MTH126: Algebra I

Students are able to gain credit if they have previously completed this course but did not successfully earn credit. For each unit, students take a diagnostic test that assesses their current knowledge of fundamental content. The results of these tests help students create individualized study plans.

In this course, students review the tools of algebra. Topics include the structure and properties of real numbers; operations with integers and other rational numbers; square roots and irrational numbers; linear equations; ratios, proportions, and percentages; the Pythagorean Theorem; polynomials; and logic and reasoning.

COURSE LENGTH: Two semesters

MATERIALS: *Algebra I: A Reference Guide and Problem Sets*

NOTE: List subject to change

PREREQUISITES: Student completed the course or its equivalent, but did not receive credit; teacher/school counselor recommendation required

SEMESTER ONE

Unit 1: Algebra Basics

The English word algebra and the Spanish word *algebrista* both come from the Arabic word *al-jabr*, which means "restoration." A barber in medieval times often called himself an *algebrista*. The *algebrista* also was a bonesetter who restored or fixed bones. Mathematicians today use algebra to solve problems. Algebra can find solutions and "fix" certain problems that you encounter.

- Semester Introduction
- Expressions
- Variables
- Translating Words into Variable Expressions
- Equations
- Translating Words into Equations
- Replacement Sets
- Problem Solving

Unit 2: Properties of Real Numbers

There are many different kinds of numbers. Negative numbers, positive numbers, integers, fractions, and decimals are just a few of the many groups of numbers. What do these varieties of numbers have in common? They all obey the rules of arithmetic. They can be added, subtracted, multiplied, and divided.

- Number Lines
- Sets
- Comparing Expressions
- Number Properties
- Distributive Property
- Algebraic Proof
- Opposites and Absolute Value

Unit 3: Operations with Real Numbers

There are many different kinds of numbers. Negative numbers, positive numbers, integers, fractions, and decimals are just a few of the many groups of numbers. What do these varieties of numbers have in common? They all obey the rules of arithmetic. They can be added, subtracted, multiplied, and divided.

- Addition
- Subtraction
- Multiplication
- Reciprocals and Division

Unit 4: Solving Equations

The Greek mathematician Diophantus is often called "the father of algebra." His book *Arithmetica* described the solutions to 130 problems. He did not discover all of these solutions himself, but he did collect many solutions that had been found by Greeks, Egyptians, and Babylonians before him. Some people of long ago obviously enjoyed doing algebra. It also helped them—and can help you—solve many real-world problems.

- Addition and Subtraction Equations
- Multiplication and Division Equations
- Multiple Transformations
- Variables on Both Sides of an Equation
- Transforming Formulas

Unit 5: Solving Inequalities

Every mathematician knows that 5 is less than 7, but when is $y < x$? An inequality symbol can be used to describe how one number compares to another. It can also indicate a relationship between values.

- Inequalities
- Solving Inequalities
- Combined Inequalities
- Absolute Value Equations and Inequalities
- Applications: Inequalities

Unit 6: Applying Fractions

What do a scale drawing, a bicycle's gears, and a sale at the local store all have in common? They all present problems that can be solved using equations with fractions.

- Ratios
- Proportions
- Percents
- Applications: Percents

Unit 7: Linear Equations and Inequalities

You've probably heard the phrase, "That's where I draw the line!" In algebra, you can take this expression literally. Linear functions and their graphs play an important role in the never-ending quest to model the real world.

- Equations in Two Variables
- Graphs
- Lines and Intercepts
- Slope

- Slope-Intercept Form
- Point-Slope Form
- Parallel and Perpendicular Lines
- Equations from Graphs
- Applications: Linear Models
- Graphing Linear Inequalities

Unit 8: Systems of Equations

When two people meet, they often shake hands or say "hello" to each other. Once they start talking to each other, they can find out what they have in common. What happens when two lines meet? Do they say anything? Probably not, but whenever two lines meet, you know they have at least one point in common. Finding the point at which they meet can help you solve problems in the real world.

- Systems of Equations
- Substitution Method
- Linear Combination
- Applications: Systems of Linear Equations
- Systems of Linear Inequalities

Unit 9: Semester Review and Test

- Semester Review
- Semester Test

SEMESTER TWO

Unit 1: Relations and Functions

A solar cell is a little machine that takes in solar energy and puts out electricity. A mathematical function is a machine that takes in a number as an input and produces another number as an output. There are many kinds of functions. Some have graphs that look like lines, while others have graphs that curve like a parabola. Functions can take other forms as well. Not every function has a graph that looks like a line or a parabola. Not every function has an equation. The important thing to remember is that if you put any valid input into a function, you will get a single result out of it.

- Semester Introduction
- Relations
- Functions
- Function Equations
- Absolute Value Functions
- Direct Linear Variation
- Quadratic Variation
- Inverse Variation

Unit 2: Rationals, Irrationals, and Radicals

Are rational numbers very levelheaded? Are irrational numbers hard to reason with? Not really, but rational and irrational numbers have things in common and things that make them different.

- Rational Numbers
- Terminating and Repeating Numbers
- Square Roots

- Irrational Numbers
- Evaluating and Estimating Square Roots
- Radicals with Variables
- Using Square Roots to Solve Equations
- The Pythagorean Theorem

Unit 3: Working with Polynomials

Just as a train is built from linking railcars together, a polynomial is built by bringing terms together and linking them with plus or minus signs. You can perform basic operations on polynomials in the same way that you add, subtract, multiply, and divide numbers.

- Overview of Polynomials
- Adding and Subtracting Polynomials
- Multiplying Monomials
- Multiplying Polynomials by Monomials
- Multiplying Polynomials
- The FOIL Method

Unit 4: Factoring Polynomials

A polynomial is an expression that has variables that represent numbers. A number can be factored, so you should be able to factor a polynomial, right? Sometimes you can and sometimes you can't. Finding ways to write a polynomial as a product of factors can be quite useful.

- Factoring Integers
- Dividing Monomials
- Common Factors of Polynomials
- Dividing Polynomials by Monomials
- Factoring Perfect Squares
- Factoring Differences of Squares
- Factoring Quadratic Trinomials
- Finding Roots of Polynomials

Unit 5: Quadratic Equations

Solving equations can help you find answers to many kinds of problems in your daily life. Linear equations usually have one solution, but what about quadratic equations? How can you solve them and what do the solutions look like?

- Solving Perfect Square Equations
- Completing the Square
- The Quadratic Formula
- Solving Quadratic Equations
- Equations and Graphs: Roots and Intercepts
- Applications: Area Problems
- Applications: Projectile Motion

Unit 6: Rational Expressions

A fraction always has a number in the numerator and in the denominator. However, those numbers can actually be expressions that represent numbers, which means you can do all sorts of interesting things with fractions. Fractions with variable expressions in the numerator and denominator can help you solve many kinds of problems.

- Simplifying Rational Expressions
- Multiplying Rational Expressions
- Dividing Rational Expressions
- Like Denominators
- Adding and Subtracting Rational Expressions

Unit 7: Logic and Reasoning

Professionals use logical reasoning in a variety of ways. Just as lawyers use logical reasoning to formulate convincing arguments, mathematicians use logical reasoning to formulate and prove theorems. Once you have mastered the uses of inductive and deductive reasoning, you will be able to make and understand arguments in many areas.

- Reasoning and Arguments
- Hypothesis and Conclusion
- Forms of Conditional Statements
- Inductive and Deductive Reasoning
- Analyzing and Writing Proofs
- Counterexample

Unit 8: Semester Review and Test

- Semester Review
- Semester Test