



Algebra & Trigonometry

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Knewton Algebra and Trigonometry combines material from our algebra and trigonometry courses, and was developed to allow for more flexible curricula in a variety of math programs.. To develop the course, Knewton used three main sources of content: Openstax, videos created by a Math Professor we have partnered with, and a team of Subject Matter Experts (SMEs). The SMEs come from diverse backgrounds and are all accomplished academics in the field of Trigonometry.

Knewton Algebra and Trigonometry has two instructional sequences for every learning objective, giving students multiple opportunities to learn new concepts. Between our OpenStax, Video, and Knewton SMEs, we were able to solicit ideas from math instructors and students at all levels of higher education. Knewton Algebra and Trigonometry covers the typical breadth of trigonometry and algebra topics and also provides the necessary depth to ensure the course is manageable and engaging for instructors and students alike.



Algebra & Trigonometry | Table of Contents

Chapter 1: Prerequisites

Algebra Essentials

- 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 following properties of real numbers: inverse and identity
 - Use the following properties of real numbers: commutative, associative, and distributive
- 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

Exponents and Scientific Notation

- Properties of Exponents
 - Understand exponent notation
 - Use the product rule of exponents
 - Use the quotient rule of exponents
 - Use the power rule of exponents
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- Simplify Radicals
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 - Rationalize denominators using the conjugate
 - Rational Exponents and Higher Order Radicals
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 - Evaluate expressions with rational exponents
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Polynomials

- Properties of Polynomials
 - Identify the degree and leading coefficient of a polynomial
 - Identify monomials, binomials, and trinomials
- Operations on Polynomials
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 - Multiply binomials together
 - Multiply polynomials together
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Factoring Polynomials

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 - Factor a perfect square trinomial
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Chapter 2: Equations and Inequalities

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- Cartesian Coordinates and Distances
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Linear and Rational Equations in One Variable

- Solve Linear Equations in One Variable
 - Identify identity, conditional, and inconsistent equations
 - Solve equations in one variable algebraically, variable just on one side
 - Solve equations in one variable algebraically, variable on both sides
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- Solve Rational Equations
 - Solve a rational equation, monomials in denominator
 - Solve a rational equation, binomials in denominator
 - Solve a rational equation, requires factoring to find least common denominator
- Identify Slopes and Intercepts
 - Find the slope of a line given two points
 - Understand the relationship between the slope and y-intercept of a line and its equation
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Models and Applications

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 - Solve absolute value inequalities

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 - Solve a function using function notation
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 - Evaluate or solve a function from a graph
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Domain and Range

- Domain and Piecewise Functions
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 - Graph piecewise-defined functions
 - Evaluate piecewise-defined functions

Rates of Change and Behavior of Graphs

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 - Graph an absolute value function
 - Solve absolute value equations

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
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- 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
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Chapter 4: Linear Functions and Modeling

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- Application of Linear Functions
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 - Build linear models from verbal descriptions, given inputs and outputs
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-



Graphs of Polynomial and Power Functions

- End Behavior of Polynomial Functions
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 - 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
 - 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

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
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 - Use the rational zero theorem to find rational zeros
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 - Find the equation of a rational function from a graph
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Inverses and Radical Functions

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 - Solve an application with the inverse of a function
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Modeling Using Variation

- Direct and Inverse Variation
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Chapter 6: Exponential and Logarithmic Functions

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
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- 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

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 - Graph exponential functions using transformations
 - Find the equation of an exponential function given a graph
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Logarithmic Functions

- Relate Logarithms and Exponents
 - Convert from logarithmic to exponential form
 - Convert from exponential to logarithmic form
-

- Evaluate Logarithmic Expressions
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 - Use common logarithms
 - Use natural logarithms

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Chapter 7: Right Triangle Trigonometry and the Unit Circle

