

Algebra III

Mathematics

Curriculum Framework

Revised 2004

Title: Algebra III (Fourth-year Course)
 Course/Unit Credit: 1
 Course Number:
 Teacher Licensure: Secondary Mathematics
 Pre-requisite: Algebra II
 Grades: 9-12

ALGEBRA III

Algebra III is designed for students who have successfully completed Algebra II. This course will enhance the higher level thinking skills developed in Algebra II through a more in-depth study of those concepts and exploration of some pre-calculus concepts. Students in Algebra III will be challenged to increase their understanding of algebraic, graphical and numerical methods to analyze, translate and solve quadratic, polynomial, rational, exponential and logarithmic functions. Modeling real world situations is an important part of this course. Sequences and series will be used to represent and analyze real world problems and mathematical situations. Algebra III will also include a study of trigonometric functions, right triangles, and oblique triangles. Arkansas teachers are responsible for integrating appropriate technology for Algebra III.

Strand	Standard
Linear and Quadratic Functions	
	1. Students will use algebraic, graphical, and numerical methods to analyze, compare, <i>translate</i> , and solve <i>linear and quadratic equations</i> .
Polynomial and Rational Functions	
	2. Students will use algebraic, graphical, and numerical methods to analyze, compare, translate, and solve <i>polynomial and rational equations</i> .
Exponential and Logarithmic Functions	
	3. Students will solve real world problems involving logarithmic and exponential functions. They will draw and analyze graphs and find <i>inverse functions</i> .
Sequences and Series	
	4. Students will use sequences and series to represent and analyze mathematical situations.
Trigonometric Functions	
	5. Students will identify, create, and solve real world problems involving right triangles and oblique triangles.

Linear and Quadratic Functions

CONTENT STANDARD 1. Students will use algebraic, graphical, and numerical methods to analyze, compare, *translate*, and solve *linear* and *quadratic equations*.

LQF.1.AIII.1	Evaluate, add, subtract, multiply, divide and <i>compose functions</i> and determine appropriate <i>domain</i> and <i>range</i> restrictions
LQF.1.AIII.2	Develop, write, and graph, with and without appropriate technology, equations of lines in <i>slope-intercept</i> , <i>point-slope</i> , and <i>standard forms</i> given <ul style="list-style-type: none"> • a point and the slope • two points • real world data
LQF.1.AIII.3	Develop, write, and graph, given a point and the slope, two points, or a point and a line, the equation of <ul style="list-style-type: none"> • a parallel line • a perpendicular line • the perpendicular bisector of a line segment
LQF.1.AIII.4	Perform computations with <i>radicals</i> <ul style="list-style-type: none"> • simplify radicals with different <i>indices</i> • add, subtract, multiply and divide radicals • solve equations that contain radicals or <i>radical expressions</i>
LQF.1.AIII.5	Solve, with and without appropriate technology, quadratic equations by <ul style="list-style-type: none"> • extracting the square root • graphing • factoring • <i>completing the square</i> • using the <i>quadratic formula</i>
LQF.1.AIII.6	Graph, with and without appropriate technology, functions defined as <i>piece-wise</i> and <i>step</i>
LQF.1.AIII.7	Solve, with and without appropriate technology, <i>systems</i> of linear and quadratic <i>equations</i> and <i>inequalities</i> with two or more variables
LQF.1.AIII.8	Apply, with and without appropriate technology the concepts of functions to real world situations including <i>linear programming</i>

Polynomial and Rational Functions

CONTENT STANDARD 2. Students will use algebraic, graphical, and numerical methods to analyze, compare, translate, and solve *polynomial and rational equations*.

