocal exponents
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  - Solve rational equation which leads to a quadratic (5)

## 2.7 Linear Inequalities and Absolute Value Inequalities

- Interval Notation and Inequalities
    - Use interval notation
    - Use properties of inequalities (40)
    - Solve simple inequalities in one variable algebraically (5)
    - Solve compound inequalities in one variable algebraically (40)
  - Absolute Value Equations and Inequalities
    - Solve absolute value equations
    - Solve absolute value inequalities
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- Applications with Linear Inequalities
  - Translate words to an inequality and solve applications with linear inequalities
  - 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

## Chapter 3: Functions

### 3.1 Functions and Function Notation

- Relations and Functions
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  - Determine whether a relation represents a function (40)
  - Use the vertical line test to identify functions (10)
- One-to-One Functions
  - Determine whether a function is one-to-one (40)
  - Use the horizontal line test to identify one-to-one functions (10)
- Function Notation
  - Evaluate a function using function notation (40)
  - Solve a function using function notation (20)
  - Evaluate or solve a function from a table (40)
  - Evaluate or solve a function from a graph (10)

### 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 (5)

### 3.3 Domain and Range

- Domain and Range of Functions
  - Find the domain of a function defined by an equation (40)
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- Piecewise Functions
  - Graph piecewise-defined functions
  - Evaluate piecewise-defined functions

### 3.4 Rates of Change and Behavior of Graphs

- Graphical Properties of Functions
    - Use a graph to locate the absolute maximum and absolute minimum (5)
    - Use a graph to determine intervals of increase and decrease (24)
    - Use a graph to determine local extrema
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- Find the average rate of change of a function
- Difference Quotients
  - Determine the difference quotient (40)

### 3.5 Composition of Functions

- Combinations of Functions
  - Combine functions using algebraic operations (40)
  - Create a new function by composition of functions (40)
- Evaluate Composite Functions
  - Evaluate composite functions given a table of values (10)
  - Evaluate composite functions given the graph of functions
  - Evaluate composite functions given explicit functions
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  - Decompose a composite function into its component functions (40)

### 3.6 Function Graphs and Transformations

- Transformations of Functions
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  - Graph functions using reflections about the x-axis and the y-axis (5)
  - Graph functions using compressions and stretches (5)
  - Combine transformations (6)
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  - Determine whether a function is even, odd, or neither given algebraically (40)

### 3.7 Inverse Functions

- Inverse Function Values
  - Verify inverse function ordered pairs (10)
  - 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 (5)
  - Given function, find the inverse function
  - Use the graph of a one-to-one function to graph its inverse function on the same axes (5)

### 3.8 Circles

- Graphs of Circles
  - Given the equation of a circle not in standard form, determine the standard form by completing the square (5)
  - Determine the center and radius of a circle from the standard equation of a circle and sketch its graph (40)

## Chapter 4: Linear Functions and Modeling

### 4.1 Linear Functions

- Interpretations of Linear Functions
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- Represent a linear function in table form (40)
- Determine whether a linear function is increasing, decreasing, or constant (40)
- Interpret slope as a rate of change (5)
- Represent a real-world application as a linear function (5)
- Graph linear functions (6)

#### 4.2 Modeling with Linear Functions

- Application of Linear Functions
  - Build linear models from verbal descriptions, given a y-intercept (40)
  - Build linear models from verbal descriptions, given inputs and outputs (40)
  - Use a diagram to build a model (10, 10)
  - Model a set of data with a linear function (33)

#### 4.3 Fitting Linear Models to Data

- Scatter Diagrams and Lines of Best Fit
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  - Distinguish between linear and nonlinear relations (10, 10)
- Linear Regressions
  - Find the line of best fit using a graphing utility (5)
  - Use the line of best fit to make predictions (5)