Right Triangle Trigonometry

- The Six Trigonometric Ratios
 - Use right triangles to evaluate \sin , \cos , and \tan functions
 - Evaluate reciprocal trig functions using right triangles or a \sin , \cos , or \tan function
 - Evaluate trigonometric functions of angles not in standard position
-

- Use Right Triangle Trigonometry in Solving Problems
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 - Use right triangle trigonometry to solve applied problems

Angles as Rotations and Arc Length

- Angles as Rotations and Radian Measures
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 - Understand sin and cos values on the unit circle
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 - Use reference angles to evaluate sec, csc, tan, and cot functions
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 - Understand the relationship between the quadrant in which an angle falls and the signs of the trig functions of that angle
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- Characteristics of Sin and Cos Graphs
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 - Graph the cos function and understand its properties
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 - Determine the phase shift and vertical shift of a sinusoidal function
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 - Find the graph of a sinusoidal function given equation
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- Characteristics of Sec and Csc Graphs
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 - Graph sec functions
- Graph Sec and Csc Functions
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 - Understand inverse sec, csc, and cot functions
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- 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
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 - Evaluate composite functions with inverse trigonometric functions in the form $f^{-1}(f(x))$ or $f^{-1}(g(x))$

Chapter 9: Trigonometric Identities and Equations

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- Simplify Expressions with Basic Trigonometric Identities
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 - Use even and odd identities in simplifying trigonometric expressions
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 - Understand all forms of the pythagorean identity
 - Use the cofunction identities
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 - Use all identities to simplify trigonometric expressions
 - Use algebraic techniques to simplify trigonometric expressions
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- Sum and Difference Formulas
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 - Use double-angle formulas to simplify trigonometric expressions
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 - Use the law of sines to solve SSA triangles
 - Solve applied problems with the law of sines
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 - Use the law of cosines to solve SAS triangles
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 - Solve applied problems with the law of cosines
 - Area of Oblique Triangles
 - Find the area of an oblique triangle using the sine function
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 - Convert from rectangular coordinates to polar coordinates
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 - Write a polar equation in cartesian form
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 - Test a polar equation for symmetry
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 - Graph a limaçon from a polar equation
 - Graph a lemniscate from a polar equation
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 - Eliminate the parameter in exponential and logarithmic equations
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 - Graph trigonometric parametric equations by plotting points
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-



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 - Multiply a vector by a scalar
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 - Find the unit vector
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 - Find the angle between two vectors
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Chapter 11: Systems of Equations and Inequalities

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 - Solve systems of equations in two variables by addition
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 - Solve a linear system of inequalities by graphing
- Applications of Systems of Linear Equations
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 - Write and solve a system of equations in two variables from a word problem

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Systems of Nonlinear Equations in Two Variables

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- Graphing Nonlinear Inequalities and Systems of Inequalities
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 - Find the sum or difference of scalar multiples
 - Multiply two matrices

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 - Use row operations to solve a system of linear equations in three variables
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- Finding Determinants of Matrices
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 - Find the determinant of a 3x3 matrix

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 - Find the inverse of a 3x3 matrix
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 - Solve a system of linear equations using the inverse of a 3x3 matrix

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 - Use Cramer's rule to solve inconsistent or dependent systems
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 - Graph an ellipse centered at the origin from an equation in standard form
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 - Graph an ellipse not centered at the origin
- Ellipses Not in Standard Form and Applications of Ellipses
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 - Graph an ellipse where the equation is not given in standard form
 - Use ellipses in applications

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
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- Hyperbolas Not in Standard Form and Applications of Hyperbolas
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 - Use hyperbolas in applications

Parabolas

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 - Write the terms of a sequence defined by a recursive formula
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 - Write terms of a geometric sequence
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 - Write an explicit formula for a geometric sequence
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 - Write an explicit formula for the n th term of a sequence
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 - Solve application problems with geometric sequences
 - Solve geometric sequence problems

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

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

Binomial Theorem

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

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
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