

Alignments of PSAT/NMSQT Skill Categories and State Standards

PSAT/NMSQT Skill Category and Description of Skills	New Hampshire Math: Grade Level and Grade Span Expectations 2006		
	Course/ Level	Standard	Standard ID
<b>Algebra and Functions</b> Solve problems using algebraic expressions and symbols to represent relationships, patterns and functions of different types.	Advanced	Understands functions and relations from a set-theoretic perspective, and operations on functions including composition.	M(F&A)-AM-2.a
	Advanced	Analyzes characteristics of classes of functions and inverse functions (exponential, logarithmic, trigonometric) to include domain, range, intercepts, increasing and decreasing intervals and rates of change, periodicity, end behavior, maximum and minimum values, continuity, and asymptotes; graphs classes of functions; and understands domain restrictions and their effects on functions.	M(F&A)-AM-2.b
	Advanced	Analyzes properties of functions including onto (surjectivity), critical points and inflection points. Determine graphically and analytically whether a function is even, odd or neither.	M(F&A)-AM-2.c
	Advanced	Analyzes informally the idea of continuity and limits.	M(F&A)-AM-2.d
	Advanced	Simplifies complex fractions.	M(F&A)-AM-3.a
	Advanced	Uses the Remainder Theorem, the Factor Theorem and Rational Root Theorem for polynomials.	M(F&A)-AM-3.b
	Advanced	Knows the Fundamental Theorem of Algebra and that non-constant polynomials always factor into linear factors over the complex numbers.	M(F&A)-AM-3.c
	Advanced	Understands the difference between factoring polynomials over integer, rational, real, and complex numbers.	M(F&A)-AM-3.d
	Advanced	Solves equations involving exponential and logarithmic expressions; graphs and interprets the solutions.	M(F&A)-AM-4.b
	Advanced	M:F&A:AM:1 Computes partial sums of infinite arithmetic and geometric sequences, determines when an infinite geometric series converges, and finds its sum. Connects arithmetic and geometric sequences to linear and exponential functions, respectively. Works between recursive and explicit representations.	M:F&A:AM:1
High School	Analyzes characteristics of classes of functions (polynomial, rational, and exponential) to include domain, range, intercepts, increasing and decreasing intervals and rates of change.	M(F&A)-HS-2.a	
High School	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.	M(F&A)-HS-2.b	
High School	Graphs polynomial, rational and exponential functions, including vertical and horizontal shifts, stretches, and compressions as well as reflections across vertical and horizontal axes.	M(F&A)-HS-2.c	

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<b>Algebra and Functions</b> Solve problems using algebraic expressions and symbols to represent relationships, patterns and functions of different types.	High School	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.	M(F&A)-HS-2.d
	High School	Manipulates, evaluates, and simplifies algebraic and numerical expressions.	M(F&A)-HS-3.a
	High School	Adds, subtracts, multiplies and divides polynomials and rational expressions.	M(F&A)-HS-3.b
	High School	Factors quadratic and higher degree polynomials.	M(F&A)-HS-3.c
	High School	Manipulates, evaluates, and simplifies expressions involving rational exponents and radicals and converts between expressions with rational exponents and expressions with radicals.	M(F&A)-HS-3.e
	High School	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).	M(F&A)-HS-3.f
	High School	Factors, completes the square, uses the quadratic formula, and graphs quadratic functions to solve quadratic equations.	M(F&A)-HS-4.a
	High School	Solves equations involving polynomial, rational, and radical expressions. Graphs and interprets the solutions.	M(F&A)-HS-4.b
	High School	Understands extraneous solutions.	M(F&A)-HS-4.c
	High School	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 $y = g(x)$ .	M(F&A)-HS-4.d
	High School	Solves 2x2 and 3x3 systems of linear equations and graphically interprets the solutions.	M(F&A)-HS-4.e
	High School	Solves systems of linear and quadratic inequalities.	M(F&A)-HS-4.f
	High School	Solves systems of equations involving nonlinear expressions and graphically interprets the solutions.	M(F&A)-HS-4.g
	High School	Translates problem situations into inequalities; and solves linear and non-linear inequalities (symbolically and graphically).	M(F&A)-HS-4.h
High School	M:F&A:10:1 Identifies, extends, and generalizes a variety of patterns (linear and nonlinear) represented by models, tables, sequences, or graphs in problem solving situations.	M:F&A:10:1	