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

#### 5.1 Quadratic Functions

- Characteristics of Parabolas
  - Determine axis of symmetry and vertex of parabolas from a graph (6)
  - Determine x- and y-intercepts of parabolas from a graph (6)
  - 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 (5)
  - Write the equation of a quadratic function given intercepts on a graph (5)
  - Write the equation of a quadratic function in standard form given the equation in general form (5)
- Applications of Quadratic Functions
  - Find the domain and range of a quadratic function (5)
  - Determine the maximum and minimum values of quadratic functions (40)
  - Find the x- and y-intercepts of a quadratic function
  - Use a quadratic function to model projectile motion (40)
- Quadratic Regressions
  - Find the parabola of best fit using a graphing utility (5)
  - 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 (5)
    - Identify if a graph is a polynomial function (5)
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- Determine end behavior (40)
- Local Behavior of Polynomial Functions
  - Identify intercepts of polynomial functions in factored form
  - Understand the relationship between degree, turning points, and x-intercepts (5)
  - Understand the intermediate value theorem
  - Use factoring to find zeros of polynomial functions
  - Identify zeros and their multiplicities from an equation or a graph (6)
- Write and Graph Polynomial Functions
  - Draw conclusions about a polynomial function from a graph (5)
  - Graph polynomial functions (5)
  - Write a formula for a polynomial function from a graph (5)
  - Determine equation of a polynomial given key information

### 5.3 Dividing Polynomials

- Long Division of Polynomials
  - Use long division to divide polynomials (40)
  - Use polynomial division to solve application problems (40)
- Synthetic Division and Remainder Theorem
  - Use synthetic division to divide polynomials (40)
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  - Use the rational zero theorem to find rational zeros (40)
  - Solve real-world applications of polynomial equations (40)
- Complex Zeros of Polynomial Functions
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  - Use the linear factorization theorem to find polynomials with given zeros (40)
  - Use Descartes' rule of signs (40)

### 5.5 Rational Functions

- Asymptotic Behavior of Rational Functions
  - Identify removable discontinuities of rational functions
  - Identify horizontal asymptotes of rational functions (40)
  - Identify slant asymptotes of rational functions (10, 10)
  - Use arrow notation to describe local behavior and end behavior of rational functions (5)
  - Identify vertical asymptotes of rational functions (40)
- Graphs and Applications of Rational Functions
  - Solve applied problems involving rational functions (40)
  - Find the intercepts of a rational function (40)
  - 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 (40)
    - Restrict the domain to find the inverse of a polynomial function (40)
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- Solve an application with the inverse of a function (40)
- Inverses of Radical and Rational Functions
  - Find the inverse of a square root function (20)
  - Find the inverse of a cube root function (20)
  - Find the value of an inverse radical function (40)
  - Find the domain of a radical function composed with a rational function (5)
  - Find the inverse of a rational function (5)

#### 5.7 Modeling Using Variation

- Direct and Inverse Variation
  - Solve direct variation problems (40)
  - Solve inverse variation problems (40)
  - Solve problems involving joint variation (40)

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

#### 6.1 Exponential Functions

- Evaluate and Write Exponential Functions
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  - Evaluate exponential functions (40)
  - Find the equation of an exponential function given the initial value and a point (40)
  - Find the equation of an exponential function when the initial value is not known (40)
- Applications of Exponential Functions and Base  $e$ 
  - Find the equation of an exponential function in a word problem context
  - Calculate compound interest (40)
  - Evaluate exponential functions with base  $e$  (20)
  - Calculate continuous growth and decay (40)

#### 6.2 Graphs of Exponential Functions

- Exponential Function Graphs
  - Graph exponential functions
  - Graph exponential functions using transformations (5)
  - Find the equation of an exponential function given a graph (5)
  - Write an exponential function from a description (40)

#### 6.3 Logarithmic Functions

- Relate Logarithms and Exponents
  - Convert from logarithmic to exponential form (40)
  - Convert from exponential to logarithmic form (40)
- Evaluate Logarithmic Expressions
  - Evaluate logarithms with positive integer solutions (40)
  - Evaluate logarithms with negative integer solutions
  - Use common logarithms (40)
  - Use natural logarithms (40)

