

Syllabus

Developmental Math 4—Advanced Algebra

Course Overview

Advanced Algebra is a comprehensive collection of mathematical concepts such as rational expressions, linear and nonlinear equations and inequalities, trigonometry, conic sections, and functions.

In this course, you will study how to simplify rational expressions and recognize graphs of types of functions. You will also learn about the relation between equations and functions. The course includes offline learning activities that focus on improving your understanding of the concepts taught in the course.

Course Goals

By the end of this course, you will be able to do the following:

- Apply rules for exponents when the exponents are rational numbers.
- Simplify rational expressions with exponents and radicals and review polynomials and factoring.
- Find the least common denominator (LCM) of two rational expressions and the sum and difference of rational expressions with unlike denominators.
- Factor a difference of squares and common algebraic expressions.
- Simplify algebraic expressions by collecting like terms and by grouping symbols.
- Multiply algebraic expressions using a shortcut approach to binomials and special products.
- Add, subtract, multiply, and divide rational expressions.
- Solve equations and graph the solution sets on a number line and solve word problems represented by linear equations in one variable.
- Describe solutions of linear equations as ordered pairs and solve equations with absolute values.
- Use interval notation to describe expressions with absolute values and inequalities.
- Add, subtract, multiply, and divide complex numbers and plot them in the complex number plane.
- Solve a quadratic equation by factoring or using the quadratic formula.
- Apply the slope-intercept and point-slope form of the equation of a line.
- Understand the relationship between parallel lines and perpendicular lines and their slopes.
- Investigate conjectures and solve problems involving two- and three-dimensional objects represented using Cartesian coordinates.

- Apply distance and mid-point formulas to linear relations and solve and graph such equations.
- Solve a system of linear equations practical problems with two variables.
- Solve basic linear equations in one variable by using the inspection method and isolating the variable.
- Solve a system of equations by adding, subtracting, or by the substitution method.
- Solve systems of two linear equations through the graphing method and use matrices for two and three variables.
- Determine whether a relation is a function and find the domain and range of a function.
- Graph absolute value functions.
- Find the product of two polynomials and compute functional values by translating and transforming a function.
- Determine whether a relation represents a function and use the rule of a function to determine its output values.
- Determine if a graph represents a function and learn to graph a function.
- Find composite functions and their values.
- Determine whether a function has an inverse by looking at a mapping diagram and find the inverse of a function.
- Evaluate a rational expression for a given set of values.
- Identify non-permissible values for the variables in a rational expression and review how to solve rational expressions.
- Apply the properties of translations to solve problems and alter a function by translating and transforming a graph.
- Divide a polynomial by a binomial and other polynomials using synthetic division.
- Solve problems that involve exponential decay and growth.
- Understand the properties of exponential and logarithmic functions and identify these functions by looking at graphs.
- Solve problems that involve exponential or logarithmic functions.
- Understand different types of patterns and predict future items in these patterns.
- Use and write sequences and series and find the sum of a series.
- Write rules for arithmetic and geometric sequences and find their sums.
- Calculate the measure of lengths of chords, secant segments, and tangent segments.
- Solve problems based on the characteristics of lines that are tangent to circles.
- Study how to find the center, vertices, and foci of an ellipse and hyperbola.
- Given the appropriate minimum information for a triangle, find the unknown parts.
- Study the Pythagorean Theorem and its corollary and apply them to solve problems.
- Use the relationship between the hypotenuse, the legs, and the altitude of right triangles to solve problems.
- Given the appropriate parts of a triangle, use the law of sines or the law of cosines to determine the remaining parts.
- Solve trigonometric equations.
- Determine the exact value of sine, cosine, and tangent of integer multiples of $\pi/6$ and $\pi/4$ without using tables or a calculator.
- Identify the graphs of any trigonometric function of a single argument.

- Evaluate cotangent, secant, and cosecant of specific numbers, and recognize the graphs of these three functions.

General Skills

To participate in this course, you should be able to do the following:

- Complete basic operations with word processing software, such as Microsoft Word or Google Docs.
- Complete basic operations with presentation software, such as Microsoft PowerPoint or Google Docs presentation.
- Perform online research using various search engines and library databases.
- Communicate through email and participate in discussion boards.

Credit Value

Advanced Algebra is a 0.5-credit course.

Course Materials

- notebook
- computer with Internet connection and speakers or headphones
- Microsoft Word or equivalent
- Microsoft PowerPoint or equivalent

Course Pacing Guide

This course description and pacing guide is intended to help you keep on schedule with your work. Note that your course instructor may modify the schedule to meet the specific needs of your class.