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<b>Algebra and Functions</b> Solve problems using algebraic expressions and symbols to represent relationships, patterns and functions of different types.	High School	M:F&A:10:2 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 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).	M:F&A:10:2
	High School	M:F&A:10:3 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.	M:F&A:10:3
	High School	M:F&A:10:4 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.	M:F&A:10:4
	High School	M:F&A:HS:1 Identifies arithmetic and geometric sequences and finds the $n$ th term; then uses the generalization to find a specific term.	M:F&A:HS:1
<b>Communication</b> Express mathematical ideas precisely and communicate them coherently and clearly in the language and notation of mathematics.	Advanced	Analyzes characteristics of classes of functions and inverse functions (exponential, logarithmic, trigonometric) to include domain, range, intercepts, increasing and decreasing intervals and rates of change, periodicity, end behavior, maximum and minimum values, continuity, and asymptotes; graphs classes of functions; and understands domain restrictions and their effects on functions.	M(F&A)-AM-2.b
	Advanced	Analyzes informally the idea of continuity and limits.	M(F&A)-AM-2.d
	Advanced	Uses the Remainder Theorem, the Factor Theorem and Rational Root Theorem for polynomials.	M(F&A)-AM-3.b
	High School	Explain and justify their thinking and develop increasingly sophisticated questions for given problem-situations.	M(CCR)-HS-1.a
	High School	Critique and follow the logic of arguments presented within mathematics and across disciplines.	M(CCR)-HS-1.b

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<b>Communication</b> Express mathematical ideas precisely and communicate them coherently and clearly in the language and notation of mathematics.	High School	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.	M(CCR)-HS-2.a
	High School	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).	M(CCR)-HS-3.a
	High School	Explain multiple approaches that lead to equivalent results when solving problems.	M(CCR)-HS-3.b
	High School	Analyzes characteristics of classes of functions (polynomial, rational, and exponential) to include domain, range, intercepts, increasing and decreasing intervals and rates of change.	M(F&A)-HS-2.a
	High School	Formulate and redefine problem situations as needed to arrive at appropriate conclusions.	M(PRP)-HS-1.c
	High School	M:DSP:10:3 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.	M:DSP:10:3
	High School	M:DSP:HS:2 Analyzes patterns, trends, or distributions in data in a variety of contexts by determining or using measures of dispersion (standard deviation, variance, and percentiles).	M:DSP:HS:2
	High School	M:F&A:10:2 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 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).	M:F&A:10:2
<b>Connections</b> Connect ideas from different areas of mathematics (particularly geometry and algebra) to state or solve abstract or applied problems.	Advanced	M:G&M:AM:9 Solves problems using analytic geometry (including three-dimensions) and circular trigonometry (e.g., find the equation of a circle inscribed in a triangle; find the distance between opposite vertices in a rectangular solid); explores and interprets the characteristics of conic sections graphically and algebraically including understanding how different planar slices of a double cone yield different conic sections; knows the characterization of conic sections as loci of points in the plane satisfying certain distance requirements, and uses the distance formula to obtain equations for the conic sections.	M:G&M:AM:9
	High School	Solves equations involving polynomial, rational, and radical expressions. Graphs and interprets the solutions.	M(F&A)-HS-4.b

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<b>Connections</b> Connect ideas from different areas of mathematics (particularly geometry and algebra) to state or solve abstract or applied problems.	High School	Solves 2x2 and 3x3 systems of linear equations and graphically interprets the solutions.	M(F&A)-HS-4.e
	High School	Recognize how reasoning and proof influence the structure of mathematics.	M(PRP)-HS-2.f
	High School	M:G&M:10:7 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.	M:G&M:10:7
	High School	M:G&M:HS:10 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.	M:G&M:HS:10
<b>Data, Statistics, and Probability</b> Analyze data, understand descriptive statistics, make inferences and determine the likelihood that certain events will occur.	Advanced	M:DSP:AM:5 Solves probability problems (e.g., by applying concepts of counting, random variables, independence/dependence of events, and conditional probability).	M:DSP:AM:5
	High School	M:DSP:10:1 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).	M:DSP:10:1
	High School	M:DSP:10:2 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.	M:DSP:10:2
	High School	M:DSP:10:3 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.	M:DSP:10:3
	High School	M:DSP:10:4 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).	M:DSP:10:4
	High School	M:DSP:10:5 Solves problems involving experimental or theoretical probability.	M:DSP:10:5