#### 6.4 Graphs of Logarithmic Functions

- Logarithmic Function Graphs
    - Identify the domain of a logarithmic function (40)
    - Graph logarithmic functions (5)
-

- Graph transformations of logarithmic functions (5)
- Write a logarithmic function from a description (40)

#### 6.5 Logarithmic Properties

- Basic Properties of Logarithms
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  - Use the quotient rule for logarithms (40)
  - Use the power rule for logarithms (40)
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  - Expand logarithmic expressions (40)
  - Condense logarithmic expressions (40)
  - Use the change-of-base formula for logarithms (40)

#### 6.6 Exponential and Logarithmic Equations

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  - Rewrite equations so all powers have the same base and solve exponential equations (40)
  - Use logarithms to solve exponential equations (40)
  - Solve an equation with a base  $e$  using natural logarithms (40)
- 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 (40)
  - Use the one-to-one property of logarithms to solve logarithmic equations (40)

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- Applications of Exponential and Logarithmic Functions
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  - Applied logarithmic models (40)
  - Choose an appropriate model for data (40)
  - Express an exponential model in base  $e$  (5)

#### 6.8 Fitting Exponential Models to Data

- Exponential and Logarithmic Regressions
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  - Build a logarithmic model from data using a graphing utility
- Logistic Growth Models
  - Use logistic growth models (5)
  - Build a logistic model from data using a graphing utility

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

#### 7.1 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 (20)
- Understand when two angles are coterminal
- Arc Length and Area of a Sector
  - Find the length of an arc (40)
  - Find the area of a sector of a circle (40)
  - Understand the relationship between linear and angular speed (40)

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  - Evaluate trigonometric functions of angles not in standard position (5)
- Use Right Triangle Trigonometry in Solving Problems
  - Find missing side lengths using trig ratios (5)
  - Use right triangle trigonometry to solve applied problems (5)

### 7.3 The Unit Circle

- Sine and Cosine Values in the First Quadrant
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  - Find exact sine and cosine values for angles in the first quadrant of the unit circle (40)
- Sine and Cosine Values with Reference Angles
  - Find the reference angle for a given angle (40)
  - Use reference angles to evaluate sine and cosine functions
  - Use reference angles to find coordinates on the unit circle (40)
  - Evaluate sine and cosine functions with a calculator (40)

### 7.4 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 (40)
  - Use reference angles to evaluate secant, cosecant, tangent, and cotangent functions (40)
  - Evaluate trigonometric functions with a calculator (40)
- 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 (31)
  - Use the pythagorean identity (40)
  - Find the values of all trigonometric functions given coordinates on a unit circle (40)
  - Find the values of all trigonometric functions given the value of one trigonometric function (40)

## Chapter 8: Periodic Functions

### 8.1 Sine and Cosine Graphs

- Characteristics of Sine and Cosine Graphs
    - Graph the sine function and understand its properties (40)
    - Graph the cosine function and understand its properties (40)
  - Transformations of Sine and Cosine Graphs
-

- Determine the period and amplitude of a sinusoidal function (40)
- Determine the phase shift and vertical shift of a sinusoidal function (40)
- Graph Sine and Cosine Functions
  - Find the equation of a sinusoidal function given a graph
  - Find the graph of a sinusoidal function given equation (5)
  - Use sinusoidal functions to solve real-world applications (40)

