

Algebraic Connections

Mathematics Curriculum Framework

Revised 2004

Course Title: Algebraic Connections (Third-year Course)
 Course/Unit Credit: 1
 Course Number:
 Teacher Licensure: Secondary Mathematics
 Pre-requisite: Algebra I/Geometry or Equivalents
 Grades: 9-12

ALGEBRAIC CONNECTIONS

Algebraic Connections is designed for students who have successfully completed Algebra I (or its equivalent) and Geometry (or its equivalent). Algebraic Connections will build on a foundation of previously taught Algebra and Geometry concepts, enlarge upon the development of each concept, and introduce new concepts. Students will be expected to evaluate data, interpret data, analyze linear functions, write and solve equations and inequalities and their systems, and use algebraic, graphical, and numerical methods for analysis. Arkansas teachers are responsible for integrating technology in the course work for Algebraic Connections.

Strand	Standard
Probability and Statistics	
	1. Students will evaluate and interpret data, make predictions based on data, and apply basic understanding of probability to solve real-world problems.
Linear Function	
	2. Students will analyze linear functions by investigating rates of change, intercepts, and zeros.
Solving Equations and Inequalities	
	3. Students will write and solve, with and without appropriate technology, <i>equations, inequalities, systems of equations and systems of inequalities</i> .
Nonlinear Function	
	4. Students will use algebraic, graphical and numerical methods to analyze, compare, <i>transform</i> , and solve nonlinear equations (<i>absolute value, quadratic, and exponential</i>).

Probability and Statistics

CONTENT STANDARD 1. Students will evaluate and interpret data, make predictions based on data, and apply basic understanding of probability to solve real-world problems.

PS.1.AC.1	Apply counting techniques to determine the number of outcomes <ul style="list-style-type: none">• <i>tree diagram</i>• <i>fundamental Counting Principle</i>• <i>permutations</i> (with and without repetition)• <i>combinations</i>
PS.1.AC.2	Conduct and interpret simple probability experiments using <ul style="list-style-type: none">• manipulatives (spinners, dice, cards, coins)• simulations (using random number tables, graphing calculators, or computer software)
PS.1.AC.3	Compute and display <i>theoretical</i> and <i>experimental probability</i> including the use of <i>Venn diagrams</i> . <ul style="list-style-type: none">• <i>simple</i>• <i>complementary</i>• <i>compound (mutually exclusive, inclusive, independent and dependent events)</i>
PS.1.AC.4	Apply probability to real-world situations such as weather prediction, game theory, fair division, insurance tables, and election theory.
PS.1.AC.5	Interpret and evaluate, with and without appropriate technology, graphical and <i>tabular data</i> displays for <ul style="list-style-type: none">• consistency with the data• appropriateness of type of graph or data display• scale• overall message

Linear Functions

CONTENT STANDARD 2. Students will analyze linear functions by investigating rates of change, intercepts, and zeros.

LF.2.AC.1	Create, given a graph without an <i>explicit formula</i> , a written or oral interpretation of the relationship between the <i>independent</i> and <i>dependent variables</i>
LF.2.AC.2	Create, given a situation, a graph that models the relationship between the independent and dependent variables
LF.2.AC.3	Determine the independent and dependent variables, <i>domain</i> and <i>range</i> of a <i>relation</i> from an algebraic expression, graph, set of ordered pairs, or table of data
LF.2.AC.4	Interpret the rate of change (<i>slope</i>) and intercepts within the context of everyday life (Ex. telephone charges based on base rate (y-intercept) plus rate per minute (slope))
LF.2.AC.5	Calculate the <i>slope</i> given <ul style="list-style-type: none"> • two points • a graph of a line • an equation of a line
LF.2.AC.6	Determine, using slope, whether a pair of lines are <i>parallel</i> , <i>perpendicular</i> , or neither
LF.2.AC.7	Write an equation given <ul style="list-style-type: none"> • two points • a point and y-intercept • <i>an x-intercept</i> and <i>y-intercept</i> • a point and slope • a table of data • the graph of a line
LF.2.AC.8	Graph, with and without appropriate technology, functions defined as <i>piece-wise</i> and <i>step</i>

Solving Equations and Inequalities

CONTENT STANDARD 3. Students will write and solve, with and without appropriate technology, *equations, inequalities, systems of equations and systems of inequalities.*

SEI.3.AC.1	SLE 1. Solve, with and without appropriate technology, multi-step equations and inequalities with <i>rational coefficients</i> numerically, algebraically and graphically
SEI.3.AC.2	SLE 2. Solve, with and without appropriate technology, systems of two linear equations and systems of two inequalities numerically, algebraically and graphically
SEI.3.AC.3	SLE 3. Solve <i>linear formulas</i> and <i>literal equations</i> for a specified variable
SEI.3.AC.4	Use, with and without appropriate technology, <i>coordinate geometry</i> to represent and solve problems including <i>midpoint</i> , length of a line segment and <i>Pythagorean Theorem</i>
SEI.3.AC.5	SLE 5. Determine and describe, with and without appropriate technology, the resulting change in the perimeter, area, and volume when one or more dimensions change (apply this idea in solving real world problems)
SEI.3.AC.6	SLE 6. Apply linear, piece-wise and step functions to real world situations that involve a combination of rates, proportions and percents such as sales tax, simple interest, social security, constant depreciation and appreciation, arithmetic sequences, constant rate of change, income taxes, postage, utility bills, commission, and traffic tickets

Nonlinear Functions

CONTENT STANDARD 4. Students will use algebraic, graphical and numerical methods to analyze, compare, *transform*, and solve nonlinear equations (*absolute value*, *quadratic*, and *exponential*).