PRF.2.AIII.1	Determine the factors of polynomials by <ul style="list-style-type: none">• using factoring techniques including grouping, the difference of two squares, and the sum or difference of two cubes• using <i>synthetic division</i>
PRF.2.AIII.2	Investigate and sketch the graphs of polynomial and rational functions using the characteristics of domain and range, <i>upper and lower bounds</i> , <i>maximum</i> and <i>minimum</i> points, <i>asymptotes</i> and <i>end behavior</i> , <i>zeros</i> , <i>multiplicity of zeros</i> , <i>y-intercepts</i> , and <i>symmetry</i> with and without appropriate technology
PRF.2.AIII.3	Simplify, add, subtract, multiply, and divide with rational expressions
PRF.2.AIII.4	Describe, with and without appropriate technology, the fundamental characteristics of rational functions: zeros, <i>discontinuities</i> (including vertical asymptotes), and end behavior (including horizontal asymptotes)
PRF.2.AIII.5	Establish the relationship between radical expressions and expressions containing <i>rational exponents</i> , and simplify variable expressions containing rational exponents using the laws of exponents
PRF.2.AIII.6	Apply, with and without appropriate technology, the concepts of polynomial and rational functions to model real world situations

Exponential and Logarithmic Functions

CONTENT STANDARD 3. Students will solve real world problems involving logarithmic and exponential functions. They will draw and analyze graphs and find *inverse functions*.

ELF.3.AIII.1	Establish the inverse relationship between <i>exponential</i> and <i>logarithmic functions</i>
ELF.3.AIII.2	Develop and apply, with and without appropriate technology, the laws of logarithms and the change-of-base formula to simplify and evaluate expressions
ELF.3.AIII.3	Solve, with and without appropriate technology, equations and real world problems involving exponential and logarithmic expressions graphically, algebraically and numerically
ELF.3.AIII.4	Find, with and without appropriate technology, the domain, range, intercepts, and asymptotes of logarithmic and exponential functions
ELF.3.AIII.5	Draw and analyze, with and without appropriate technology, graphs of logarithmic and exponential functions

Sequences and Series

CONTENT STANDARD 4. Students will use sequences and series to represent and analyze mathematical situations.

SS.4.AIII.1	Develop, with and without appropriate technology, a representation of <i>sequences recursively</i> and <i>explicitly</i>
SS.4.AIII.2	Define and discriminate, with and without appropriate technology, between <i>arithmetic</i> and <i>geometric sequences and series</i>
SS.4.AIII.3	Solve, with and without appropriate technology, problems involving the sum (including <i>Sigma notation</i>) of finite and infinite sequences and series
SS.4.AIII.4	Determine, with and without appropriate technology, the n^{th} term of a sequence given a rule or specific terms
SS.4.AIII.5	Use, with and without appropriate technology, sequences and series to solve real world problems

Trigonometric Functions

CONTENT STANDARD 5. Students will identify, create, and solve real world problems involving right triangles and oblique triangles.

TF.5.AIII.1	Define <i>sine</i> , <i>cosine</i> , and <i>tangent</i> as ratios of sides of right triangles
TF.5.AIII.2	Develop and use, with and without appropriate technology, the Law of Sines and the Law of Cosines to solve <i>oblique triangles</i>
TF.5.AIII.3	Determine (by using an appropriate formula), with and without technology, the area of an oblique triangle
TF.5.AIII.4	Solve, with and without appropriate technology, real world problems involving applications of <ul style="list-style-type: none">• trigonometric functions• law of Sines• law of Cosines• area of oblique triangles