## 8.2 Graphs of Other Trigonometric Functions

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  - Graph tangent functions
  - Graph cotangent functions
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  - Graph transformations of tangent and cotangent functions (5)
- Characteristics of Secant and Cosecant Graphs
  - Graph cosecant functions
  - Graph secant functions
- Graph Secant and Cosecant Functions
  - Graph transformations of cosecant functions (5)
  - Graph transformations of secant functions (5)
  - 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 (24)
  - Understand inverse secant, cosecant, and cotangent functions (23)
  - Use a calculator to evaluate inverse trigonometric functions (40)
- Solve Triangles with Inverse Trigonometric Functions
  - Find an angle given two sides of a right triangle
  - Solve right triangle problems (5)
- Compose Functions with Inverse Trigonometric Functions
  - Evaluate composite functions with inverse trigonometric functions in the form  $f(f^{-1}(x))$  or  $f(g^{-1}(x))$  (40)
  - Evaluate composite functions with inverse trigonometric functions in the form  $f^{-1}(f(x))$  or  $f^{-1}(g(x))$  (40)

## 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 (5)
  - Use Pythagorean and Cofunction Identities
    - Understand all forms of the pythagorean identity (40)
    - Use the cofunction identities (40)
  - Verify Trigonometric Identities
-

- Use all identities to simplify trigonometric expressions (5)
- Use algebraic techniques to simplify trigonometric expressions (5)

#### 9.2 Sum and Difference Identities

- Sum and Difference Formulas
  - Use the sum and difference formula for cosine (40)
  - Use the sum and difference formula for sine (40)
  - Use the sum and difference formula for tangent (40)
  - Use the sum and difference formulas to simplify trigonometric expressions (5)

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

- Double-Angle Formulas
  - Use double-angle formulas to find values of trigonometric functions (40)
  - Use double-angle formulas to simplify trigonometric expressions (5)
- Half-Angle and Power-Reduction Formulas
  - Use reduction formulas to simplify an expression
  - Use half-angle formulas to find values of trigonometric functions (40)

#### 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 (40)
  - Express sums of trigonometric functions as a product (40)

#### 9.5 Solving Trigonometric Equations

- Trigonometric Equations in Sine and Cosine
  - Solve linear trigonometric equations in sine (40)
  - Solve linear trigonometric equations in cosine (5)
- Trigonometric Equations Involving a Single Trigonometric Function
  - Solve linear trigonometric equations in secant and cosecant (40)
  - Solve linear trigonometric equations in tangent and cotangent (40)
  - Solve trigonometric equations using a calculator (40)
- Trigonometric Equations in Quadratic Form or Requiring Factoring
  - Solve equations with a single trigonometric function (40)
  - Solve factorable trigonometric equations in quadratic form (40)
  - Solve trigonometric equations in quadratic form requiring the quadratic formula (40)
- Trigonometric Equations Requiring Identities or Multiple Angles
  - Solve trigonometric equations using fundamental identities
  - Solve trigonometric equations with multiple angles (40)
  - Solve trigonometric equations using cofunction identities (40)

### **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
  - Solve applied problems with the law of sines (5)

#### 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 (5)
- Use the law of cosines to solve SSS triangles (5)
- Solve applied problems with the law of cosines (5)
- 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 (5)
  - Convert from polar coordinates to rectangular coordinates (20)
  - Convert from rectangular coordinates to polar coordinates
- Convert Equations Between Rectangular and Polar Forms
  - Write a cartesian equation in polar form (40)
  - Write a polar equation in cartesian form (40)

### 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 (5)
  - Graph a limaçon from a polar equation (5)
  - Graph a lemniscate from a polar equation (5)
  - Graph a rose curve from a polar equation (5)

### 10.5 Polar Form of Complex Numbers

- Write Complex Numbers in Polar Form
  - Plot complex numbers (5)
  - Find the absolute value of a complex number (20)
  - Write complex numbers in polar form
  - Convert a complex number from polar to rectangular form (20)
- Product and Quotient of Complex Numbers in Polar Form
  - Find the product of complex numbers in polar form (20)
  - Find the quotient of complex numbers in polar form (20)
- 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 (40)
    - Find the parametric equations for a line segment given an orientation (40)
  - Eliminate the Parameter
    - Eliminate the parameter in linear equations (40)
    - Eliminate the parameter in polynomial and radical equations (8)
-

