

Algebra 2

Missouri Learning Standards: Grade-Level Expectations for Mathematics		Missouri Learning Standards: Mathematics	
(Adopted April 2016 for implementation in the 2016 - 2017 school year, assessed beginning in the 2017 - 2018 school year.)		(Adopted 2010, transitioning out, assessed through the 2016 - 2017 school year.)	
Code	Adopted Standards	Code	Current MLS
<b>A2.NQ.A</b>	<b>Extend and use the relationship between rational exponents and radicals.</b>		
<b>A2.NQ.A.1</b>	Extend the system of powers and roots to include rational exponents.		
<b>A2.NQ.A.2</b>	Create and recognize equivalent expressions involving radical and exponential forms of expressions.	<b>HSA-SSE.A.1</b>	Interpret expressions that represent a quantity in terms of its context. a. Interpret parts of an expression, such as terms, factors, and coefficients. b. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret <math>P(1+r)^n</math> as the product of <math>P</math> and a factor not depending on <math>P</math>.</i>
<b>A2.NQ.A.3</b>	Add, subtract, multiply and divide radical expressions.	<b>HSA-SSE.A.2</b>	Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>
<b>A2.NQ.A.4</b>	Solve equations involving rational exponents and/or radicals and identify situations where extraneous solutions may result.	<b>HSA-REI.A.2</b>	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
<b>A2.NQ.B</b>	<b>Use complex numbers.</b>		
<b>A2.NQ.B.5</b>	Represent complex numbers.	<b>HSN-CN.A.1</b>	Know there is a complex number $i$ such that $i^2 = -1$ , and every complex number has the form $a + bi$ with $a$ and $b$ real.
<b>A2.NQ.B.6</b>	Add, subtract, multiply and divide complex numbers.	<b>HSN-CN.A.2</b>	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
<b>A2.NQ.B.7</b>	Know and apply the Fundamental Theorem of Algebra.	<b>HSN-CN.C.9</b>	Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
<b>A2.SSE.A</b>	<b>Define and use logarithms.</b>		
<b>A2.SSE.A.1</b>	Develop the definition of logarithms based on properties of exponents.	<b>HSF-LE.A.4</b>	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a$ , $c$ , and $d$ are numbers and the base $b$ is 2, 10, or $e$ ; evaluate the logarithm using technology.
<b>A2.SSE.A.2</b>	Use the inverse relationship between exponents and logarithms to solve exponential and logarithmic equations.		
<b>A2.SSE.A.3</b>	Use properties of logarithms to solve equations or find equivalent expressions.		
<b>A2.SSE.A.4</b>	Understand why logarithmic scales are used, and use them to solve problems.		
<b>A2.REI.A</b>	<b>Solve equations and inequalities.</b>		

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A2.REI.A.1	Create and solve equations and inequalities, including those that involve absolute value.	HSA-CED.A.1	Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.
		HSA-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i>
		HSA-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. <i>For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</i>
		HSN-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
A2.REI.A.2	Solve rational equations where numerators and denominators are polynomials and where extraneous solutions may result.	HSA-REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
A2.REI.B	<b>Solve general systems of equations and inequalities.</b>		
A2.REI.B.3	Create and solve systems of equations that may include non-linear equations and inequalities.	HSA-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i>
		HSA-REI.D.11	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, polynomial, rational, absolute value, exponential, and logarithmic functions.
A2.APR.A	<b>Perform operations on polynomials and rational expressions.</b>		
A2.APR.A.1	Extend the knowledge of factoring to include factors with complex coefficients.	HSA-SSE.A.2	Use the structure of an expression to identify ways to rewrite it. <i>For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</i>
		HSA-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

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		<b>HSN-CN.C.8</b>	Extend polynomial identities to the complex numbers. <i>For example, rewrite <math>x^2+4</math> as <math>(x+2i)(x-2i)</math>.</i>
<b>A2.APR.A.2</b>	Understand the Remainder Theorem and use it to solve problems.	<b>HSA-APR.B.2</b>	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number $a$ , the remainder on division by $x - a$ is $p(a)$ , so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$ .
<b>A2.APR.A.3</b>	Find the least common multiple of two or more polynomials.	<b>HSA-APR.A.1</b>	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
<b>A2.APR.A.4</b>	Add, subtract, multiply and divide rational expressions.	<b>HSA-APR.D.6</b>	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x)+r(x)/b(x)$ , where $a(x)$ , $b(x)$ , $q(x)$ , and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$ , using inspection, long division, or, for the more complicated examples, a computer algebra system.
		<b>HSA-APR.D.7</b>	Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.
<b>A2.APR.A.5</b>	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to sketch the function defined by the polynomial.	<b>HSA-APR.B.3</b>	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
		<b>HSF-IF.C.7</b>	Graph functions expressed symbolically and show key features of the graph, by hand in simple case and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
<b>A2.IF.A</b>	<b>Use and interpret functions.</b>		
<b>A2.IF.A.1</b>	Identify and interpret key characteristics of functions represented graphically, with tables and with algebraic symbolism to solve problems.	<b>HSF-IF.B.5</b>	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. <i>For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</i>

