



Alignment Document  
 State of New Hampshire and Aventa Learning Algebra II  
**Algebra II**  
 2005-2007 Benchmark Blueprint

Strands	Standards	Unit Name	Course Topic Description
Number and Operations	<b>M:N&amp;O:HS:1</b> Demonstrates conceptual understanding of rational numbers by knowing why a real number is rational if and only if the number's decimal expansion eventually repeats or terminates.		
	<b>M:N&amp;O:HS:2</b> Demonstrates understanding of the relative magnitude of real numbers by solving problems that involve ordering or comparing elements of any subset of the real numbers.		
	<b>M:N&amp;O:10:2</b> Demonstrates understanding of the relative magnitude of real numbers by solving problems involving ordering or comparing rational numbers, common irrational numbers (e.g., square root of 2 , pi), rational bases with integer exponents, square roots, absolute values, integers, or numbers represented in scientific notation using number lines or equality and inequality symbols.	Complex Numbers Absolute Value Absolute Value	Introduction Shortcuts Introduction
	<b>M:N&amp;O:HS:3</b> No standard at this level		
	<b>M:N&amp;O:HS:4</b> Accurately solves problems.		
	<b>M(N&amp;O)-HS-4.a</b> Interprets and computes with rational exponents and their relation to radicals, by hand in simple cases (e.g., 4 to the 3/2 power), and using a calculator when appropriate.		
	<b>M(N&amp;O)-HS-4.b</b> Interprets and computes in scientific notation with and without a calculator.		

	<b>M(N&amp;O)-HS-4.c</b> Solves compound interest problems using $A = P(1 + r/n)$ to the $nt$ power, where $n$ is finite.		
	<b>M:N&amp;O:10:4</b> Accurately solves problems involving rational numbers within mathematics, across content strands, disciplines or contexts (with emphasis on, but not limited to, proportions, percents, ratios, and rates).		
	<b>M:N&amp;O:HS:5</b> No standard at this level		
	<b>M:N&amp;O:HS:6</b> Uses a variety of mental computation strategies to solve problems (e.g., using compatible numbers, applying properties of operations, using mental imagery, using patterns) and to determine the reasonableness of answers.		
	<b>M:N&amp;O:HS:7</b> Makes estimates in a given situation (e.g., tips, discounts, tax, the value of a non-perfect square root or cube root) by identifying when estimation is appropriate, selecting the appropriate method of estimation; determining the level of accuracy needed given the situation; analyzing the effect of the estimation method on the accuracy of results; evaluating the reasonableness of solutions appropriate to GSEs across content strands.		
	<b>M:N&amp;O:HS:8</b> Applies properties of numbers and field properties (including determining whether a given subset of numbers is closed under a given arithmetic operation) to solve problems or to simplify computations; and compares and contrasts the properties of numbers and number systems; adds and multiplies numerical matrices with attention to the arithmetic properties of these operations.		
Geometry and Measurement	<b>M:G&amp;M:HS:1</b> No standard at this level		
	<b>M:G&amp;M:HS:2</b> Creates formal proofs of propositions (e.g., angles, lines, circles, distance,		

	midpoint and polygons including triangle congruence and similarity).		
	<b>M:G&amp;M:10:2</b> Makes and defends conjectures, constructs geometric arguments, uses geometric properties, or uses theorems to solve problems involving angles, lines, polygons, circles, or right triangle ratios (sine, cosine, tangent) within mathematics or across disciplines or contexts (e.g., Pythagorean Theorem, Triangle Inequality Theorem).		
	<b>M:G&amp;M:HS.3</b> No standard at this level		
	<b>M:G&amp;M:HS:4</b> Applies the concepts of congruency by using matrices to represent reflections, translations, and rotations.		
	<b>M:G&amp;M:10:4</b> Applies the concepts of congruency by solving problems on or off a coordinate plane involving reflections, translations, or rotations; or solves problems using congruency involving problems within mathematics or across disciplines or contexts.		
	<b>M:G&amp;M:HS:5</b> Applies concepts of similarity to define the trigonometric functions as ratios of sides of right triangles; uses the ratios of the sides of special right triangles ( $30^\circ - 60^\circ - 90^\circ$ and $45^\circ - 45^\circ - 90^\circ$ ) to determine the sine, cosine and tangent of $30^\circ$ , $45^\circ$ , and $60^\circ$ ; and solves related problems.		
	<b>M:G&amp;M:10:5</b> Applies concepts of similarity by solving problems within mathematics or across disciplines or contexts.		
	<b>M:G&amp;M:HS:6</b> Applies trigonometric formulas (e.g., Law of Sines, Law of Cosines, $A = 1/2 ab \sin C$ ) to find angles, lengths and areas of polygons.		
	<b>M:G&amp;M:10:6</b> Solves problems involving perimeter, circumference, or area of two-dimensional figures (including composite figures) or surface area or volume of three-dimensional figures (including		