ALGEBRA III Glossary

<i>Arithmetic Sequence</i>	A sequence in which each term after the first is found by adding a constant, called the common difference d to the previous term
<i>Arithmetic Series</i>	The indicated sum of the terms of an arithmetic sequence
<i>Completing the Square</i>	A process used to create a perfect square trinomial
<i>Composition of Functions</i>	Suppose f and g are functions such that the range of g is a subset of the domain of f , then the composite function f of g can be described by the equation $[(f \circ g)(x) = f(g(x))]$
<i>Cosine Ratio</i>	In a right triangle, the ratio of the length of the adjacent side to the length of the hypotenuse
<i>Discontinuous</i>	A function that is not continuous
<i>Domain</i>	Set of all first coordinates from the ordered pairs of a relation
<i>End Behavior</i>	A reference to the graph of a polynomial function as rising or falling to the right and rising or falling to the left
<i>Explicit</i>	A formula whose dependent variable is defined in terms of the independent variable Ex. $y = 2x - 3$
<i>Exponential Function</i>	A function in which the variable(s) occurs in the exponent Ex. A function of the form $f(x) = ab^x$, $b > 0$
<i>Geometric Sequence</i>	A sequence in which each term after the first is found by multiplying the previous term by a constant, called the common ratio, r
<i>Geometric Series</i>	The indicated sum of the terms of a geometric sequence
<i>Horizontal Asymptote</i>	A horizontal line to which a graph becomes arbitrarily close as the value of x increases or decreases without bound
<i>Index (indices)</i>	The number that indicates the root of a radical
<i>Inverse Function</i>	Two functions f and g are inverse functions if and only if both their compositions are the identity function Ex. $[f \circ g](x) = x$ and $[g \circ f](x) = x$
<i>Linear Equation</i>	A function that has a constant rate of change and can be modeled by a straight line
<i>Linear Programming</i>	A method for finding the maximum or minimum value of a function in two variables subject to given constraints on the variables
<i>Logarithmic Function</i>	A function of the form $y = \log_b x$, where $b > 0$, $x > 0$ and $b \neq 1$
<i>Lower Bound</i>	A number which is less than or equal to every number in the set
<i>Maximum</i>	The greatest value of a function if the function has such an extreme value
<i>Minimum</i>	The least value of a function if the function has such an extreme value
<i>Multiplicity of Zeros</i>	The number of times that a repeated zero of a function occurs
<i>Oblique Triangles</i>	Triangles that have no right angles
<i>Piece-wise Function</i>	A function using different rules for different parts of the domain
<i>Point-slope Form</i>	A linear equation in the form $(y - y_1) = m(x - x_1)$ where m is the slope and (x_1, y_1) are the coordinates of a given point on the line
<i>Polynomial Equation</i>	An equation of the form $a_0x^n + a_1x^{n-1} + \dots + a_{n-2}x^2 + a_{n-1}x + a_n$, where the coefficients $a_0, a_1, a_2, \dots, a_n$ are real numbers, a_0 is not zero and n is a non-negative integer

<i>Quadratic Equation</i>	An equation that can be written in the form $ax^2 + bx + c = 0$ where $a \neq 0$
<i>Radical</i>	A radical symbol $\sqrt{\quad}$ and its radicand
<i>Radical Expression</i>	An expression that contains a radical (the radicand may contain variables)
<i>Range</i>	The set of all second coordinates from the ordered pairs of a relation
<i>Rational Equations</i>	An equation that can be written in the form $P/Q = 0$ where P and Q are polynomials and $Q \neq 0$
<i>Rational Exponents</i>	An exponent written in the form a/b where a is an integer and b is a natural number
<i>Recursive</i>	When consecutive terms are defined in terms of the previous one
<i>Sequence</i>	A list that is ordered so that it has a first member, a second member, a third member, and so on
<i>Series</i>	The summation of the terms of a sequence
<i>Sigma (summation) Notation</i>	Notation that uses the symbol \sum to indicate the sum of a series
<i>Sine Ratio</i>	In a right triangle, the ratio of the length of the opposite side to the length of the hypotenuse
<i>Slope-intercept Form</i>	A linear equation in the form $y = mx + b$ where m is the slope of the line and b is the y-intercept
<i>Standard Form</i>	An equation of the form $Ax + By = C$ where A , B and C are integers and A and B are not both 0
<i>Step Function</i>	A function whose graph is a series of disjoint line segments or steps
<i>Symmetry</i>	A figure has symmetry if the figure and its image coincide after a transformation.
<i>Synthetic Division</i>	A shortcut method for long division of polynomials with divisors of the form $x - k$
<i>System of Equations</i>	A set of equations with the same variables
<i>System of Inequalities</i>	A set of inequalities with the same variables
<i>Tangent Ratio</i>	In a right triangle, the ratio of the length of the opposite side to the length of the adjacent side
<i>Translation</i>	A horizontal and/or vertical shift of a graph
<i>Upper Bound</i>	A number greater than or equal to every number in the set
<i>Vertical Asymptote</i>	A vertical line to which a graph becomes arbitrarily close as the value of $f(x)$ increases or decreases without bound
<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 $(0,y)$.)
<i>Zero</i>	For any function $f(x)$, if $f(a) = 0$, then a is a zero of the function