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<b>Data, Statistics, and Probability</b> Analyze data, understand descriptive statistics, make inferences and determine the likelihood that certain events will occur.	High School	M:DSP:HS:1 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.	M:DSP:HS:1
	High School	M:DSP:HS:2 Analyzes patterns, trends, or distributions in data in a variety of contexts by determining or using measures of dispersion (standard deviation, variance, and percentiles).	M:DSP:HS:2
	High School	M:DSP:HS:3 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.	M:DSP:HS:3
	High School	M:DSP:HS:4 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.	M:DSP:HS:4
	High School	M:DSP:HS:5 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.	M:DSP:HS:5
	High School	M:DSP:HS:6 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.	M:DSP:HS:6
<b>Geometry and Measurement</b> Solve problems based on understanding the properties of shapes, such as triangles and circles, and the spatial relationships between angles and lines.	Advanced	M:G&M:AM:2 Extends and deepens knowledge and usage of proofs and proof techniques; and uses geometric models to represent and distinguish between Euclidean and Non-Euclidean Systems.	M:G&M:AM:2
	Advanced	M:G&M:AM:6 Derives and uses formulas for lengths of arcs and areas of sectors and areas of segments of circles.	M:G&M:AM:6
	Advanced	M:G&M:AM:7 Uses radian measure appropriately when solving problems; converts between radian measure and degree measure; and understands why radian measure is useful.	M:G&M:AM:7

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<b>Geometry and Measurement</b>  Solve problems based on understanding the properties of shapes, such as triangles and circles, and the spatial relationships between angles and lines.	Advanced	M:G&M:AM:9 Solves problems using analytic geometry (including three-dimensions) and circular trigonometry (e.g., find the equation of a circle inscribed in a triangle; find the distance between opposite vertices in a rectangular solid); explores and interprets the characteristics of conic sections graphically and algebraically including understanding how different planar slices of a double cone yield different conic sections; knows the characterization of conic sections as loci of points in the plane satisfying certain distance requirements, and uses the distance formula to obtain equations for the conic sections.	M:G&M:AM:9
	High School	M:G&M:10:2 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).	M:G&M:10:2
	High School	M:G&M:10:4 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.	M:G&M:10:4
	High School	M:G&M:10:5 Applies concepts of similarity by solving problems within mathematics or across disciplines or contexts.	M:G&M:10:5
	High School	M:G&M:10:6 Solves problems involving perimeter, circumference, or area of two-dimensional figures (including composite figures) or surface area or volume of three-dimensional figures (including composite figures) within mathematics or across disciplines or contexts.	M:G&M:10:6
	High School	M:G&M:10:7 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.	M:G&M:10:7
	High School	M:G&M:10:9 Solves problems on and off the coordinate plane involving distance, midpoint, perpendicular and parallel lines, or slope.	M:G&M:10:9
	High School	M:G&M:HS:10 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.	M:G&M:HS:10
	High School	M:G&M:HS:2 Creates formal proofs of propositions (e.g., angles, lines, circles, distance, midpoint and polygons including triangle congruence and similarity).	M:G&M:HS:2