	<p>composite figures) within mathematics or across disciplines or contexts.</p> <p><b>M:G&amp;M:HS:7</b> Applies informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations (e.g., use successive approximation to find the area of a pond); and uses measurement conversion strategies (e.g., unit/dimensional analysis).</p> <p><b>M:G&amp;M:10:7</b> Uses units of measure appropriately and consistently when solving problems across content strands; makes conversions within or across systems and makes decisions concerning an appropriate degree of accuracy in problem situations involving measurement in other GSEs.</p> <p><b>M:G&amp;M:HS:8</b> No standard at this level</p> <p><b>M:G&amp;M:10:9</b> Solves problems on and off the coordinate plane involving distance, midpoint, perpendicular and parallel lines, or slope.</p> <p><b>M:G&amp;M:HS:10</b> Demonstrates conceptual understanding of spatial reasoning and visualization by sketching or using dynamic geometric software to generate three-dimensional objects from two-dimensional perspectives, or to generate two-dimensional perspectives from three-dimensional objects, and by solving related problems; perform and justify constructions with a compass and straightedge or dynamic geometric software.</p>		
Functions and Algebra	<p><b>M:F&amp;A:HS:1</b> Identifies arithmetic and geometric sequences and finds the <math>n</math>th term; then uses the generalization to find a specific term.</p>	<p>Sequences and Series</p> <p>Sequences and Series</p> <p>Sequences and Series</p> <p>Sequences and Series</p>	<p>One very special Arithmetic Series</p> <p>Series: An important example</p> <p>Geometric sequences</p> <p>Arithmetic Series</p>

		Sequences and Series	Arithmetic sequences
		Sequences and Series	Sigma notation and series
		Sequences and Series	Series
		Sequences and Series	Geometric Series
		Sequences and Series	Summation notation (also called Sigma notation)
	<b>M:F&amp;A:10:1</b> Identifies, extends, and generalizes a variety of patterns (linear and nonlinear) represented by models, tables, sequences, or graphs in problem solving situations.		
	<b>M:F&amp;A:HS:2</b> Demonstrates conceptual understanding of linear and nonlinear functions and relations.		
	<b>M(F&amp;A)-HS-2.a</b> Analyzes characteristics of classes of functions (polynomial, rational, and exponential) to include domain, range, intercepts, increasing and decreasing intervals and rates of change.	Composition of Functions	Domain Restrictions
	<b>M(F&amp;A)-HS-2.b</b> Understands one-to-one (injective) functions and that a function that is one-to-one has a converse that is also a function; and finds inverses algebraically and graphically.	Composition of Functions	Review of Functions
		Composition of Functions	Checking that two functions really are inverse functions of each other
		Composition of Functions	Finding an Inverse Function
		Composition of Functions	Horizontal Line Test
		Composition of Functions	Function Notation
		Composition of Functions	Inverse functions
		Composition of Functions	Definition of Functions

	Conic Sections	Parabolas in Standard Form
<p><b>M(F&amp;A)-HS-2.c</b> Graphs polynomial, rational and exponential functions, including vertical and horizontal shifts, stretches, and compressions as well as reflections across vertical and horizontal axes.</p>	Exponential and Logarithm functions	Computations with exponential functions
	Exponential and Logarithm functions	Graphs of exponential functions
	Exponential and Logarithm functions	Exponential functions: an intuitive approach
	Exponential and Logarithm functions	Exponential functions: the formal definition
	Exponential and Logarithm functions	Exponential functions: an example
	Exponential and Logarithm functions	Introduction
	Composition of Functions	Horizontal Line Test
	Composition of Functions	Domain Restrictions
<p><b>M(F&amp;A)-HS-2.d</b> Applies knowledge of functions to interpret and understand situations, design mathematical models, and solve problems in mathematics as well as in the natural and social sciences.</p>	Composition of Functions	Horizontal Line Test
	Composition of Functions	Function Notation
	Composition of Functions	Definition of Functions
	Composition of Functions	Review of Functions
<p><b>M:F&amp;A:10:2</b> Demonstrates conceptual understanding of linear and nonlinear functions and relations (including characteristics of classes of functions) through an analysis of constant, variable, or average rates of change, intercepts, domain, range, maximum and minimum values, increasing and decreasing intervals and rates of</p>	Composition of Functions	Domain Restrictions
	Composition of Functions	Inverse functions
	Composition of Functions	Function Notation