- Eliminate the parameter in exponential and logarithmic equations (40)
- Eliminate the parameter in trigonometric parametric equations (40)

#### 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 (40)

#### 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 (20)
  - Multiply a vector by a scalar (20)
  - Use vector addition and scalar multiplication to find a new vector (5)
- The Unit Vector
  - Write a vector in terms of  $i$  and  $j$  (20)
  - Find the unit vector (20)
  - Perform operations on vectors in terms of  $i$  and  $j$  (20)
  - Write a vector in terms of magnitude and direction (5)
- The Dot Product and Vector Applications
  - Find the dot product of two vectors (20)
  - Find the angle between two vectors (20)
  - Use vectors in applications (40)

### **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 (40)
  - Solve systems of equations in two variables by graphing
- Solving Systems of Linear Equations
  - Solve systems of equations in two variables by substitution (5)
  - 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 (40)
  - Write and solve a system of equations in two variables from a word problem (40)
- 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 (20)
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- Solve systems of three equations in three variables (20)
- 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 (5)
  - Solve a system of nonlinear equations representing a circle and a line
  - Solve a system of nonlinear equations in two variables using elimination (5)
- Graphing Nonlinear Inequalities and Systems of Inequalities
  - Graph a nonlinear inequality (5)
  - Graph a system of nonlinear inequalities (6)

### 11.4 Partial Fractions

- Partial Fraction Decomposition with Linear Factors
  - Decompose a rational expression where the denominator has only nonrepeated linear factors (40)
  - Decompose a rational expression where the denominator has repeated linear factors (40)
- Partial Fraction Decomposition with Quadratic Factors
  - Decompose a rational expression where the denominator has a nonrepeated irreducible quadratic factor (40)
  - Decompose a rational expression where the denominator has a repeated irreducible quadratic factor (40)

### 11.5 Matrices and Matrix Operations

- Introduction to Matrices
  - Determine the order of a matrix and describe elements within a matrix (40)
  - Add or subtract matrices (40)
- Matrix Multiplication
  - Multiply a matrix by a scalar (40)
  - Find the sum or difference of scalar multiples (40)
  - Multiply two matrices (40)

### 11.6 Augmented Matrices and Gaussian Elimination

- Solving Systems with Gaussian Eliminations
  - Convert between a system of equations and its corresponding augmented matrix (40)
  - Use row operations to solve a system of linear equations in two variables (40)
  - Use row operations to solve a system of linear equations in three variables (40)
  - Use matrices to solve applications of systems of linear equations (40)
- 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 (40)
    - Find the determinant of a 3x3 matrix (40)
  - Inverse and Identity Matrices
    - Understand the identity matrix and how it relates to the inverse matrix (40)
    - Determine if a matrix is invertible using the determinant (40)
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- Find the inverse of a  $2 \times 2$  matrix (40)
- Find the inverse of a  $3 \times 3$  matrix (40)
- Solving Systems with Inverses
  - Solve a system of linear equations using the inverse of a  $2 \times 2$  matrix (40)
  - Solve a system of linear equations using the inverse of a  $3 \times 3$  matrix (40)

#### 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 (40)
  - Use Cramer's rule to solve a system of three equations in three variables (40)
  - Use Cramer's rule to solve inconsistent or dependent systems (40)

#### 11.9 Linear Programming

- Using Linear Programming
  - Graph a feasible region given a set of constraints (5)
  - 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 (5)
  - Identify key points and axes of ellipses from an equation
  - Write the equation in standard form of an ellipse centered at the origin (5)
  - Graph an ellipse centered at the origin from an equation in standard form (5)
- Ellipses Not Centered at the Origin
  - Identify key points and axes of ellipses not centered at the origin
  - Write the equation in standard form of an ellipse not centered at the origin
  - Graph an ellipse not centered at the origin (5)
- Ellipses Not in Standard Form and Applications of Ellipses
  - Convert an equation of an ellipse into standard form (40)
  - Graph an ellipse where the equation is not given in standard form (5)
  - Use ellipses in applications (40)