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<p><b>Geometry and Measurement</b></p> <p>Solve problems based on understanding the properties of shapes, such as triangles and circles, and the spatial relationships between angles and lines.</p>	High School	M:G&M:HS:7 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).	M:G&M:HS:7
<p><b>Number and Operations</b></p> <p>Understand types of numbers (integers, fractions, decimals), their properties and the correct order of operations. Perform computations correctly.</p>	Advanced	Solves problems involving scientific notation and assesses the precision of the answer in terms of significant digits.	M(N&O)-AM-4.a
	Advanced	Solves compound interest problems including continuously compounded interest.	M(N&O)-AM-4.e
	Advanced	M:N&O:AM:1 Demonstrates conceptual understanding of the real number system as an extension of the rational numbers by representing real numbers as infinite decimal expansions (that provide successive rational approximations to the number) and as points on a number line. Determines whether the decimal expansion of a rational number given in fractional form eventually repeats or terminates (without using a calculator).	M:N&O:AM:1
	High School	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.	M(N&O)-HS-4.a
	High School	Interprets and computes in scientific notation with and without a calculator.	M(N&O)-HS-4.b
	High School	Solves compound interest problems using $A = P(1 + r/n)^{nt}$ to the $nt$ power, where $n$ is finite.	M(N&O)-HS-4.c
	High School	M:N&O:10:2 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.	M:N&O:10:2
	High School	M:N&O:10:4 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).	M:N&O:10:4
	High School	M:N&O:HS:1 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.	M:N&O:HS:1
High School	M:N&O:HS:2 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.	M:N&O:HS:2	

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<b>Number and Operations</b> Understand types of numbers (integers, fractions, decimals), their properties and the correct order of operations. Perform computations correctly.	High School	M:N&O:HS:6 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.	M:N&O:HS:6
	High School	M:N&O:HS:7 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.	M:N&O:HS:7
	High School	M:N&O:HS:8 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.	M:N&O:HS:8
<b>Problem Solving</b> Solve abstract and practical problems, applying and adapting a variety of strategies. Monitor progress and evaluate answers in terms of questions asked.	Advanced	Analyzes properties of functions including onto (surjectivity), critical points and inflection points. Determine graphically and analytically whether a function is even, odd or neither.	M(F&A)-AM-2.c
	Advanced	Simplifies complex fractions.	M(F&A)-AM-3.a
	Advanced	Solves equations involving exponential and logarithmic expressions; graphs and interprets the solutions.	M(F&A)-AM-4.b
	Advanced	Solves problems involving scientific notation and assesses the precision of the answer in terms of significant digits.	M(N&O)-AM-4.a
	Advanced	Solves compound interest problems including continuously compounded interest.	M(N&O)-AM-4.e
	Advanced	M:DSP:AM:5 Solves probability problems (e.g., by applying concepts of counting, random variables, independence/dependence of events, and conditional probability).	M:DSP:AM:5
	Advanced	M:F&A:AM:1 Computes partial sums of infinite arithmetic and geometric sequences, determines when an infinite geometric series converges, and finds its sum. Connects arithmetic and geometric sequences to linear and exponential functions, respectively. Works between recursive and explicit representations.	M:F&A:AM:1
Advanced	M:G&M:AM:7 Uses radian measure appropriately when solving problems; converts between radian measure and degree measure; and understands why radian measure is useful.	M:G&M:AM:7	

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<b>Problem Solving</b> Solve abstract and practical problems, applying and adapting a variety of strategies. Monitor progress and evaluate answers in terms of questions asked.	High School	Adds, subtracts, multiplies and divides polynomials and rational expressions.	M(F&A)-HS-3.b
	High School	Factors, completes the square, uses the quadratic formula, and graphs quadratic functions to solve quadratic equations.	M(F&A)-HS-4.a
	High School	Understands extraneous solutions.	M(F&A)-HS-4.c
	High School	Solves systems of linear and quadratic inequalities.	M(F&A)-HS-4.f
	High School	Solves systems of equations involving nonlinear expressions and graphically interprets the solutions.	M(F&A)-HS-4.g
	High School	Translates problem situations into inequalities; and solves linear and non-linear inequalities (symbolically and graphically).	M(F&A)-HS-4.h
	High School	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.	M(N&O)-HS-4.a
	High School	Interprets and computes in scientific notation with and without a calculator.	M(N&O)-HS-4.b
	High School	Solves compound interest problems using $A = P(1 + r/n)^{nt}$ to the $nt$ power, where $n$ is finite.	M(N&O)-HS-4.c
	High School	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).	M(PRP)-HS-1.b
	High School	M:DSP:10:4 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).	M:DSP:10:4
	High School	M:DSP:10:5 Solves problems involving experimental or theoretical probability.	M:DSP:10:5
	High School	M:DSP:HS:4 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.	M:DSP:HS:4