	change (e.g., the height is increasing at a decreasing rate); describes how change in the value of one variable relates to change in the value of a second variable; or works between and among different representations of functions and relations (e.g., graphs, tables, equations, function notation).		
	<b>M:F&amp;A:HS:3</b> Demonstrates conceptual understanding of algebraic expressions.		
	<b>M(F&amp;A)-HS-3.a</b> Manipulates, evaluates, and simplifies algebraic and numerical expressions.		
	<b>M(F&amp;A)-HS-3.b</b> Adds, subtracts, multiplies and divides polynomials and rational expressions.	Polynomials	Dividing polynomials
	<b>M(F&amp;A)-HS-3.c</b> Factors quadratic and higher degree polynomials.	Polynomials	Combining polynomials
	<b>M(F&amp;A)-HS-3.d</b> Understands properties of logarithms and converts between logarithmic and exponential forms.	Polynomials	The Factor Theorem
		Polynomials	Working with Cubes
		Polynomials	Factoring Polynomials
		Exponential and Logarithm functions	Values of logarithm functions: a look at your calculator
		Exponential and Logarithm functions	Comparing sizes
		Exponential and Logarithm functions	Values of logarithm functions
		Exponential and Logarithm functions	Computations with logarithm functions
		Exponential and Logarithm functions	Logarithm functions
		Exponential and Logarithm functions	Properties of Logarithms

		Exponential and Logarithm functions	Logarithm functions and exponential functions together
	<b>M(F&amp;A)-HS-3.e</b> Manipulates, evaluates, and simplifies expressions involving rational exponents and radicals and converts between expressions with rational exponents and expressions with radicals.		
	<b>M(F&amp;A)-HS-3.f</b> Understands the effect of simplifying rational expressions on the domain of the related functions (e.g., $x^2/x = x$ for $x$ is not equal to 0).	Composition of Functions	Domain Restrictions
	<b>M:F&amp;A:10:3</b> Demonstrates conceptual understanding of algebraic expressions by solving problems involving algebraic expressions, by simplifying expressions (e.g., simplifying polynomial or rational expressions, or expressions involving integer exponents, square roots, or absolute values), by evaluating expressions, or by translating problem situations into algebraic expressions.		
	<b>M:F&amp;A:HS:4</b> Demonstrates conceptual understanding of equality.		
	<b>M(F&amp;A)-HS-4.a</b> Factors, completes the square, uses the quadratic formula, and graphs quadratic functions to solve quadratic equations.	Quadratics Quadratics Quadratics Quadratics Quadratics Quadratics Quadratics	Factored form of quadratics Quadratic functions in the real world Quadratic functions and their graphs Developing the Quadratic Formula Completing the Square The Quadratic Formula Introduction

	Quadratics	From the zeros to the equation of quadratic functions
	Quadratics	Zeros of the quadratic function
	Composition of Functions	Domain Restrictions
	Composition of Functions	Horizontal Line Test
<b>M(F&amp;A)-HS-4.b</b> Solves equations involving polynomial, rational, and radical expressions. Graphs and interprets the solutions.	Polynomials	Introduction
	Polynomials	Combining polynomials
	Polynomials	Factoring Polynomials
	Polynomials	The Factor Theorem
<b>M(F&amp;A)-HS-4.c</b> Understands extraneous solutions.		
<b>M(F&amp;A)-HS-4.d</b> Finds approximate solutions to equations by graphing each side as a function using technology. Understands that any equation in $x$ can be interpreted as the equation $f(x) = g(x)$ and interpret the solutions of the equation as the $x$ -value(s) of the intersection point(s) of the graphs of $y = f(x)$ and $y = g(x)$ .	Composition of Functions	Domain Restrictions
	Composition of Functions	Horizontal Line Test
<b>M(F&amp;A)-HS-4.e</b> Solves $2 \times 2$ and $3 \times 3$ systems of linear equations and graphically interprets the solutions.		
<b>M(F&amp;A)-HS-4.f</b> Solves systems of linear and quadratic inequalities.	Absolute Value	Absolute Value and Inequalities Shortcuts Summary
	Absolute Value	Absolute Value and Inequalities
<b>M(F&amp;A)-HS-4.g</b> Solves systems of equations involving nonlinear expressions and graphically interprets the solutions.		
<b>M(F&amp;A)-HS-4.h</b> Translates problem situations into	Absolute Value	Absolute Value and Inequalities Shortcuts

