

## **Appendix F. Prerequisite Mathematics Content Map (objective level)**

*Findings presented for CSS, HVAC, LPN, PT Introductory, PT Concluding, and AMT*

Key	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached

**Note** Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework		CSS					
		Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC
Number properties and operations	Number sense	Represent, interpret, or compare expressions for real numbers, including expressions using exponents and logarithms.	1-1-d	11%	67%	22%	0%	0%	0%
		Represent or interpret expressions involving very large or very small numbers in scientific notation.	1-1-f	100%	0%	0%	0%	0%	0%
		Represent, interpret, or compare expressions or problem situations involving absolute values.	1-1-g	89%	11%	0%	0%	0%	0%
	Estimation	Order or compare real numbers, including very large and very small real numbers.	1-1-i	33%	56%	11%	0%	0%	0%
		Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze the effect of the estimation method on the accuracy of results.	1-2-b	100%	0%	0%	0%	0%	0%
		Verify solutions or determine the reasonableness of results in a variety of situations.	1-2-c	89%	11%	0%	0%	0%	0%
		Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	1-2-d	89%	0%	11%	0%	0%	0%
		Find integral or simple fractional powers of real numbers.	1-3-a	67%	33%	0%	0%	0%	0%
		Perform arithmetic operations with real numbers, including common irrational numbers.	1-3-b	22%	67%	11%	0%	0%	0%
	Number operations	Perform arithmetic operations with expressions involving absolute value.	1-3-c	89%	11%	0%	0%	0%	0%
		Describe the effect of multiplying and dividing by numbers including the effect of multiplying or dividing a real number by zero or a number less than zero or a number between zero and one or one or a number greater than one.	1-3-d	100%	0%	0%	0%	0%	0%
		Solve application problems involving numbers, including rational and common irrationals.	1-3-f	22%	56%	22%	0%	0%	0%
	Ratios and proportional reasoning	Use proportions to solve problems (including rates of change).	1-4-c	89%	11%	0%	0%	0%	0%
		Solve multistep problems involving percentages, including compound percentages.	1-4-d	78%	11%	11%	0%	0%	0%
		Solve problems using factors, multiples, or prime factorization.	1-5-c	100%	0%	0%	0%	0%	0%
Use divisibility or remainders in problem settings.		1-5-d	78%	22%	0%	0%	0%	0%	
Properties of number and operations	Apply basic properties of operations, including conventions about the order of operations.	1-5-e	22%	56%	22%	0%	0%	0%	
	Recognize properties of the number system (whole numbers, integers, rational numbers, real numbers, and complex numbers) and how they are related to each other, and identify examples of each type of number.	1-5-f	100%	0%	0%	0%	0%	0%	
Mathematical reasoning using number	Give a mathematical argument to establish the validity of a simple numerical property or relationship.	1-6-a	100%	0%	0%	0%	0%	0%	
	Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	1-6-b	100%	0%	0%	0%	0%	0%	
Measurement	Measuring physical attributes	Determine the effect of proportions and scaling on length, area, and volume.	2-1-b	100%	0%	0%	0%	0%	0%
		Estimate or compare perimeters or areas of two-dimensional geometric figures.	2-1-c	100%	0%	0%	0%	0%	0%
		Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.	2-1-d	100%	0%	0%	0%	0%	0%
		Solve problems involving perimeter or area of plane figures such as polygons, circles, or composite figures.	2-1-f	89%	11%	0%	0%	0%	0%
		Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.	2-1-h	100%	0%	0%	0%	0%	0%
	Systems of measurement	Solve problems involving rates such as speed, density, population density, or flow rates.	2-1-i	100%	0%	0%	0%	0%	0%
		Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.	2-2-a	100%	0%	0%	0%	0%	0%
		Solve problems involving conversions within or between measurement systems, given the relationship between the units.	2-2-b	78%	22%	0%	0%	0%	0%
		Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation and must be assigned units of measurement.	2-2-d	89%	11%	0%	0%	0%	0%
		Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	2-2-e	89%	11%	0%	0%	0%	0%
	Measurement in triangles	Construct or solve problems involving scale drawings.	2-2-f	100%	0%	0%	0%	0%	0%
		Solve problems involving indirect measurement.	2-3-a	100%	0%	0%	0%	0%	0%
		Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	2-3-b	100%	0%	0%	0%	0%	0%
		Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	2-3-c	100%	0%	0%	0%	0%	0%
		Interpret and use the identity $\sin^2 \theta + \cos^2 \theta = 1$ for angles $\theta$ between $0^\circ$ and $90^\circ$ ; recognize this identity as a special representation of the Pythagorean theorem.	2-3-d	100%	0%	0%	0%	0%	0%
Geometry	Dimension and shape	Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.	2-3-e	100%	0%	0%	0%	0%	0%
		Use trigonometric formulas such as addition and double angle formulas.	2-3-f	100%	0%	0%	0%	0%	0%
		Use the law of cosines and the law of sines to find unknown sides and angles of a triangle.	2-3-g	100%	0%	0%	0%	0%	0%
	Transformation of shapes and preservation of properties	Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	3-1-c	100%	0%	0%	0%	0%	0%
		Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	3-1-d	89%	11%	0%	0%	0%	0%
		Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	3-1-e	89%	11%	0%	0%	0%	0%
		Analyze properties of three-dimensional figures including spheres and hemispheres.	3-1-f	100%	0%	0%	0%	0%	0%
		Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	3-2-a	100%	0%	0%	0%	0%	0%
		Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	3-2-b	100%	0%	0%	0%	0%	0%
	Relationships between geometric figures	Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, and dilations).	3-2-c	100%	0%	0%	0%	0%	0%