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<p><b>Problem Solving</b></p> <p>Solve abstract and practical problems, applying and adapting a variety of strategies. Monitor progress and evaluate answers in terms of questions asked.</p>	High School	M:F&A:10:3 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.	M:F&A:10:3
	High School	M:F&A:10:4 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.	M:F&A:10:4
	High School	M:F&A:HS:1 Identifies arithmetic and geometric sequences and finds the $n$ th term; then uses the generalization to find a specific term.	M:F&A:HS:1
	High School	M:G&M:10:4 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.	M:G&M:10:4
	High School	M:G&M:10:5 Applies concepts of similarity by solving problems within mathematics or across disciplines or contexts.	M:G&M:10:5
	High School	M:G&M:10:6 Solves problems involving perimeter, circumference, or area of two-dimensional figures (including composite figures) or surface area or volume of three-dimensional figures (including composite figures) within mathematics or across disciplines or contexts.	M:G&M:10:6
	High School	M:G&M:10:9 Solves problems on and off the coordinate plane involving distance, midpoint, perpendicular and parallel lines, or slope.	M:G&M:10:9
	High School	M:G&M:HS:7 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).	M:G&M:HS:7
	High School	M:N&O:10:2 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.	M:N&O:10:2

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	Course/ Level	Standard	Standard ID
<b>Problem Solving</b> Solve abstract and practical problems, applying and adapting a variety of strategies. Monitor progress and evaluate answers in terms of questions asked.	High School	M:N&O:10:4 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).	M:N&O:10:4
	High School	M:N&O:HS:2 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.	M:N&O:HS:2
	High School	M:N&O:HS:6 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.	M:N&O:HS:6
	High School	M:N&O:HS:7 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.	M:N&O:HS:7
	High School	M:N&O:HS:8 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.	M:N&O:HS:8
<b>Reasoning</b> Develop and use mathematical arguments and proofs to explore the truth of conjectures and justify conclusions.	Advanced	Understands functions and relations from a set-theoretic perspective, and operations on functions including composition.	M(F&A)-AM-2.a
	Advanced	Knows the Fundamental Theorem of Algebra and that non-constant polynomials always factor into linear factors over the complex numbers.	M(F&A)-AM-3.c
	Advanced	Understands the difference between factoring polynomials over integer, rational, real, and complex numbers.	M(F&A)-AM-3.d
	High School	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.	M(F&A)-HS-2.b
	High School	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.	M(F&A)-HS-2.d
	High School	Understands the effect of simplifying rational expressions on the domain of the related functions (e.g., $x/x = x$ for $x$ is not equal to 0).	M(F&A)-HS-3.f

Alignments of PSAT/NMSQT Skill Categories and State Standards

PSAT/NMSQT Skill Category and Description of Skills	New Hampshire Math: Grade Level and Grade Span Expectations 2006		
	Course/ Level	Standard	Standard ID
<b>Reasoning</b> Develop and use mathematical arguments and proofs to explore the truth of conjectures and justify conclusions.	High School	Expand the repertoire of problem-solving strategies and use those strategies in more sophisticated ways.	M(PRP)-HS-1.a
	High School	Expand the repertoire of proof techniques and use those techniques in more sophisticated ways.	M(PRP)-HS-2.a
	High School	Use informal and formal reasoning and proof to explain and justify conclusions.	M(PRP)-HS-2.b
	High School	Formalize mathematical arguments through the use of deductive reasoning.	M(PRP)-HS-2.c
	High School	Use the principle of mathematical induction.	M(PRP)-HS-2.d
	High School	Use reasoning and proof throughout classroom discussions independent of the mathematical topic being studied.	M(PRP)-HS-2.e
	High School	M:DSP:10:1 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).	M:DSP:10:1
	High School	M:DSP:10:2 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.	M:DSP:10:2
	High School	M:DSP:HS:1 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.	M:DSP:HS:1
	High School	M:DSP:HS:5 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.	M:DSP:HS:5