	inequalities; and solves linear and non-linear inequalities (symbolically and graphically).	Absolute Value Systems of Linear Equations	Summary Absolute Value and Inequalities Systems of Linear Inequalities
	<b>M:F&amp;A:10:4</b> Demonstrates conceptual understanding of equality by solving problems involving algebraic reasoning about equality; by translating problem situations into equations; by solving linear equations (symbolically and graphically) and expressing the solution set symbolically or graphically, or provides the meaning of the graphical interpretations of solution(s) in problem-solving situations; or by solving problems involving systems of linear equations in a context (using equations or graphs) or using models or representations.		
Data, Statistics, and Probability	<b>M:DSP:HS:1</b> Interprets a given representation(s) (e.g., regression function including linear, quadratic, and exponential) to analyze the data to make inferences and to formulate, justify, and critique conclusions.		
	<b>M:DSP:10:1</b> Interprets a given representation(s) (e.g., box-and-whisker plots, scatter plots, bar graphs, line graphs, circle graphs, histograms, frequency charts) to make observations, to answer questions, to analyze the data to formulate or justify conclusions, critique conclusions, make predictions, or to solve problems within mathematics or across disciplines or contexts (e.g., media, workplace, social and environmental situations).		
	<b>M:DSP:HS:2</b> Analyzes patterns, trends, or distributions in data in a variety of contexts by determining or using measures of dispersion		

	(standard deviation, variance, and percentiles).		
	<b>M:DSP:10:2</b> Analyzes patterns, trends, or distributions in data in a variety of contexts by determining, using, or analyzing measures of central tendency (mean, median, or mode), dispersion (range or variation), outliers, quartile values, estimated line of best fit, regression line, or correlation (strong positive, strong negative, or no correlation) to solve problems; and solve problems involving conceptual understanding of the sample from which the statistics were developed.		
	<b>M:DSP:HS:3</b> Organizes and displays one- and two-variable data using a variety of representations (e.g., box-and-whisker plots, scatter plots, bar graphs, line graphs, circle graphs, histograms, frequency charts, linear, quadratic, and exponential regression functions) to analyze the data to formulate or justify conclusions, make predictions, or to solve problems with or without using technology.		
	<b>M:DSP:10:3</b> Identifies or describes representations or elements of representations that best display a given set of data or situation, consistent with the representations required in M:DSP:10:1.		
	<b>M:DSP:HS:4</b> Uses counting techniques to solve problems in context involving combination or permutations using a variety of strategies (e.g., $nCr$ , $nPr$ , or $n!$ ); and finds unions, intersections, and complements of sets.	Counting Counting Counting Counting Counting Counting	Counting Subsets Formula Some computations with factorials More about the Multiplication Principle Counting: An introduction to choosing subsets Factorial notation Counting: An introduction to the Multiplication

		Counting	Principle
		Counting	Combinations
		Counting	Permutations
	<b>M:DSP:10:4</b> Uses counting techniques to solve problems in context involving combinations or permutations using a variety of strategies (e.g., organized lists, tables, tree diagrams, models, Fundamental Counting Principle, or others).	Counting	Combinations
		Counting	More about the Multiplication Principle
		Counting	Permutations
		Counting	Counting Subsets Formula
		Counting	Some computations with factorials
		Counting	Factorial notation
		Counting	Counting: An introduction to choosing subsets
		Counting	Counting: An introduction to the Multiplication Principle
	<b>M:DSP:HS:5</b> For a probability event in which the sample space may or may not contain equally likely outcomes, predicts the theoretical probability of an event and tests the prediction through experiments and simulations; compares and contrasts theoretical and experimental probabilities; finds the odds of an event and understands the relationship between probability and odds.	Counting	Probability: More examples
		Counting	Frequency Expectation Interpretation of probability
		Counting	Probability: An introduction
	<b>M:DSP:10:5</b> Solves problems involving experimental or theoretical probability.	Counting	Probability: An introduction
	<b>M:DSP:HS:6</b> In response to a teacher or student generated question or hypothesis decides the most effective method (e.g., survey, observation, research, experimentation) and sampling		

