Bridge to Algebra II

Curriculum Framework

2012

Course Title: Bridge to Algebra II
Course/Unit Credit: 1
Course Number:
Teacher Licensure: Secondary Mathematics
Grades: 9-12

Bridge to Algebra II

Bridge to Algebra II was developed with the intent to provide students who have completed Algebra I, under the 2004, amended 2006, Arkansas Mathematics Curriculum Framework (AMCF), with the additional math foundation they need to be successful in a Common Core State Standards for Mathematics (CCSS-M) Algebra II course.

Each student learning expectation for Bridge to Algebra II is intended to:

- reinforce linear concepts that were previously included in the Algebra I Course;
- master quadratics and exponential concepts not included within the Arkansas Department of Education Algebra I Curriculum Framework through modeling functions and summarizing, representing, and interpreting data; or
- introduce higher order concepts to prepare students for success in CCSS-M Algebra II.

Teachers are responsible for including the eight Standards for Mathematical Practice found in the CCSS-M. Bridge to Algebra II does not require Arkansas Department of Education approval.

Prerequisite: Students must have successfully completed coursework for Algebra I (AMCF) or Algebra A & B (AMCF) but not Algebra II. Students may enroll concurrently with Geometry but not concurrently with Algebra II.

Strand	Content Standard
Functional Relationships	
	1. Interpret the structure of expressions, write expressions in equivalent forms to solve problems, perform arithmetic operations on functions, and understand the relationship between zeros and factors of polynomials.
Representing Functions	
	2. Represent and solve equations and inequalities graphically and analyze functions using different representations.
Function Modeling	
	3. Create equations that describe numbers or relationships, interpret functions that arise in applications in terms of a context, analyze functions using different representations, build a function that models a relationship between two quantities, and build new functions from existing functions.
Statistics and Probability	
	4. Summarize, represent, and interpret data on a single count or a measurement variable and use probability to evaluate outcomes of decisions.

Strand: Functional Relationships

Content Standard 1: Interpret the structure of expressions, write expressions in equivalent forms to solve problems, perform arithmetic operations on functions, and understand the relationship between zeros and factors of polynomials.

		Connections to CCSS-M
FR.1.BTAII.1	Interpret expressions that represent a quantity in terms of its context: • interpret parts of an expression, such as terms, factors, and coefficients • interpret complicated expressions by viewing one or more of their parts as a single entity [e.g., interpret $P(1+r)^n$ as the product of P and a factor not depending on P]	A.SSE.1
FR.1.BTAII.2	Use the structure of an expression to identify ways to rewrite it [e.g., see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$]	A.SSE.2
FR.1.BTAII.3	Understand that polynomials form a system analogous to the integers and exhibit closure under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials	A.APR.1
FR.1.BTAII.4	Use various methods to factor quadratic polynomials; understand the relationship between the factored form of a quadratic polynomial and the zeros of a function	Not Applicable
FR.1.BTAII.5	Identify zeros of linear and quadratic polynomials when suitable factorizations are available; use the zeros to construct a rough graph of the function defined by the polynomial	A.APR.3
FR.1.BTAII.6	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters	A.REI.3
FR.1.BTAII.7	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions	A.REI.5
FR.1.BTAII.8	Interpret the *parameters* in a linear or exponential function in terms of a context	F.LE.5

Key: FR.1.BTAII.1 – Functional Relationships.Content Standard 1.Bridge to Algebra II.1st Student Learning Expectation

Strand: Representing Functions

Content Standard 2: Represent and solve equations and inequalities graphically and analyze functions using different representations.

		Connections to CCSS-M
RF.2.BTAII.1	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately [e.g., using technology to graph the functions, make tables of values or find successive approximations; include cases where $f(x)$ and/or $g(x)$ are linear, quadratic, absolute value, and exponential functions]	A.REI.11
RF.2.BTAII.2	Graph polynomial functions identifying real zeros from the factored form; show *end behavior* by hand in simple cases and by technology in more complicated cases	F.IF.7c
RF.2.BTAII.3	Explain how the definition of the meaning of rational exponent follows from extending the properties of integer exponents to those values allowing for a notation for radicals in terms of rational exponents	N.RN.1
RF.2.BTAII.4	Rewrite expressions involving radicals and rational exponents using the properties of exponents	N.RN.2
RF.2.BTAII.5	Observe, using graphs and tables, that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or more generally, as a polynomial function	F.LE.3
RF.2.BTAII.6	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines	A.SSE.3b
RF.2.BTAII.7	Solve quadratic equations in one variable: • use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions; derive the quadratic formula from this form • solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation; recognize when the quadratic formula gives complex solutions	A.REI.4
RF.2.BTAII.8	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically [e.g., find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$]	A.REI.7

Strand: Function Modeling

Content Standard 3: Create equations that describe numbers or relationships, interpret functions that arise in applications in terms of a context, analyze functions using different representations, build a function that models a relationship between two quantities, and build new functions from existing functions.