Alignments of PSAT/NMSQT Skill Categories and State Standards

PSAT/NMSQT Skill Category and Description of Skills	New Hampshire Math: Grade Level and Grade Span Expectations 2006		
	Course/ Level	Standard	Standard ID
<b>Reasoning</b> Develop and use mathematical arguments and proofs to explore the truth of conjectures and justify conclusions.	High School	M:DSP:HS:6 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.	M:DSP:HS:6
	High School	M:G&M:10:2 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).	M:G&M:10:2
	High School	M:G&M:HS:2 Creates formal proofs of propositions (e.g., angles, lines, circles, distance, midpoint and polygons including triangle congruence and similarity).	M:G&M:HS:2
	High School	M:N&O:HS:1 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.	M:N&O:HS:1
<b>Representation</b> Use and translate among representations including verbal, numerical, symbolic and graphical to communicate mathematical ideas and solve problems.	Advanced	M:G&M:AM:2 Extends and deepens knowledge and usage of proofs and proof techniques; and uses geometric models to represent and distinguish between Euclidean and Non-Euclidean Systems.	M:G&M:AM:2
	Advanced	M:G&M:AM:6 Derives and uses formulas for lengths of arcs and areas of sectors and areas of segments of circles.	M:G&M:AM:6
	Advanced	M:N&O:AM:1 Demonstrates conceptual understanding of the real number system as an extension of the rational numbers by representing real numbers as infinite decimal expansions (that provide successive rational approximations to the number) and as points on a number line. Determines whether the decimal expansion of a rational number given in fractional form eventually repeats or terminates (without using a calculator).	M:N&O:AM:1
	High School	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 $f(x) = ax^2$ ).	M(CCR)-HS-2.b
	High School	Find representations that model essential features of a mathematical situation (e.g., cost of postage can be modeled by a step-function).	M(CCR)-HS-2.c

Alignments of PSAT/NMSQT Skill Categories and State Standards

PSAT/NMSQT	New Hampshire Math: Grade Level and Grade Span Expectations 2006		
Skill Category and Description of Skills	Course/ Level	Standard	Standard ID
<b>Representation</b> Use and translate among representations including verbal, numerical, symbolic and graphical to communicate mathematical ideas and solve problems.	High School	Use representations as a primary means for expressing and understanding more abstract mathematical concepts.	M(CCR)-HS-2.d
	High School	Graphs polynomial, rational and exponential functions, including vertical and horizontal shifts, stretches, and compressions as well as reflections across vertical and horizontal axes.	M(F&A)-HS-2.c
	High School	Manipulates, evaluates, and simplifies algebraic and numerical expressions.	M(F&A)-HS-3.a
	High School	Factors quadratic and higher degree polynomials.	M(F&A)-HS-3.c
	High School	Manipulates, evaluates, and simplifies expressions involving rational exponents and radicals and converts between expressions with rational exponents and expressions with radicals.	M(F&A)-HS-3.e
	High School	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 $y = g(x)$ .	M(F&A)-HS-4.d
	High School	M:DSP:HS:3 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.	M:DSP:HS:3
	High School	M:F&A:10:1 Identifies, extends, and generalizes a variety of patterns (linear and nonlinear) represented by models, tables, sequences, or graphs in problem solving situations.	M:F&A:10:1

# PSAT/NMSQT Skills Insight™ Alignment to State Standards

## Executive Summary, July 2010

### Purpose

PSAT/NMSQT *Skills Insight*™ is a free online tool designed to help students and educators gain a better understanding of how PSAT/NMSQT® scores relate to specific academic skills. It provides a description of the academic skills that are typical of students scoring at each score band, suggestions for improvement, and practice test questions. Learn more by visiting [www.collegeboard.com/psatskills](http://www.collegeboard.com/psatskills).

The information provided by PSAT/NMSQT *Skills Insight* is organized by skill category. There are five skill categories for the critical reading section, nine for the mathematics section (4 content skill categories; 5 process skill categories), and 5 for the writing skills section. This report shows the alignment between state standards in English Language Arts and Mathematics and the content and skills measured by the PSAT/NMSQT.

### Using Alignment Results with PSAT/NMSQT Reports

Schools and districts that administer the PSAT/NMSQT have access to the *Summary of Answers and Skills* (SOAS) report<sup>1</sup>. SOAS reports summarize performance on test sections, skill categories, and individual test questions, and compare local results to the state or nation. Using SOAS and the alignment information provided in this report, schools and districts can develop remediation strategies to help students improve their college readiness skills, future SAT scores, and performance on state assessments.