	techniques (e.g., random sample, stratified random sample) to collect the data necessary to answer the question; collects, organizes, and appropriately displays the data; analyzes the data to draw conclusions about the questions or hypotheses being tested while considering the limitations of the data that could effect interpretations; and when appropriate makes predications, asks new questions, or makes connections to real-world situations.		
Problem Solving, Reasoning, and Proof	<b>M:PRP:HS:1</b> Students will use problem-solving strategies to investigate and understand increasingly complex mathematical content and be able to:		
	<b>M(PRP)-HS-1.a</b> Expand the repertoire of problem-solving strategies and use those strategies in more sophisticated ways.		
	<b>M(PRP)-HS-1.b</b> Use technology whenever appropriate to solve real-world problems (e.g., personal finance, wages, banking and credit, home improvement problems, measurement, taxes, business situations, purchasing, and transportation).		
	<b>M(PRP)-HS-1.c</b> Formulate and redefine problem situations as needed to arrive at appropriate conclusions.		
	<b>M:PRP:HS:2</b> Students will use mathematical reasoning and proof and be able to:		
	<b>M(PRP)-HS-2.a</b> Expand the repertoire of proof techniques and use those techniques in more sophisticated ways.		
	<b>M(PRP)-HS-2.b</b> Use informal and formal reasoning and proof to explain and justify conclusions.		
	<b>M(PRP)-HS-2.c</b> Formalize mathematical arguments through the use of deductive reasoning.		
<b>M(PRP)-HS-2.d</b> Use the principle of mathematical	Mathematical Induction	Principle of Mathematical Induction	

	induction.	Mathematical Induction	Mathematical Induction: Some final comments
		Mathematical Induction	Mathematical Induction: The intuitive approach
		Mathematical Induction	Mathematical Induction: Some notation
		Mathematical Induction	Mathematical Induction: More examples
		Mathematical Induction	Mathematical Induction
		Mathematical Induction	Introduction
	<b>M(PRP)-HS-2.e</b> Use reasoning and proof throughout classroom discussions independent of the mathematical topic being studied.		
	<b>M(PRP)-HS-2.f</b> Recognize how reasoning and proof influence the structure of mathematics.		
Communication, Connections, and Representations	<b>M(CCR)-HS:1</b> Students will communicate their understanding of mathematics and be able to:		
	<b>M(CCR)-HS-1.a</b> Explain and justify their thinking and develop increasingly sophisticated questions for given problem-situations.		
	<b>M(CCR)-HS-1.b</b> Critique and follow the logic of arguments presented within mathematics and across disciplines.		
	<b>M(CCR)-HS:2</b> Students will create and use representations to communicate mathematical ideas and to solve problems and be able to:		
	<b>M(CCR)-HS-2.a</b> Choose appropriate representations and mathematical language (e.g., spreadsheets, geometric models, algebraic symbols, tables, graphs, matrices) to present ideas clearly and logically for a given situation.		
	<b>M(CCR)-HS-2.b</b> See a common structure in mathematical phenomena that come from very different contexts (e.g., the sum of the first n odd		

	natural numbers, the areas of square gardens, and the distance traveled by a vehicle that starts at rest and accelerates at a constant rate can be represented by functions of the form $f(x) = ax^2$ .		
	<b>M(CCR)-HS-2.c</b> Find representations that model essential features of a mathematical situation (e.g., cost of postage can be modeled by a step-function).		
	<b>M(CCR)-HS-2.d</b> Use representations as a primary means for expressing and understanding more abstract mathematical concepts.		
	<b>M:CCR:HS:3</b> Students will recognize, explore, and develop mathematical connections and be able to:		
	<b>M(CCR)-HS-3.a</b> Explain in oral or written form how mathematics connects to other disciplines, to daily life, careers, and society (e.g., geometry in art and literature, data analysis in social studies, and exponential growth in finance).		
	<b>M(CCR)-HS-3.b</b> Explain multiple approaches that lead to equivalent results when solving problems.		