		Identify transformations, combinations, or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	3-2-d	100%	0%	0%	0%	0%	0%
		Justify relationships of congruence and similarity and apply these relationships using scaling and proportional reasoning.	3-2-e	100%	0%	0%	0%	0%	0%
		Perform or describe the effects of successive transformations.	3-2-g	100%	0%	0%	0%	0%	0%
		Apply geometric properties and relationships to solve problems in two and three dimensions.	3-3-b	89%	11%	0%	0%	0%	0%
		Represent problem situations with geometric models to solve mathematical or real-world problems.	3-3-c	100%	0%	0%	0%	0%	0%
Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.		3-3-d	100%	0%	0%	0%	0%	0%	
Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel, perpendicular and intersecting lines, and associated angle relationships.		3-3-e	100%	0%	0%	0%	0%	0%	
Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.		3-3-f	100%	0%	0%	0%	0%	0%	
Position, direction, and coordinate geometry	Analyze properties and relationships of parallel, perpendicular, or intersecting lines including the angle relationships that arise in these cases.	3-3-g	100%	0%	0%	0%	0%	0%	
	Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, and chords).	3-3-h	100%	0%	0%	0%	0%	0%	
	Solve problems involving the coordinate plane such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.	3-4-a	89%	11%	0%	0%	0%	0%	
	Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.	3-4-b	100%	0%	0%	0%	0%	0%	
	Describe or identify conic sections and other cross sections of solids.	3-4-c	100%	0%	0%	0%	0%	0%	
	Represent two-dimensional figures algebraically using coordinates and/or equations.	3-4-d	100%	0%	0%	0%	0%	0%	
	Use vectors to represent velocity and direction; multiply a vector by a scalar and add vectors both algebraically and graphically.	3-4-e	100%	0%	0%	0%	0%	0%	
	Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.	3-4-f	100%	0%	0%	0%	0%	0%	
Mathematical reasoning in geometry	Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.	3-4-g	100%	0%	0%	0%	0%	0%	
	Represent situations and solve problems involving polar coordinates.	3-4-h	100%	0%	0%	0%	0%	0%	
	Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counter examples.	3-5-a	100%	0%	0%	0%	0%	0%	
	Determine the role of hypotheses, logical implications, and conclusion in proofs of geometric theorems.	3-5-b	100%	0%	0%	0%	0%	0%	
	Analyze or explain a geometric argument by contradiction.	3-5-c	100%	0%	0%	0%	0%	0%	
Analyze or explain a geometric proof of the Pythagorean theorem.	3-5-d	100%	0%	0%	0%	0%	0%		
Prove basic theorems about congruent and similar triangles and circles.	3-5-e	100%	0%	0%	0%	0%	0%		

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		NAEP Framework		CSS					
Domain	Standard	Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC
Data analysis, statistics, and probability	Data representation	Read or interpret graphical or tabular representations of data.	4-1-a	89%	0%	11%	0%	0%	0%
		For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, and line graphs).	4-1-b	100%	0%	0%	0%	0%	0%
		Solve problems involving univariate or bivariate data.	4-1-c	100%	0%	0%	0%	0%	0%
		Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	4-1-d	67%	0%	11%	0%	22%	0%
		Compare and contrast different graphical representations of univariate and bivariate data.	4-1-e	89%	0%	0%	0%	11%	0%
		Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	4-1-f	89%	0%	0%	0%	11%	0%
	Characteristics of data sets	Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median, position (quartiles, percentiles) and spread (range, interquartile range, variance, and standard deviation).	4-2-a	100%	0%	0%	0%	0%	0%
		Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	4-2-b	100%	0%	0%	0%	0%	0%
		Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	4-2-c	100%	0%	0%	0%	0%	0%
		Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation) describing the same characteristic for two different populations or subsets of the same population.	4-2-d	100%	0%	0%	0%	0%	0%
		Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line and use the line or equation to make predictions.	4-2-e	100%	0%	0%	0%	0%	0%
		Recognize that the correlation coefficient is a number from -1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5, or 1.0) of a scatterplot.	4-2-f	100%	0%	0%	0%	0%	0%
		Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).	4-2-g	100%	0%	0%	0%	0%	0%
		Identify possible sources of bias in sample surveys and describe how such bias can be controlled and reduced.	4-3-a	100%	0%	0%	0%	0%	0%
	Experiments and samples	Recognize and describe a method to select a simple random sample.	4-3-b	100%	0%	0%	0%	0%	0%
		Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."	4-3-c	100%	0%	0%	0%	0%	0%
		Identify or evaluate the characteristics of a good survey or of a well-designed experiment.	4-3-d	100%	0%	0%	0%	0%	0%
		Recognize the differences in design and in conclusions between randomized experiments and observational studies.	4-3-e	100%	0%	0%	0%	0%	0%
	Probability	Recognize whether two events are independent or dependent.	4-4-a	100%	0%	0%	0%	0%	0%
		Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	4-4-b	100%	0%	0%	0%	0%	0%
		Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	4-4-c	100%	0%	0%	0%	0%	0%
		Use theoretical probability to evaluate or predict experimental outcomes.	4-4-d	100%	0%	0%	0%	0%	0%
		Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	4-4-e	100%	0%	0%	0%	0%	0%
		Determine the probability of independent and dependent events.	4-4-h	100%	0%	0%	0%	0%	0%
		Determine conditional probability using two-way tables.	4-4-i	100%	0%	0%	0%	0%	0%
		Interpret and apply probability concepts to practical situations.	4-4-j	100%	0%	0%	0%	0%	0%
		Use the binomial theorem to solve problems.	4-4-k	100%	0%	0%	0%	0%	0%
		Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.	4-5-a	100%	0%	0%	0%	0%	0%
	Mathematical reasoning with data	Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.	4-5-b	100%	0%	0%	0%	0%	0%
		Recognize, use, and distinguish between the processes of mathematical (deterministic) and statistical modeling.	4-5-c	100%	0%	0%	0%	0%	0%
Recognize when arguments based on data confuse correlation with causation.		4-5-d	100%	0%	0%	0%	0%	0%	
Recognize and explain the potential errors caused by extrapolating from data.		4-5-e	100%	0%	0%	0%	0%	0%	
Algebra	Patterns, relations, and functions	Recognize, describe, or extend numerical patterns, including arithmetic and geometric progressions.	5-1-a	89%	11%	0%	0%	0%	0%
		Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.	5-1-b	89%	11%	0%	0%	0%	0%
		Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	5-1-e	100%	0%	0%	0%	0%	0%
		Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	5-1-g	100%	0%	0%	0%	0%	0%
		Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.	5-1-h	100%	0%	0%	0%	0%	0%
		Determine the domain and range of functions given in various forms and contexts.	5-1-i	100%	0%	0%	0%	0%	0%
	Algebraic representations	Given a function, determine its inverse if it exists and explain the contextual meaning of the inverse for a given situation.	5-1-j	100%	0%	0%	0%	0%	0%
		Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	5-2-a	78%	22%	0%	0%	0%	0%
		Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	5-2-b	100%	0%	0%	0%	0%	0%
		Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	5-2-d	100%	0%	0%	0%	0%	0%
		Make inferences or predictions using an algebraic model of a situation.	5-2-e	100%	0%	0%	0%	0%	0%
		Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	5-2-f	100%	0%	0%	0%	0%	0%
		Solve problems involving exponential growth and decay.	5-2-g	100%	0%	0%	0%	0%	0%
		Analyze properties of exponential, logarithmic, and rational functions.	5-2-h	100%	0%	0%	0%	0%	0%
		Write algebraic expressions, equations, or inequalities to represent a situation.	5-3-b	56%	44%	0%	0%	0%	0%
		Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.	5-3-c	78%	22%	0%	0%	0%	0%
	Variables, expressions, and operations	Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.	5-3-d	89%	11%	0%	0%	0%	0%
		Evaluate algebraic expressions including polynomials and rational expressions.	5-3-e	89%	11%	0%	0%	0%	0%
		Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.	5-3-f	100%	0%	0%	0%	0%	0%
		Determine the sum of finite and infinite arithmetic and geometric series.	5-3-g	100%	0%	0%	0%	0%	0%
Use basic properties of exponents and *logarithms to solve problems.		5-3-h	100%	0%	0%	0%	0%	0%	
Solve linear, rational, or quadratic equations or inequalities, including those involving absolute value.		5-4-a	100%	0%	0%	0%	0%	0%	
Equations and inequalities	Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	5-4-c	67%	33%	0%	0%	0%	0%	
	Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	5-4-d	100%	0%	0%	0%	0%	0%	
	Solve problems involving special formulas such as $A = P(1 + r)^t$ , $A = Pert$ .	5-4-e	78%	22%	0%	0%	0%	0%	
	Solve an equation or formula involving several variables for one variable in terms of the others.	5-4-f	100%	0%	0%	0%	0%	0%	
	Solve quadratic equations with complex roots.	5-4-g	100%	0%	0%	0%	0%	0%	
	Use algebraic properties to develop a valid mathematical argument.	5-5-a	100%	0%	0%	0%	0%	0%	
Mathematical reasoning in algebra	Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.	5-5-b	100%	0%	0%	0%	0%	0%	
	Explain the use of relational conjunctions (and, or) in algebraic arguments.	5-5-c	89%	0%	0%	0%	11%	0%	

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App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached

**Note** Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain		NAEP Framework		HVAC					
Standard	Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC	
Number properties and operations	Number sense	Represent, interpret, or compare expressions for real numbers, including expressions using exponents and logarithms.	1-1-d	29%	53%	12%	0%	0%	
		Represent or interpret expressions involving very large or very small numbers in scientific notation.	1-1-f	94%	0%	0%	0%	0%	
		Represent, interpret, or compare expressions or problem situations involving absolute values.	1-1-g	94%	0%	0%	0%	0%	
		Order or compare real numbers, including very large and very small real numbers.	1-1-i	71%	12%	12%	0%	0%	
	Estimation	Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze the effect of the estimation method on the accuracy of results.	1-2-b	94%	0%	0%	0%	0%	
		Verify solutions or determine the reasonableness of results in a variety of situations.	1-2-c	88%	6%	0%	0%	0%	
		Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	1-2-d	94%	0%	0%	0%	0%	
		Find integral or simple fractional powers of real numbers.	1-3-a	88%	6%	0%	0%	0%	
	Number operations	Perform arithmetic operations with real numbers including common irrational numbers.	1-3-b	6%	65%	24%	0%	0%	
		Perform arithmetic operations with expressions involving absolute value.	1-3-c	94%	0%	0%	0%	0%	
		Describe the effect of multiplying and dividing by numbers including the effect of multiplying or dividing a real number by zero, or a number less than zero, or a number between zero and one, or one, or a number greater than one.	1-3-d	94%	0%	0%	0%	0%	
		Solve application problems involving numbers, including rational and common irrationals.	1-3-f	6%	35%	53%	0%	0%	
	Ratios and proportional reasoning	Use proportions to solve problems (including rates of change).	1-4-c	47%	35%	12%	0%	0%	
		Solve multistep problems involving percentages, including compound percentages.	1-4-d	71%	24%	0%	0%	0%	
		Solve problems using factors, multiples, or prime factorization.	1-5-c	94%	0%	0%	0%	0%	
		Use divisibility or remainders in problem settings.	1-5-d	82%	12%	0%	0%	0%	