### Mathematics: Alignment Approach and Findings

- There are nine Skills Categories in Mathematics, representing both content and process skills: *Number and Operations; Algebra and Functions; Geometry and Measurement; Data, Statistics and Probability; Problem Solving; Representation; Reasoning; Connections and Communication*.
- Only standards for grades 9-12 were considered for these alignments. Within grades 9-12, the areas with the greatest concentration of alignments are the Number and Operations, Algebra and Geometry strands of the state standards. In most cases, Precalculus and Trigonometry were excluded from the alignment study.
- The organization and hierarchy of standards varies on a state-by-state basis. During the alignment process, the College Board aligned the PSAT/NMSQT skills to the most specific level of the state's standards.
- States often integrate process and content standards. In such cases, the state standard received an alignment to both a process skill category and a content skill category.
- Generally, there is strong correspondence between the PSAT/NMSQT Skills Categories in Mathematics and state standards. Coverage of the Skills Categories across a state standards document is dependent upon the specific state standards and on the degree of specificity of language employed within the standards.
- The PSAT/NMSQT is administered to students in grades 10 and 11; consequently, the strongest areas of alignment are in the content categories of *Number and Operations, Algebra and Functions* and *Geometry and Measurement* and in the process categories of *Problem Solving, Reasoning and Representations*. Considering the design and purpose of the PSAT/NMSQT, extensive alignments in upper levels of high school mathematics standards, including Trigonometry, are not intended or expected.

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<sup>1</sup> Using the access code printed on the PSAT/NMSQT *Roster of Student Scores and Plans*, SOAS reports can be downloaded from [www.collegeboard.com/reports](http://www.collegeboard.com/reports) beginning in the first week of January.

- The College Board content specialists who conducted the alignments have a deep understanding of the PSAT/NMSQT test specifications. Therefore, although multiple Skills Categories might link to a particular standard, these alignments display only the strongest and most appropriate matches.

## English Language Arts: Alignment Approach and Findings

- Reading and Writing each have five PSAT/NMSQT Skills Categories. In Reading, the categories are *Determining the Meaning of Words*, *Author’s Craft*, *Reasoning and Inferencing*, *Organization and Ideas* and *Understanding Literary Elements*. In Writing, the categories are *Manage Word Choice and Grammatical Relationships Between Words*, *Manage Grammatical Structures Used to Modify or Compare*, *Manage Phrases and Clauses in a Sentence*; *Recognize Correctly Formed Sentences* and *Manage Order and Relationships of Sentences and Paragraphs*.
- The PSAT/NMSQT is administered to students in grades 10 and 11, and the College Board targeted the English Language Arts alignments at these specific grade levels. In states where the standards are organized by grade band (grades 9-10, 11-12) or by one high school band (grades 9-12), the College Board aligned to all high school grade levels.
- Given the purpose and design of the PSAT/NMSQT, the English Language Arts alignment is focused on the areas of reading and writing and does not include state standards in speaking, listening, or media literacy. Additionally, these alignments excluded genre-specific state standards (such as those related to American, British, or World literature), although the essential PSAT/NMSQT skills in Reading can be used to support instruction in literature.
- The organization and hierarchy of standards varies on a state-by-state basis. During the alignment process, the College Board aligned the PSAT/NMSQT skills to the most specific level of the state’s standards. Coverage of the Skills Categories across a state standards document is dependent upon the specific state standards and on the degree of specificity of language employed within the standards.
- In Writing, generally there is strong correspondence between the PSAT/NMSQT Skills Categories and state standards that focus on grammar, usage, language conventions, and the role of editing and revising in writing.
- In Reading, there is strong correspondence between the PSAT/NMSQT Skills Categories and state standards in the essential areas of vocabulary development (determine the meaning of unfamiliar words or of words with multiple meanings by understanding context and by analyzing roots, prefixes, and suffixes) and reading comprehension (determine the main idea and supporting details; understand the organization of passages; analyze the various elements of an author’s craft, including purpose, perspective, word choice, and use of rhetorical and literary devices and understand literary elements such as plot, characterization, and setting).

## Summary

In summary, the PSAT/NMSQT Skills Categories correspond well to state standards. Educators can use these alignments to connect the PSAT/NMSQT to their local curricula and state standards to monitor student learning and to build a coherent instructional plan for their students.