



# Finite Mathematics

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Alta Finite Mathematics was developed to meet the scope and sequence of a typical one-semester finite math course. To develop the course, Knewton used a variety of different source content, including OpenStax Calculus, a Math in Society textbook developed by a professor at Pierce College and the Open Course Library project, 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 mathematics.

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

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## Finite Mathematics | Table of Contents

### Chapter 1: Algebra Reference

#### 1.1 Properties of Real Numbers and Polynomials

- Properties of Real Numbers
  - Use the following properties of real numbers: inverse and identity
  - Use the following properties of real numbers: commutative, associative, and distributive
- Polynomials
  - Add and subtract polynomials
  - Multiply binomials together
  - Multiply polynomials together
  - Perform operations with polynomials of several variables
- 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

#### 1.2 Factoring

- Factoring Quadratics
  - Factor the greatest common factor of a polynomial
  - Factor a trinomial
  - Factor a trinomial by grouping
  - Factor a perfect square trinomial
  - Factor a difference of squares
- Other Factoring Techniques
  - Factor a cubic by grouping
  - Factor the sum and difference of cubes
  - Factor expressions using fractional or negative exponents
  - Factor expressions using greatest common factor and other technique

#### 1.3 Rational Expressions

- Operations on Rational Expressions
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    - Multiply rational expressions
-

- Divide rational expressions
- Add and subtract rational expressions

#### 1.4 Equations

- Linear Equations
  - 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
- Quadratic Equations
  - Solve quadratic equations by factoring, leading coefficient 1
  - Solve quadratic equations by factoring, leading coefficient  $> 1$
  - Solve quadratic equations by using the quadratic formula
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#### 1.5 Inequalities

- Linear Inequalities
  - Use interval notation
  - Use properties of inequalities
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#### 1.6 Exponents

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-

## 1.7 Radicals

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  - Use the quotient rule to simplify square roots
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  - Rationalize denominators using the conjugate

## Chapter 2: Linear Functions

### 2.1 Slopes and Equations of Lines

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  - Graph equations by plotting points
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  - Understand the relationship between the slope and y-intercept of a line and its equation
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  - Find equation, in slope-intercept form, of a line passing through two given points
  - Given slope and intercept, find the equation of a line and write it in standard form
  - Find the equation of vertical and horizontal lines
- Graphing Linear Equations
  - Graph a linear equation using the slope and the origin
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  - Write the equation of a line parallel to a given line
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### 2.2 Linear Functions and Applications

- Linear Functions
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    - Evaluate a linear function at a value
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    - Solve break even analysis problems using linear functions
-

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  - Convert between celsius and fahrenheit

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- The Least Squares Line
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## Chapter 3: Systems of Linear Equations and Matrices

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  - Solve systems of equations in two variables by substitution
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-

### 3.4 Matrix Inverses and Determinants

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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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- Solving Linear Programming Problems Graphically
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-

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  - Determine if two conditional statements are equivalent

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- Euler Diagrams and Syllogistic Arguments
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  - Determine if a syllogistic argument is valid with a Euler diagram

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  - Determine if two switching circuits are equivalent

### **Chapter 8: Sets and Counting Principles**

#### 8.1 Set Concepts

- Introduction to Sets and Set Builder Notation
    - Represent a set using a written description and the roster method
    - Represent a set using set builder notation
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    - Identify subsets, universal sets, and empty sets
    - Distinguish between finite and infinite sets
  - Subsets and Proper Subsets
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- Representing Sets with Venn Diagrams
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  - Illustrate two sets using Venn diagram and set notation
- Set Relationships
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  - Determine the intersection of two sets using Venn diagrams and set notation
  - Determine the union of two sets using Venn diagrams and set notation
- Set Operations
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  - Determine the cardinal number of a union of two finite sets

## 8.3 Venn Diagrams with Three Sets and Verification of Equality of Sets

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## 8.4 The Fundamental Counting Principle

- The Fundamental Counting Principle
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## 8.5 Permutations and Combinations

- Permutations
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  - Find the number of permutations of  $n$  distinct objects using a formula
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    - Determine an event of an experiment
  - Fundamentals of Probability
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    - Compute the probability of equally likely outcomes in application
-

- Probability with Permutations and Combinations
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- The Complement Rule and Probability
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  - Compute the probability of an event happening at least once
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  - Compute odds using probability

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- Bayes' Theorem
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#### 9.5 Random Variables, Probability Distributions and Expected Value

- Random Variables, Probability Distributions, and Expected Value
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  - Calculate the expected value of a random variable

### Chapter 10: Statistics

#### 10.1 Sampling, Frequency Distributions, and Graphs

- Sampling and Parameters
    - Understand the definitions of population, sampling, statistic, parameter, and data
    - Identify stratified, cluster, systematic, and convenience sampling
    - Identify sampling errors and bias
    - Identify situations in which statistics can be misleading
  - Frequency Distributions and Histograms
    - Construct and understand frequency tables for a set of data
    - Create and interpret histograms
    - Create and interpret stem-and-leaf plots
-

- Estimation from Graphs/Figures
  - Estimate using a pie chart or bar graph
  - Estimate using a line graph

## 10.2 Measures of Central Tendency and Measures of Dispersion

- Means and Medians
  - Find the mean of a set of data
  - Find the mean from a frequency table
  - Find the median of a set of data
- Modes, Midranges, and Choosing a Measurement
  - Find the mode of a set of data
  - Find the midrange of a set of data
  - Determine whether the mean, median, or mode is the best measure of center for a data set
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  - Compute the sample variance and sample standard deviation
  - Interpret the standard deviation of a set of data

## 10.3 The Normal Distribution, Margins of Error, and Skewness

- The Normal Distribution
  - Understand the notation and interpret the parameters of a normal distribution
  - Compute z-scores and use them to compare values from different data sets
  - Determine if a data set is skewed
- Percentiles, Quartiles, and Margins of Error
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- Problem Solving with the Normal Distribution
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  - Calculate the mean and standard deviation of a standard normal distribution

## Chapter 11: Nonlinear Functions

### 11.1 Properties of Functions

- Functions and Function Notation
    - Identify domain and range from a set of ordered pairs
    - Determine whether a relation represents a function
  - Relations and Functions
    - Determine whether a function is one-to-one
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-

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  - Determine x- and y-intercepts of parabolas from a graph
- Graphs of Quadratic Functions
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  - Identify the axis of symmetry and vertex of a parabola from its equation in standard form
  - 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
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## 11.3 Transformations of Functions

- Transformations of Functions
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## 11.4 Polynomial and Rational Functions

- Polynomial Functions
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## Chapter 12: Markov Chains

### 12.1 Properties of Markov Chains

- Transitions
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    - Create a transition diagram and matrix for a given word problem
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- States
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  - Find powers of a transition matrix
  - Solve application problems using powers of transition matrices

#### 12.2 Regular Markov Chains

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  - Find a stationary matrix for a given transition matrix
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#### 12.3 Absorbing Markov Chains

- Absorbing States
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    - Write a transition matrix in standard form
  - Limiting Matrix
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