	Properties of number and operations	Apply basic properties of operations, including conventions about the order of operations.	1-5-e	6%	76%	12%	0%	0%	
		Recognize properties of the number system (whole numbers, integers, rational numbers, real numbers, and complex numbers) and how they are related to each other, and identify examples of each type of number.	1-5-f	94%	0%	0%	0%	0%	
		Give a mathematical argument to establish the validity of a simple numerical property or relationship.	1-6-a	94%	0%	0%	0%	0%	
		Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	1-6-b	94%	0%	0%	0%	0%	
Measurement	Measuring physical attributes	Determine the effect of proportions and scaling on length, area, and volume.	2-1-b	82%	6%	6%	0%	0%	
		Estimate or compare perimeters or areas of two-dimensional geometric figures.	2-1-c	88%	6%	0%	0%	0%	
		Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.	2-1-d	94%	0%	0%	0%	0%	
		Solve problems involving perimeter or area of plane figures such as polygons, circles, or composite figures.	2-1-f	88%	6%	0%	0%	0%	
		Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.	2-1-h	76%	18%	0%	0%	0%	
		Solve problems involving rates such as speed, density, population density, or flow rates.	2-1-i	65%	24%	6%	0%	0%	
	Systems of measurement	Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.	2-2-a	47%	41%	6%	0%	0%	
		Solve problems involving conversions within or between measurement systems, given the relationship between the units.	2-2-b	29%	47%	18%	0%	0%	
		Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation, and must be assigned units of measurement.	2-2-d	41%	47%	6%	0%	0%	
		Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	2-2-e	82%	6%	6%	0%	0%	
	Measurement in triangles	Construct or solve problems involving scale drawings.	2-2-f	88%	0%	6%	0%	0%	
		Solve problems involving indirect measurement.	2-3-a	94%	0%	0%	0%	0%	
		Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	2-3-b	94%	0%	0%	0%	0%	
		Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	2-3-c	94%	0%	0%	0%	0%	
		Interpret and use the identity $\sin^2 \theta + \cos^2 \theta = 1$ for angles $\theta$ between $0^\circ$ and $90^\circ$ ; recognize this identity as a special representation of the Pythagorean theorem.	2-3-d	94%	0%	0%	0%	0%	
		Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.	2-3-e	94%	0%	0%	0%	0%	
Geometry	Dimension and shape	Use trigonometric formulas such as addition and double angle formulas.	2-3-f	94%	0%	0%	0%	0%	
		Use the law of sines and the law of cosines to find unknown sides and angles of a triangle.	2-3-g	94%	0%	0%	0%	0%	
		Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	3-1-c	94%	0%	0%	0%	0%	
		Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	3-1-d	59%	24%	12%	0%	0%	
	Transformation of shapes and preservation of properties	Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	3-1-e	47%	29%	18%	0%	0%	
		Analyze properties of three-dimensional figures including spheres and hemispheres.	3-1-f	94%	0%	0%	0%	0%	
		Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	3-2-a	94%	0%	0%	0%	0%	
		Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	3-2-b	94%	0%	0%	0%	0%	
		Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, and dilations).	3-2-c	94%	0%	0%	0%	0%	
		Identify transformations, combinations, or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	3-2-d	94%	0%	0%	0%	0%	
	Relationships between geometric figures	Justify relationships of congruence and similarity and apply these relationships using scaling and proportional reasoning.	3-2-e	88%	6%	0%	0%	0%	
		Perform or describe the effects of successive transformations.	3-2-g	94%	0%	0%	0%	0%	
		Apply geometric properties and relationships to solve problems in two and three dimensions.	3-3-b	94%	0%	0%	0%	0%	
		Represent problem situations with geometric models to solve mathematical or real-world problems.	3-3-c	94%	0%	0%	0%	0%	
		Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.	3-3-d	94%	0%	0%	0%	0%	
		Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel, perpendicular and intersecting lines, and associated angle relationships.	3-3-e	94%	0%	0%	0%	0%	
		Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.	3-3-f	94%	0%	0%	0%	0%	
		Analyze properties and relationships of parallel, perpendicular, or intersecting lines including the angle relationships that arise in these cases.	3-3-g	94%	0%	0%	0%	0%	
	Position, direction, and coordinate geometry	Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, and chords).	3-3-h	94%	0%	0%	0%	0%	
		Solve problems involving the coordinate plane such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.	3-4-a	94%	0%	0%	0%	0%	
Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.		3-4-b	94%	0%	0%	0%	0%		
Describe or identify conic sections and other cross sections of solids.		3-4-c	94%	0%	0%	0%	0%		
Represent two-dimensional figures algebraically using coordinates and/or equations.		3-4-d	94%	0%	0%	0%	0%		
Use vectors to represent velocity and direction; multiply a vector by a scalar and add vectors both algebraically and graphically.		3-4-e	94%	0%	0%	0%	0%		
Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.		3-4-f	94%	0%	0%	0%	0%		
Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.		3-4-g	94%	0%	0%	0%	0%		
Mathematical reasoning in geometry	Represent situations and solve problems involving polar coordinates.	3-4-h	94%	0%	0%	0%	0%		
	Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counter examples.	3-5-a	94%	0%	0%	0%	0%		
	Determine the role of hypotheses, logical implications, and conclusion in proofs of geometric theorems.	3-5-b	94%	0%	0%	0%	0%		
	Analyze or explain a geometric argument by contradiction.	3-5-c	94%	0%	0%	0%	0%		
	Analyze or explain a geometric proof of the Pythagorean theorem.	3-5-d	94%	0%	0%	0%	0%		