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		<b>HSF-IF.C.7</b>	Graph functions expressed symbolically and show key features of the graph, by hand in simple case and using technology for more complicated cases. d. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. e. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. f. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
		<b>HSF-IF.C.8</b>	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{12t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i>
		<b>HSF-IF.C.9</b>	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). <i>For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</i>
<b>A2.IF.A.2</b>	Translate between equivalent forms of functions.	<b>HSF-IF.B.4</b>	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. <i>Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</i>

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		<b>HSF-IF.C.8</b>	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. 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. b. Use the properties of exponents to interpret expressions for exponential functions. <i>For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.01)^{12t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</i>
<b>A2.BF.A</b>	<b>Create new functions from existing functions.</b>		
<b>A2.BF.A.1</b>	Create new functions by applying the four arithmetic operations and composition of functions (modifying the domain and range as necessary).	<b>HSF-BF.A.1</b>	Write a function that describes a relationship between two quantities. b. Combine standard function types using arithmetic operations. For example, 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.
<b>A2.BF.A.2</b>	Derive inverses of functions, and compose the inverse with the original function to show that the functions are inverses.	<b>HSF-BF.B.4</b>	Find Inverse Functions. a. Solve an equation of the form $f(x) = c$ for a simple function $f$ that has an inverse and write an expression for the inverse. <i>For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</i>
<b>A2.BF.A.3</b>	Describe the effects of transformations algebraically and graphically, creating vertical and horizontal translations, vertical and horizontal reflections and dilations (expansions/compressions) for linear, quadratic, cubic, square and cube root, absolute value, exponential and logarithmic functions.	<b>HSF-BF.B.3</b>	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.
<b>A2.FM.A</b>	<b>Use functions to model real-world problems.</b>		
<b>A2.FM.A.1</b>	Create functions and use them to solve applications of quadratic and exponential function modeling problems.	<b>HSF-BF.A.1</b>	Write a function that describes a relationship between two quantities. b. Combine standard function types using arithmetic operations. For example, 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.

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		<b>HSA-CED.A.2</b>	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
<b>A2.DS.A</b>	<b>Make inferences and justify conclusions.</b>		
<b>A2.DS.A.1</b>	Analyze how random sampling could be used to make inferences about population parameters.	<b>HSS-IC.A.1</b>	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.
<b>A2.DS.A.2</b>	Determine whether a specified model is consistent with a given data set.	<b>HSS-IC.A.2</b>	Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. <i>For example, a model says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?</i>
<b>A2.DS.A.3</b>	Describe and explain the purposes, relationship to randomization and differences, among sample surveys, experiments and observational studies.	<b>HSS-IC.B.3</b>	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.
<b>A2.DS.A.4</b>	Use data from a sample to estimate characteristics of the population and recognize the meaning of the margin of error in these estimates.	<b>HSS-IC.B.4</b>	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.
<b>A2.DS.A.5</b>	Describe and explain how the relative sizes of a sample and the population affect the margin of error of predictions.		
<b>A2.DS.A.6</b>	Analyze decisions and strategies using probability concepts.	<b>HSS-MD.B.6</b>	Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator).
		<b>HSS-MD.B.7</b>	Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game).
<b>A2.DS.A.7</b>	Evaluate reports based on data.	<b>HSS-IC.B.6</b>	Evaluate reports based on data.
<b>A2.DS.B</b>	<b>Fit a data set to a normal distribution.</b>		
<b>A2.DS.B.8</b>	Know and use the characteristics of normally distributed data sets; predict what percentage of the data will be above or below a given value that is a multiple of standard deviations above or below the mean.	<b>HSS-ID.A.4</b>	Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.
<b>A2.DS.B.9</b>	Fit a data set to a distribution using its mean and standard deviation to determine whether the data is approximately normally distributed.		

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<b>The following from the 2010 MLS have no corresponding standard in the 2016 updated Missouri Learning Standards.</b>			
		<b>HSA-APR.C.4</b>	Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</i>
		<b>HSA-APR.C.5</b>	Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of $x$ and $y$ for a positive integer $n$ , where $x$ and $y$ are any numbers, with coefficients determined for examples by Pascal's Triangle.
		<b>HSA-SSE.B.4</b>	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i>
		<b>HSF-IF.B.6</b>	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.
		<b>HSF-TF.A.1</b>	Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
		<b>HSF-TF.A.2</b>	Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
		<b>HSF-TF.B.5</b>	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
		<b>HSF-TF.C.8</b>	Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$ and use it to find $\sin(\theta)$ , $\cos(\theta)$ , or $\tan(\theta)$ given $\sin(\theta)$ , $\cos(\theta)$ , or $\tan(\theta)$ and the quadrant of the angle.
		<b>HSS-IC.B.5</b>	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.