#### 12.2 Hyperbolas

- Hyperbolas Centered at the Origin
    - Locate the vertices and foci of a hyperbola from a graph (5)
    - Identify vertices, foci, and asymptotes of a hyperbola from an equation
    - Write the equation of a hyperbola centered at the origin in standard form (5)
    - 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 (5)
    - Graph a hyperbola not centered at the origin from an equation in standard form (5)
  - Hyperbolas Not in Standard Form and Applications of Hyperbolas
    - Convert an equation of a hyperbola into standard form (40)
    - Graph a hyperbola from an equation given in general form (5)
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- Use hyperbolas in applications (40)

### 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 (7)
  - Write the equation of a parabola not centered at the origin in standard form (5)
- Parabolas Not in Standard Form and Applications of Parabolas
  - Convert an equation of a parabola into standard form (40)
  - Graph a parabola from an equation given in general form
  - Use parabolas in applications (40)

### 12.4 Rotation of Axes

- Conics in General Form and Rotation of Conics
  - Identify a conic from its general form (5)
  - 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 (5)
  - Find the polar equation of a conic given its focus, eccentricity, and directrix (5)

## **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 (5)
- 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 (5)

### 13.2 Arithmetic Sequences

- Arithmetic Sequences
  - Find the common difference of an arithmetic sequence (40)
  - Write terms of an arithmetic sequence (20)
  - Write a recursive formula for an arithmetic sequence (5)
  - Write an explicit formula for an arithmetic sequence (5)
- Applications of Arithmetic Sequences
  - Find specific terms of an arithmetic sequence given other terms (20)
  - Solve application problems with arithmetic sequences (40)

### 13.3 Geometric Sequences

- Geometric Sequences
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- Find the common ratio of a geometric sequence
- Write terms of a geometric sequence (40)
- Write a recursive formula for a geometric sequence (5)
- Write an explicit formula for a geometric sequence (5)
- Applications of Geometric Sequences
  - Write an explicit formula for the  $n$ th term of a sequence
  - Solve application problems with geometric sequences (40)
  - Solve geometric sequence problems (5)

#### 13.4 Series

- Summation Notation and Arithmetic Series
  - Evaluate expressions using summation notation (40)
  - Find the sum of a finite arithmetic series (40)
- Finite and Infinite Geometric Series
  - Find the sum of a finite geometric series (40)
  - Determine if the sum of an infinite series is defined (40)
  - Find the sum of an infinite geometric series (40)
- Applications of Series
  - Solve application problems with arithmetic series (40)
  - Solve application problems with geometric series (40)
  - Find the equivalent fraction for a repeating decimal (40)
  - Solve an annuity problem (40)

#### 13.5 Counting Theory

- The Addition and Multiplication Principles
  - Solve counting problems using the addition principle
  - Solve counting problems using the multiplication principle (40)
  - Evaluate an expression with factorials (20)
- Permutations
  - Find the number of permutations of  $n$  distinct objects using the multiplication principle (5)
  - Find the number of permutations of  $n$  distinct objects using a formula (40)
  - Find the number of permutations of  $n$  non-distinct objects (40)
- Combinations
  - Find the number of combinations using the formula (40)
  - Find the number of subsets of a set (20)

#### 13.6 Binomial Theorem

- Binomial Expansion
  - Find a binomial coefficient (20)
  - Expand a binomial using the binomial theorem (20)
  - 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 (40)
    - Use the complement rule to compute probabilities (40)
    - Compute probability using counting theory (40)
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- Binomial Probability
    - Identify a binomial experiment (5)
    - Determine the binomial probability of success in an experiment performed multiple times
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