Prove basic theorems about congruent and similar triangles and circles.	3-5-e	94%	0%	0%	0%	0%			

Key	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached

**Note** Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework		HVAC					
		Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC
Data analysis, statistics, and probability	Data representation	Read or interpret graphical or tabular representations of data.	4-1-a	59%	24%	12%	0%	0%	0%
		For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, and line graphs).	4-1-b	76%	18%	0%	0%	0%	0%
		Solve problems involving univariate or bivariate data.	4-1-c	94%	0%	0%	0%	0%	0%
		Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	4-1-d	94%	0%	0%	0%	0%	0%
		Compare and contrast different graphical representations of univariate and bivariate data.	4-1-e	94%	0%	0%	0%	0%	0%
		Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	4-1-f	88%	6%	0%	0%	0%	0%
	Characteristics of data sets	Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median), position (quartiles, percentiles), and spread (range, interquartile range, variance, and standard deviation).	4-2-a	94%	0%	0%	0%	0%	0%
		Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	4-2-b	94%	0%	0%	0%	0%	0%
		Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	4-2-c	94%	0%	0%	0%	0%	0%
		Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation) describing the same characteristic for two different populations or subsets of the same population.	4-2-d	94%	0%	0%	0%	0%	0%
		Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line and use the line or equation to make predictions.	4-2-e	94%	0%	0%	0%	0%	0%
		Recognize that the correlation coefficient is a number from -1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5, or 1.0) of a scatterplot.	4-2-f	94%	0%	0%	0%	0%	0%
	Experiments and samples	Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).	4-2-g	94%	0%	0%	0%	0%	0%
		Identify possible sources of bias in sample surveys and describe how such bias can be controlled and reduced.	4-3-a	94%	0%	0%	0%	0%	0%
		Recognize and describe a method to select a simple random sample.	4-3-b	94%	0%	0%	0%	0%	0%
		Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."	4-3-c	94%	0%	0%	0%	0%	0%
		Identify or evaluate the characteristics of a good survey or of a well-designed experiment.	4-3-d	94%	0%	0%	0%	0%	0%
		Recognize the differences in design and in conclusions between randomized experiments and observational studies.	4-3-e	94%	0%	0%	0%	0%	0%
	Probability	Recognize whether two events are independent or dependent.	4-4-a	94%	0%	0%	0%	0%	0%
		Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	4-4-b	94%	0%	0%	0%	0%	0%
		Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	4-4-c	94%	0%	0%	0%	0%	0%
		Use theoretical probability to evaluate or predict experimental outcomes.	4-4-d	94%	0%	0%	0%	0%	0%
		Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	4-4-e	94%	0%	0%	0%	0%	0%
		Determine the probability of independent and dependent events.	4-4-f	94%	0%	0%	0%	0%	0%
		Determine conditional probability using two-way tables.	4-4-g	94%	0%	0%	0%	0%	0%
		Interpret and apply probability concepts to practical situations.	4-4-h	94%	0%	0%	0%	0%	0%
		Use the binomial theorem to solve problems.	4-4-i	94%	0%	0%	0%	0%	0%
		Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.	4-4-j	94%	0%	0%	0%	0%	0%
	Mathematical reasoning with data	Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.	4-5-a	94%	0%	0%	0%	0%	0%
		Recognize, use, and distinguish between the processes of mathematical (deterministic) and statistical modeling.	4-5-b	94%	0%	0%	0%	0%	0%
Recognize when arguments based on data confuse correlation with causation.		4-5-c	94%	0%	0%	0%	0%	0%	
Recognize and explain the potential errors caused by extrapolating from data.		4-5-d	94%	0%	0%	0%	0%	0%	
Algebra	Patterns, relations, and functions	Recognize, describe, or extend numerical patterns including arithmetic and geometric progressions.	5-1-a	94%	0%	0%	0%	0%	
		Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.	5-1-b	88%	0%	6%	0%	0%	
		Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	5-1-c	88%	6%	0%	0%	0%	
		Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	5-1-d	94%	0%	0%	0%	0%	
		Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.	5-1-e	94%	0%	0%	0%	0%	
	Algebraic representations	Determine the domain and range of functions given in various forms and contexts.	5-1-f	94%	0%	0%	0%	0%	
		Given a function, determine its inverse if it exists and explain the contextual meaning of the inverse for a given situation.	5-1-g	94%	0%	0%	0%	0%	
		Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	5-1-h	94%	0%	0%	0%	0%	
		Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	5-1-i	94%	0%	0%	0%	0%	
		Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	5-1-j	94%	0%	0%	0%	0%	
		Make inferences or predictions using an algebraic model of a situation.	5-2-a	94%	0%	0%	0%	0%	
		Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	5-2-b	88%	6%	0%	0%	0%	
		Solve problems involving exponential growth and decay.	5-2-c	94%	0%	0%	0%	0%	
		Analyze properties of exponential, logarithmic, and rational functions.	5-2-d	94%	0%	0%	0%	0%	
		Write algebraic expressions, equations, or inequalities to represent a situation.	5-2-e	94%	0%	0%	0%	0%	
	Variables, expressions, and operations	Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.	5-2-f	94%	0%	0%	0%	0%	
		Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.	5-3-a	82%	12%	0%	0%	0%	
		Evaluate algebraic expressions including polynomials and rational expressions.	5-3-b	76%	18%	0%	0%	0%	
		Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.	5-3-c	35%	59%	0%	0%	0%	
		Determine the sum of finite and infinite arithmetic and geometric series.	5-3-d	94%	0%	0%	0%	0%	
Use basic properties of exponents and *logarithms to solve problems.		5-3-e	94%	0%	0%	0%	0%		
