

Advanced Algebra Essential Curriculum

Quarter I

Unit I: Problem Solving

Goal: The student will demonstrate the ability to work collaboratively performing investigations to solve problems using Algebra

Objectives: The student will be able to:

- a. Develop a problem-solving paradigm by gathering and organizing information from pictures, diagrams and graphs.
- b. Solve linear equations and systems of equations represented in a real world context.

Unit II: Sequences

Goal: The student will demonstrate the ability to work collaboratively performing investigations to problem solve using sequences.

Objectives: The student will be able to:

- a. Use recursively defined sequences to model real world situations.
- b. Use geometric sequences to model real-life situations of growth and decay
- c. Examine the concept of *limit* by exploring long run values in sequences.
- d. Recognize and use multiple representations of sequences.
- e. Use recursion to model financial loans, credit and investment scenarios.

Unit III: Linear Models and Systems

Goal: The student will demonstrate the ability to relate recursive formulas for arithmetic sequences to explicit formulas, linear equations, and systems of linear equations.

Objectives: The student will be able to:

- a. Recognize connections between explicit and recursive formulas for arithmetic sequences
- b. Deepen understanding of slope in arithmetic sequences and linear equations.
- c. Determine lines of fit for data sets and use them to make predictions through interpolation and extrapolation.
- d. Evaluate lines of fit using residuals and their root mean square error
- e. Model real-world situations using system of equations.

Quarter 2

Unit IV: Functions Relations and Transformations

Goal: The student will demonstrate the ability to work collaboratively to perform investigations and solve problems modeled by linear and non-linear functions.

Objectives: The student will be able to:

Review

- *Solve absolute value equations and inequalities using a graphing calculator.*

- a. Describe a graph as discrete or continuous and identify the independent and dependent variables, the intercepts, and the rates of change.
- b. Draw a qualitative graph from a context scenario and create a context scenario given a qualitative graph.
- c. Distinguish conceptually and graphically between functions and relations.
- d. Analyze and graph translations and transformations of linear, quadratic, absolute value, square root, and semicircle families of functions modeled in a real-world context.
- e. Explore compositions of transformations of functions graphically and numerically in real-world contexts.

Unit V: Exponential, Power and Logarithmic Functions

Goal: The student will demonstrate the ability to work collaboratively to perform investigations to solve problems involving exponential, power, and logarithmic functions.

Objectives: The student will be able to:

Review

- *Simplify square roots.*
- *Use scientific notation to solve real-world problems.*
- *Convert a number from standard form to scientific notation and vice versa.*

- a. Write explicit equations for geometric sequences and generalize them for modeling real-world growth and decay.
- b. Solve exponential and power equations using the properties of exponents.
- c. Convert between radical and rational exponent form. In order to model and solve problems in a real-world context.
- d. Define and apply inverse functions graphically and algebraically to solve problems in real-world context.
- e. Use the properties of logarithms and exponents to solve equations modeled from real-world situations.

Quarter 3

Unit VI: Matrices and Linear Systems

Goal: The student will demonstrate the ability to work collaboratively to perform investigations and solve real-world problems using matrices, systems of linear equations, and systems of linear inequalities.

Objectives: The student will be able to:

- a. Use matrices to represent transition diagrams, polygons, and transformations
- b. Apply matrix operations to solve problems with probabilities and transformations
- c. Solve systems of equations algebraically, by inverse matrices, and row reduction
- d. Write and graph systems of inequalities to describe given real-world constraints
- e. Use linear programming with two variables to optimize a function over a feasible region representing real-world situations

Unit VII: Quadratic and Other Polynomial Functions

Goal: The student will demonstrate the ability to work collaboratively to perform investigations solve problems modeled by quadratic and polynomial functions.

Objectives: The student will be able to:

Review

○ *Add, subtract, and multiply polynomials.*

- a. Use finite differences and systems of equations to find a polynomial function that fits a data set
- b. Understand the correspondence among the zeros of a polynomial, the x-intercepts of its graph, and the roots of an equation.
- c. Find roots of polynomial equations from factored form, using the zero-product property.
- d. Change quadratic polynomials from general form to vertex form by completing the square.
- e. Determine, solve, and analyze real-world problems involving quadratic equations.
- f. Define and use complex and imaginary numbers and conjugate pairs
- g. Use graphs of polynomial equations to find the roots and write the equations in factored form.
- h. Analyze relationships among the graphs of polynomial equations, functions, the number and types of roots, the possible degrees of the polynomial, and extreme values and end behavior.

- i. Change Polynomials from general form to factored form using graphs, rational Root Theorem, long or synthetic division, and the quadratic formula.

Quarter 4

Unit VIII: Conic Sections and Rational Functions

Goal: The student will demonstrate the ability to work collaboratively to perform investigations to solve problems modeled by conic sections and rational functions.

Objectives: The student will be able to:

- a. Apply the distance and midpoint formulas to solve real-world problems.
- b. Derive equations of all four conic sections to model real-world problems.
(Optional)
- c. Convert between a general quadratic equation and the standard form of the equation of a conic section. *(Optional)*
- d. Solve a system of quadratic equations in two variables by graphing or using algebraic techniques. *(Optional)*
- e. Graph and find the equations of transformations of the parent function of the rational equation.
- f. Identifying the vertical and horizontal asymptotes, holes, and x and y intercepts on the graphs of rational equations.
- g. Add, subtract, multiply and divide polynomial rational expressions.
- h. Simplify rational expression involving polynomials that can be factored.
- i. Solve rational equations and determine extraneous roots.
- j. Solve nonlinear systems of equations and inequalities algebraically and graphically.

Unit IX: Other Topics in Geometry

Goal: The student will demonstrate the ability to work collaboratively to perform investigations and solve problems modeled by Geometry.

Objectives: The student will be able to:

Review

- *Use proportions to solve problems with similar figures.*

- a. Apply the Pythagorean Theorem to explore properties of special right triangles.