		Connections to CCSS-M
FM.3.BTAII.1	Create equations and inequalities in one variable and use them to solve problems, including equations arising from linear, quadratic, and exponential functions	A.CED.1
FM.3.BTAII.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales	A.CED.2
FM.3.BTAII.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context (e.g., represent inequalities describing nutritional and cost constraints on combinations of different foods)	A.CED.3
FM.3.BTAII.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations (e.g., rearrange Ohm's law $V = IR$ to highlight resistance R)	A.CED.4
FM.3.BTAII.5	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities and sketch graphs showing key features given a verbal description of the relationship: key features include intercepts; intervals where the function is increasing, decreasing, positive or negative; maximums and minimums; symmetries; and *end behavior*	F.IF.4
FM.3.BTAII.6	Relate the *domain* of a function to its graph and, where applicable, to the quantitative relationship it describes [e.g., if the function $h(n)$ gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate *domain* for the function]	F.IF.5
FM.3.BTAII.7	Calculate and interpret the *average rate of change* of a function, presented symbolically or as a table, over a specified interval; estimate the rate of change from a graph	F.IF.6
FM.3.BTAII.8	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and by technology in more complicated cases: • graph exponential functions, showing intercepts and *end behavior* • graph square root, cube root, and *piecewise-defined functions*, including step functions and absolute value functions	F.IF.7b,e

Key: FM.3.BTAII.1 – Function Modeling.Content Standard 3.Bridge to Algebra II.1st Student Learning Expectation

Strand: Function Modeling

Content Standard 3: Create equations that describe numbers or relationships, interpret functions that arise in applications in terms of a context, analyze functions using different representations, build a function that models a relationship between two quantities, and build new functions from existing functions.

		Connections to CCSS-M
FM.3.BTAII.9	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function: • use the process of factoring and completing the square in a quadratic function to show zeros, *extreme values*, and symmetry of the graph, and interpret these in terms of a context • use the properties of exponents to interpret expressions for exponential functions	F.IF.8
FM.3.BTAII.10	Compare properties of two functions each represented in a different way algebraically, graphically, numerically in tables, or by verbal descriptions (e.g., given a graph of one quadratic function and an algebraic expression for another, determine which has the larger maximum)	F.IF.9
FM.3.BTAII.11	Write a function that describes a relationship between two quantities: • combine standard function types using arithmetic operations (e.g., build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential and relate these functions to the model) • determine an explicit expression, a *recursive process*, or steps for calculation from a context	F.BF.1a,b
FM.3.BTAII.12	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k, both positive and negative; find the value of k given the graphs; experiment with cases and illustrate an explanation of the effects on the graph using technology; include recognizing *even* and *odd functions* from their graphs and algebraic expressions for them	F.BF.3
FM.3.BTAII.13	Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse; write an expression for the inverse [e.g., $f(x) = 2x^2$ (x is greater than or equal to 0) or $f(x) = 5x + 1$]	F.BF.4a
FM.3.BTAII.14	Define appropriate quantities for the purpose of *descriptive modeling*	N.Q.2
FM.3.BTAII.15	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities	N.Q.3
FM.3.BTAII.16	Graph the solutions to a linear inequality in two variables as a half-plane, excluding the boundary in the case of a strict inequality; graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes	A.REI.12
FM.3.BTAII.17	Recognize that sequences are functions, sometimes defined recursively, whose *domain* is a subset of the integers [e.g., the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1)$ for $n \geq 1$]	F.IF.3
FM.3.BTAII.18	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another	F.LE.1c
FM.3.BTAII.19	Construct linear and exponential functions, including *arithmetic sequences* and *geometric sequences*, given a graph, a description of a relationship, or two input-output pairs; read linear and exponential functions from a table	F.LE.2
FM.3.BTAII.20	Use the properties of exponents to transform expressions for exponential functions	A.SSE.3c

Strand: Statistics and Probability

Content Standard 4: Summarize, represent, and interpret data on a single count or a measurement variable and use probability to evaluate outcomes of decisions.

		Connections to CCSS-M
SP.4.BTAII.1	Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets	S.ID.2
SP.4.BTAII.2	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator)	S.MD.6
SP.4.BTAII.3	Represent data on two quantitative variables on a scatter plot and describe how the variables are related: • fit a function to the data; use functions fitted to data to solve problems in the context of the data; use given functions or choose a function suggested by the context; emphasize linear and exponential models • informally assess the fit of a function by plotting and analyzing *residuals*	S.ID.6a,b
SP.4.BTAII.4	Compute and interpret the *correlation coefficient* of a linear fit using technology	S.ID.8

Key: SP.4.BTAII.1 – Statistics and Probability.Content Standard 4.Bridge to Algebra II.1st Student Learning Expectation

Arithmetic Sequence	A sequence such as $1, 5, 9, 13, 17, \ldots$ or $12, 7, 2, -3, -8, -13, -18, \ldots$ which has a constant difference between terms
Average Rate of Change	The change in the value of a quantity divided by the elapsed time; for a function, the change in the y-value divided by the change in the x-value for two distinct points on the graph
Correlation Coefficient	A measure of how nearly a scatter plot falls on a straight line; the correlation coefficient is always between -1 and $+1$
Descriptive Modeling	A mathematical process that describes real-world events and the relationships between factors responsible for them
Domain	The set of values of the independent variable(s) for which a function or relation is defined; typically, the set of x-values that give rise to real y-values
End Behavior	A description of the dependent variable of a function as the independent variable approaches positive or negative infinity
Even Function	A function whose graph is symmetric to the y-axis [e.g., $f(-x) = f(x)$]
Explicit equation	An equation that relates the inputs to the outputs
Extreme Value	The maximum or minimum output value of a function
Geometric Sequence	A sequence such as $2, 6, 18, 54, 162, \ldots$ or $3, 1, \frac{1}{3}, \frac{1}{9}, \frac{1}{27}, \frac{1}{81}, \ldots$ which has a constant ratio between terms
Odd Function	The function whose graph is symmetric to the origin [e.g., $f(-x) = -f(x)$]
Parameters	A set of variables that define a system and determine its behavior and are varied
Piece-Wise Function	Functions using different rules for different parts of the domain
Recursive formula (process)	A recursive formula has two parts: the value(s) of the first term(s), and a recursion equation that shows how to find each term from the term(s) before it
Residuals	The vertical distance between a data point and the graph of a regression equation: the residual is positive if the data point is above the graph, the residual is negative if the data point is below the graph, and the residual is 0 only when the graph passes through the data point