Equations and inequalities	Solve linear, rational, or quadratic equations or inequalities, including those involving absolute value.	5-3-f	94%	0%	0%	0%	0%		
	Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	5-4-a	53%	41%	0%	0%	0%		
	Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	5-4-b	53%	41%	0%	0%	0%		
	Solve problems involving special formulas such as $A = P(1 + r)^t$ , $A = Pert$ .	5-4-c	94%	0%	0%	0%	0%		
	Solve an equation or formula involving several variables for one variable in terms of the others.	5-4-d	12%	12%	71%	0%	0%		
	Solve quadratic equations with complex roots.	5-4-e	82%	12%	0%	0%	0%		
	Solve quadratic equations with complex roots.	5-4-f	94%	0%	0%	0%	0%		
Mathematical reasoning in algebra	Use algebraic properties to develop a valid mathematical argument.	5-4-g	94%	0%	0%	0%	0%		
	Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.	5-5-a	94%	0%	0%	0%	0%		
	Explain the use of relational conjunctions (and, or) in algebraic arguments.	5-5-b	94%	0%	0%	0%	0%		

<b>Key</b>	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached
<b>Note</b>	Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework		LPN					
		Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC
Number properties and operations	Number sense	Represent, interpret, or compare expressions for real numbers, including expressions using exponents and logarithms.	1-1-d	0%	0%	100%	0%	0%	0%
		Represent or interpret expressions involving very large or very small numbers in scientific notation.	1-1-f	90%	0%	0%	0%	10%	0%
		Represent, interpret, or compare expressions or problem situations involving absolute values.	1-1-g	90%	0%	0%	0%	10%	0%
		Order or compare real numbers, including very large and very small real numbers.	1-1-i	50%	10%	30%	0%	0%	10%
	Estimation	Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze the effect of the estimation method on the accuracy of results.	1-2-b	70%	0%	10%	10%	0%	10%
		Verify solutions or determine the reasonableness of results in a variety of situations.	1-2-c	70%	0%	20%	0%	10%	0%
		Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	1-2-d	100%	0%	0%	0%	0%	0%
		Find integral or simple fractional powers of real numbers.	1-3-a	80%	0%	0%	0%	20%	0%
	Number operations	Perform arithmetic operations with real numbers, including common irrational numbers.	1-3-b	0%	0%	60%	30%	10%	0%
		Perform arithmetic operations with expressions involving absolute value.	1-3-c	90%	0%	0%	0%	10%	0%
		Describe the effect of multiplying and dividing by numbers including the effect of multiplying or dividing a real number by zero, or a number less than zero, or a number between zero and one, or a number greater than one.	1-3-d	100%	0%	0%	0%	0%	0%
		Solve application problems involving numbers, including rational and common irrationals.	1-3-f	0%	10%	70%	20%	0%	0%
	Ratios and proportional reasoning	Use proportions to solve problems (including rates of change).	1-4-c	0%	10%	30%	0%	60%	0%
		Solve multistep problems involving percentages, including compound percentages.	1-4-d	90%	10%	0%	0%	0%	0%
	Properties of number and operations	Solve problems using factors, multiples, or prime factorization.	1-5-c	60%	0%	20%	10%	10%	0%
		Use divisibility or remainders in problem settings.	1-5-d	80%	0%	20%	0%	0%	0%
		Apply basic properties of operations, including conventions about the order of operations.	1-5-e	0%	20%	80%	0%	0%	0%
	Mathematical reasoning using number	Recognize properties of the number system (whole numbers, integers, rational numbers, real numbers, and complex numbers) and how they are related to each other and identify examples of each type of number.	1-5-f	80%	10%	10%	0%	0%	0%
		Give a mathematical argument to establish the validity of a simple numerical property or relationship.	1-6-a	90%	0%	0%	0%	0%	10%
	Measurement	Measuring physical attributes	Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	1-6-b	100%	0%	0%	0%	0%
Determine the effect of proportions and scaling on length, area, and volume.			2-1-b	100%	0%	0%	0%	0%	0%
Estimate or compare perimeters or areas of two-dimensional geometric figures.			2-1-c	100%	0%	0%	0%	0%	0%
Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.			2-1-d	100%	0%	0%	0%	0%	0%
Solve problems involving perimeter or area of plane figures such as polygons, circles, or composite figures.			2-1-f	90%	10%	0%	0%	0%	0%
Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.			2-1-h	100%	0%	0%	0%	0%	0%
Solve problems involving rates such as speed, density, population density, or flow rates.			2-1-i	50%	0%	0%	0%	50%	0%
Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.			2-2-a	30%	0%	10%	0%	60%	0%
Solve problems involving conversions within or between measurement systems, given the relationship between the units.			2-2-b	20%	0%	10%	0%	70%	0%
Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation, and must be assigned units of measurement.			2-2-d	40%	10%	20%	10%	20%	0%
Measurement in triangles		Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	2-2-e	90%	0%	0%	0%	10%	0%
		Construct or solve problems involving scale drawings.	2-2-f	100%	0%	0%	0%	0%	0%
		Solve problems involving indirect measurement.	2-3-a	100%	0%	0%	0%	0%	0%
		Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	2-3-b	100%	0%	0%	0%	0%	0%
		Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	2-3-c	100%	0%	0%	0%	0%	0%
		Interpret and use the identity $\sin^2 \theta + \cos^2 \theta = 1$ for angles $\theta$ between $0^\circ$ and $90^\circ$ ; recognize this identity as a special representation of the Pythagorean theorem.	2-3-d	100%	0%	0%	0%	0%	0%
		Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.	2-3-e	100%	0%	0%	0%	0%	0%
		Use trigonometric formulas such as addition and double angle formulas.	2-3-f	100%	0%	0%	0%	0%	0%