NF.4.AC.1	Factor <i>polynomials</i> <ul style="list-style-type: none">• greatest common factor• <i>binomials</i> (difference of squares)• <i>trinomials</i>• combinations of the above
NF.4.AC.2	Simplify, add, subtract and multiply <i>radical expressions</i>
NF.4.AC.3	Solve, with and without appropriate technology, quadratic equations with real number solutions using factoring and the <i>quadratic formula</i>
NF.4.AC.4	Determine the independent and dependent variables, domain and range of a relation from algebraic equations, graphs, sets of ordered pairs, or tables of data
NF.4.AC.5	Identify and apply <i>nonlinear functions</i> to real world situations such as acceleration, area, volume, population, bacteria, compound interest, percent depreciation and appreciation, amortization, geometric sequences, etc.
NF.4.AC.6	Recognize <i>function families</i> including vertical shifts, horizontal shifts and reflections over the x-axis

Algebraic Connections Glossary

<i>Absolute Value Function</i>	A function described by $y = x $ or $f(x) = x $
<i>Binomial</i>	In algebra, an expression consisting of two terms connected by a plus or minus sign Ex. $4a+6$
<i>Combination</i>	Subsets chosen from a larger set of objects in which the order of the items doesn't matter (Ex. the number of different committees of three that can be chosen from a group of twelve members)
<i>Coordinate Geometry</i>	Geometry based on the coordinate system
<i>Coordinate System</i>	A method of locating points in the plane or in space by means of numbers (A point in the plane is located by its distances from both a horizontal and a vertical line called the axes. The horizontal line is called the x-axis. The vertical line is called the y-axis. The pairs of numbers are called ordered pairs. The first number, called the x-coordinate, designates the distance along the horizontal axis. The second number, called the y-coordinate, designates the distance along the vertical axis. The point at which the two axes intersect has the coordinates (0, 0) and is called the origin.)
<i>Dependent Variable</i>	A variable whose value depends upon, or is affected by, the value of another variable
<i>Domain</i>	Set of all first coordinates from the ordered pairs of a relation
<i>Equation</i>	A sentence that states that two mathematical expressions are equal
<i>Experimental Probability</i>	A probability determined by performing tests or experiments and observing the outcomes
<i>Explicit Formula</i>	A formula whose dependent variable is defined in terms of the independent variable Ex. $y = 2x - 3$
<i>Exponential Equation</i>	An equation in which variables occur in exponents
<i>Function Families</i>	Functions whose graphs are variations of the parent function
<i>Fundamental Counting Principle</i>	If event M can occur in m ways and is followed by an event N that can occur in n ways, then the event M followed by the event n can occur in $m \cdot n$
<i>Independent Variable</i>	The variable whose value does not depend upon, nor is affected by, the value of another variable
<i>Inequality</i>	Statements indicating that two quantities are not equal, utilizing symbols $>$ (greater than) or $<$ (less than) and \geq or \leq .
<i>Linear Formulas</i>	A formula whose graph is a line
<i>Literal Equations</i>	An equation in which the coefficients and constants are represented by letters
<i>Midpoint of a Segment</i>	The point that divides the segment into two congruent segments
<i>Nonlinear Functions</i>	Functions of degree higher than the first degree
<i>Parallel Lines</i>	Lines in the same plane that do not intersect
<i>Permutation</i>	An arrangement of a given number of objects from a given set in which the order of the objects is significant

<i>Perpendicular Lines</i>	Lines that intersect and form right angles
<i>Piece-Wise Function</i>	Function using different rules for different parts of the domain
<i>Polynomial</i>	An algebraic expression of the form $a_0x^n + a_1x^{n-1} + \dots + a_n$, where a_0, a_1, \dots, a_n are real numbers, a_0 is not zero, and n is a nonnegative integer
<i>Pythagorean Theorem</i>	The sum of the squares of the lengths of the legs of a right triangle is equal to the square of the length of the hypotenuse.
<i>Quadratic Equations</i>	An equation of the form $ax^2 + bx + c = 0$
<i>Quadratic Formula</i>	The solutions of a quadratic equation of the form $ax^2 + bx + c = 0$, where $a \neq 0$, are given by the quadratic formula, which is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
<i>Radical Expression</i>	An expression that contains a radical
<i>Range</i>	The set of all second coordinates from the ordered pairs of a relation
<i>Rational Coefficients</i>	A number preceding a variable of the form $\frac{a}{b}$ where a is any integer and b is any integer except zero
<i>Slope</i>	The ratio of vertical change over the corresponding horizontal change (rise/run)
<i>Step Function</i>	The function whose graph is a series of disjoint line segments or steps
<i>Systems Of Equations</i>	A set of equations with the same variables
<i>Systems Of Inequalities</i>	A set of inequalities with the same variables
<i>Theoretical Probability</i>	Theoretical Probability is determined using mathematical methods to provide an idea of what outcomes might occur in a given situation
<i>Transformation</i>	The process of changing one configuration or expression into another in accordance with a rule (Common geometric transformations include translations “slides”, rotations “turns”, and reflections “flips”)
<i>Tree Diagram</i>	A diagram used to show the total number of possible outcomes in a probability experiment
<i>Trinomial</i>	A polynomial with three terms
<i>Venn Diagram</i>	A Venn diagram is a pictorial way of showing the relations among sets or events.
<i>X-Intercept</i>	The x –coordinate of the point at which a graph crosses the x-axis (The x-intercept is represented as an ordered pair $(x, 0)$.)
<i>Y-Intercept</i>	The y –coordinate of the point at which a graph crosses the y-axis (The y-intercept is represented as an ordered pair $(0,y)$.)