Unit 1: Essentials of Algebra

Summary

In this unit, you will apply the rules for the exponents when they are rational numbers. You will simplify rational expressions with exponents and radicals and review polynomials and factoring. You will find the least common denominator of two rational expressions as well as the sum and difference of rational expressions with unlike denominators. You will learn to factor a difference of squares and factor common algebraic expressions. In this unit, you will simplify algebraic expressions by collecting like terms and multiply algebraic expressions using a shortcut approach to binomials and special products. You will add, subtract, multiply, and divide rational expressions. You will solve equations and then graph the solution sets on a number line. You will solve word problems represented by linear equations in one variable. You will describe solutions of linear equations as ordered pairs and solve equations having absolute values. By using interval notation, you will describe expressions with absolute values and inequalities. You

will learn to add, subtract, multiply, and divide complex numbers and plot complex numbers in the complex number plane and find the solution set for quadratic equations by factoring. In the latter part of the unit, you will study how to solve a quadratic equation by factoring or using the quadratic formula.

Unit 2: More Nonlinear Equations & Inequalities

Summary

In this unit, you will learn and apply the slope-intercept and point-slope form of the equation of a line. You will recognize the relationship between parallel lines and perpendicular lines and their slopes. You will also investigate conjectures and solve problems involving two- and three-dimensional objects represented using Cartesian coordinates. The unit also teaches you to apply the distance formula and the midpoint formula to linear relations and solve a system of linear equations. Additionally, the unit goes on to teach you to solve practical problems in two variables and to solve basic linear equations having one variable using inspection. By isolating the variable, you will solve more difficult linear equations and then learn to solve a system of equations by adding, subtracting, or the substitution method. You will also use the graphing method to solve systems of two linear equations. In the concluding part of the unit you will use matrices to solve a system of linear equations in two and three variables.

Unit 3: Functions

Summary

In this unit, you will start by determining whether a relation is a function and find the domain and range of a function. You will also graph absolute value functions. You will find the product of two polynomials and study how to compute functional values by translating and transforming a function. In this unit, you will determine whether a relation represents a function and study how to use the rule of a function to determine output values. You will determine if a graph represents a function and how to graph a function. You will study composite functions and their values. Then you will determine the simpler functions that make up a composite function. By looking at a mapping diagram or by inspecting a graph, you will determine whether a function has an inverse. In the end, you will study how to find the inverse of a function.

Unit 4: Nonlinear Functions

Summary

In this unit, you will evaluate a rational expression for a given set of values and identify non-permissible values for variables in the rational expression. You will solve rational expressions and apply the properties of translations to solve problems. Further in the unit, you will alter a function by translating and transforming its graph. You will then study how to divide a polynomial by a binomial. By using synthetic division, you will divide polynomials and solve problems that involve exponential decay and exponential growth. This unit also teaches you about the properties of exponential and logarithmic functions. In the concluding part of the unit, you will

identify exponential and logarithmic functions by looking at graphs and solve problems that involve exponential or logarithmic functions.

Unit 5: Induction, Sequences & Counting

Summary

Unit 5 explores patterns and sequences. You will study different types of patterns and predict future items in these patterns. You will use and write sequences and series and find the sum of a series. You will also learn to write rules for arithmetic and geometric sequences and find their sums.

Unit 6: Conic Sections

Summary

Unit 6 deals with conic sections where you will explore circles, ellipses, and hyperbola. The unit teaches you to calculate the lengths of chords, secant segments, and tangent segments. You will solve problems based on the characteristics of lines that are tangent to circles. In the latter part of the unit, you will find the center, vertices, and foci of an ellipse and hyperbola.

Unit 7: Trigonometry

Summary

Unit 7 is about trigonometric concepts. The unit starts with teaching you how to use right triangles to determine the other trigonometric functions when the value of one trigonometric function is given. In this unit, you will find the unknown parts when the appropriate minimum information for a triangle is given. You will also study the Pythagorean Theorem and its corollary and apply them to solve problems. You will learn to solve problems using the relationship between the hypotenuse, the legs, and the altitude of a right triangle. When the appropriate parts of a triangle are given, you will use the law of sines or the law of cosines to determine the remaining parts. In this unit, you will solve trigonometric equations and determine the exact value of sine, cosine, and tangent of integer multiples of $\frac{\pi}{6}$ and $\frac{\pi}{4}$ without using tables or a calculator. You will also identify the period, amplitude, and shift of $y = a \sin (bx + c)$ or $y = d \cos (ex + f)$. In the last lesson of this unit, you will evaluate cotangent, secant, and cosecant of specific numbers, and recognize the graphs of these three functions.