		Use the law of cosines and the law of sines to find unknown sides and angles of a triangle.	2-3-g	100%	0%	0%	0%	0%	0%
		Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	3-1-c	100%	0%	0%	0%	0%	0%
Geometry	Dimension and shape	Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	3-1-d	100%	0%	0%	0%	0%	0%
		Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	3-1-e	100%	0%	0%	0%	0%	0%
		Analyze properties of three-dimensional figures including spheres and hemispheres.	3-1-f	100%	0%	0%	0%	0%	0%
		Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	3-2-a	100%	0%	0%	0%	0%	0%
	Transformation of shapes and preservation of properties	Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	3-2-b	100%	0%	0%	0%	0%	0%
		Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, and dilations).	3-2-c	100%	0%	0%	0%	0%	0%
		Identify transformations, combinations, or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	3-2-d	100%	0%	0%	0%	0%	0%
		Justify relationships of congruence and similarity and apply these relationships using scaling and proportional reasoning.	3-2-e	100%	0%	0%	0%	0%	0%
	Relationships between geometric figures	Perform or describe the effects of successive transformations.	3-2-g	100%	0%	0%	0%	0%	0%
		Apply geometric properties and relationships to solve problems in two and three dimensions.	3-3-b	90%	10%	0%	0%	0%	0%
		Represent problem situations with geometric models to solve mathematical or real-world problems.	3-3-c	90%	10%	0%	0%	0%	0%
		Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.	3-3-d	100%	0%	0%	0%	0%	0%
		Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel, perpendicular and intersecting lines, and associated angle relationships.	3-3-e	100%	0%	0%	0%	0%	0%
		Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.	3-3-f	100%	0%	0%	0%	0%	0%
		Analyze properties and relationships of parallel, perpendicular, or intersecting lines including the angle relationships that arise in these cases.	3-3-g	100%	0%	0%	0%	0%	0%
		Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, and chords).	3-3-h	100%	0%	0%	0%	0%	0%
	Position, direction, and coordinate geometry	Solve problems involving the coordinate plane such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.	3-4-a	90%	0%	0%	0%	10%	0%
		Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.	3-4-b	90%	10%	0%	0%	0%	0%
		Describe or identify conic sections and other cross sections of solids.	3-4-c	100%	0%	0%	0%	0%	0%
		Represent two-dimensional figures algebraically using coordinates and/or equations.	3-4-d	80%	0%	0%	0%	20%	0%
Use vectors to represent velocity and direction; multiply a vector by a scalar and add vectors both algebraically and graphically.		3-4-e	100%	0%	0%	0%	0%	0%	
Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.		3-4-f	100%	0%	0%	0%	0%	0%	
Mathematical reasoning in geometry	Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.	3-4-g	100%	0%	0%	0%	0%	0%	
	Represent situations and solve problems involving polar coordinates.	3-4-h	100%	0%	0%	0%	0%	0%	
	Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counter examples.	3-5-a	100%	0%	0%	0%	0%	0%	
	Determine the role of hypotheses, logical implications, and conclusion in proofs of geometric theorems.	3-5-b	100%	0%	0%	0%	0%	0%	
	Analyze or explain a geometric argument by contradiction.	3-5-c	100%	0%	0%	0%	0%	0%	
Analyze or explain a geometric proof of the Pythagorean theorem.	3-5-d	100%	0%	0%	0%	0%	0%		
Prove basic theorems about congruent and similar triangles and circles.	3-5-e	100%	0%	0%	0%	0%	0%		



<b>Key</b>	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached
<b>Note</b>	Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework		LPN					
		Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC
Data analysis, statistics, and probability	Data representation	Read or interpret graphical or tabular representations of data.	4-1-a	100%	0%	0%	0%	0%	0%
		For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, and line graphs).	4-1-b	100%	0%	0%	0%	0%	0%
		Solve problems involving univariate or bivariate data.	4-1-c	100%	0%	0%	0%	0%	0%
		Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	4-1-d	100%	0%	0%	0%	0%	0%
		Compare and contrast different graphical representations of univariate and bivariate data.	4-1-e	100%	0%	0%	0%	0%	0%
		Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	4-1-f	100%	0%	0%	0%	0%	0%
	Characteristics of data sets	Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median), position (quartiles, percentiles) and spread (range, interquartile range, variance and standard deviation).	4-2-a	100%	0%	0%	0%	0%	0%
		Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	4-2-b	100%	0%	0%	0%	0%	0%
		Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	4-2-c	100%	0%	0%	0%	0%	0%
		Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation) describing the same characteristic for two different populations or subsets of the same population.	4-2-d	100%	0%	0%	0%	0%	0%
		Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line and use the line or equation to make predictions.	4-2-e	100%	0%	0%	0%	0%	0%
		Recognize that the correlation coefficient is a number from -1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5, or 1.0) of a scatterplot.	4-2-f	100%	0%	0%	0%	0%	0%
		Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).	4-2-g	100%	0%	0%	0%	0%	0%
	Experiments and samples	Identify possible sources of bias in sample surveys and describe how such bias can be controlled and reduced.	4-3-a	100%	0%	0%	0%	0%	0%
		Recognize and describe a method to select a simple random sample.	4-3-b	100%	0%	0%	0%	0%	0%
		Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."	4-3-c	100%	0%	0%	0%	0%	0%
		Identify or evaluate the characteristics of a good survey or of a well-designed experiment.	4-3-d	100%	0%	0%	0%	0%	0%
		Recognize the differences in design and in conclusions between randomized experiments and observational studies.	4-3-e	100%	0%	0%	0%	0%	0%
	Probability	Recognize whether two events are independent or dependent.	4-4-a	100%	0%	0%	0%	0%	0%
		Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	4-4-b	100%	0%	0%	0%	0%	0%
		Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	4-4-c	100%	0%	0%	0%	0%	0%
		Use theoretical probability to evaluate or predict experimental outcomes.	4-4-d	100%	0%	0%	0%	0%	0%
		Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	4-4-e	100%	0%	0%	0%	0%	0%
		Determine the probability of independent and dependent events.	4-4-h	100%	0%	0%	0%	0%	0%
		Determine conditional probability using two-way tables.	4-4-i	100%	0%	0%	0%	0%	0%
		Interpret and apply probability concepts to practical situations.	4-4-j	100%	0%	0%	0%	0%	0%
	Mathematical reasoning with data	Use the binomial theorem to solve problems.	4-4-k	100%	0%	0%	0%	0%	0%
		Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.	4-5-a	100%	0%	0%	0%	0%	0%
		Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.	4-5-b	80%	0%	0%	0%	20%	0%
		Recognize, use, and distinguish between the processes of mathematical (deterministic) and statistical modeling.	4-5-c	100%	0%	0%	0%	0%	0%
Recognize when arguments based on data confuse correlation with causation.		4-5-d	100%	0%	0%	0%	0%	0%	
Algebra	Patterns, relations, and functions	Recognize and explain the potential errors caused by extrapolating from data.	4-5-e	100%	0%	0%	0%	0%	0%
		Recognize, describe, or extend numerical patterns, including arithmetic and geometric progressions.	5-1-a	100%	0%	0%	0%	0%	0%
		Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.	5-1-b	100%	0%	0%	0%	0%	0%
		Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	5-1-e	90%	0%	0%	0%	10%	0%
		Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	5-1-g	90%	0%	0%	0%	10%	0%
		Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.	5-1-h	90%	0%	0%	0%	10%	0%
	Algebraic representations	Determine the domain and range of functions given in various forms and contexts.	5-1-i	90%	0%	0%	0%	10%	0%
		Given a function, determine its inverse if it exists and explain the contextual meaning of the inverse for a given situation.	5-1-j	100%	0%	0%	0%	0%	0%
		Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	5-2-a	20%	0%	50%	20%	10%	0%
		Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	5-2-b	20%	0%	40%	30%	0%	10%
		Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	5-2-d	100%	0%	0%	0%	0%	0%
		Make inferences or predictions using an algebraic model of a situation.	5-2-e	100%	0%	0%	0%	0%	0%
		Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	5-2-f	100%	0%	0%	0%	0%	0%
		Solve problems involving exponential growth and decay.	5-2-g	100%	0%	0%	0%	0%	0%
		Analyze properties of exponential, logarithmic, and rational functions.	5-2-h	100%	0%	0%	0%	0%	0%
		Write algebraic expressions, equations, or inequalities to represent a situation.	5-3-b	20%	0%	0%	0%	80%	0%
		Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.	5-3-c	60%	0%	0%	0%	40%	0%
		Variables, expressions, and operations	Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.	5-3-d	80%	0%	0%	10%	10%
Evaluate algebraic expressions including polynomials and rational expressions.	5-3-e		70%	0%	0%	10%	20%	0%	
Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.	5-3-f		90%	10%	0%	0%	0%	0%	
Determine the sum of finite and infinite arithmetic and geometric series.	5-3-g		100%	0%	0%	0%	0%	0%	
Use basic properties of exponents and *logarithms to solve problems.	5-3-h		80%	0%	10%	10%	0%	0%	
Solve linear, rational, or quadratic equations or inequalities, including those involving absolute value.	5-4-a		20%	0%	70%	0%	10%	0%	
Equations and inequalities	Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	5-4-c	20%	0%	0%	0%	80%	0%	
	Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	5-4-d	80%	0%	0%	0%	20%	0%	
	Solve problems involving special formulas such as $A = P(1 + r)^t$ , $A = Pert$ .	5-4-e	10%	0%	0%	0%	90%	0%	
	Solve an equation or formula involving several variables for one variable in terms of the others.	5-4-f	70%	0%	0%	0%	30%	0%	
	Solve quadratic equations with complex roots.	5-4-g	90%	0%	0%	0%	10%	0%	
	Use algebraic properties to develop a valid mathematical argument.	5-5-a	100%	0%	0%	0%	0%	0%	
Mathematical reasoning in algebra	Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.	5-5-b	100%	0%	0%	0%	0%	0%	
	Explain the use of relational conjunctions (and, or) in algebraic arguments.	5-5-c	100%	0%	0%	0%	0%	0%	

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Domain	Standard	NAEP Framework Objective	KSA ID	PT (Intro)					
				NA	App-NI	App-I	App-NC	New	NC
Number properties and operations	Number sense	Represent, interpret, or compare expressions for real numbers, including expressions using exponents and logarithms.	1-1-d	20%	5%	60%	0%	0%	15%
		Represent or interpret expressions involving very large or very small numbers in scientific notation.	1-1-f	70%	10%	0%	0%	15%	5%
		Represent, interpret, or compare expressions or problem situations involving absolute values.	1-1-g	100%	0%	0%	0%	0%	0%
		Order or compare real numbers, including very large and very small real numbers.	1-1-i	60%	10%	5%	5%	5%	15%
	Estimation	Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze the effect of the estimation method on the accuracy of results.	1-2-b	55%	5%	0%	10%	15%	15%
		Verify solutions or determine the reasonableness of results in a variety of situations.	1-2-c	60%	5%	0%	0%	20%	15%
		Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	1-2-d	100%	0%	0%	0%	0%	0%
	Number operations	Find integral or simple fractional powers of real numbers.	1-3-a	95%	0%	0%	0%	5%	0%
		Perform arithmetic operations with real numbers, including common irrational numbers.	1-3-b	15%	0%	75%	5%	0%	5%
		Perform arithmetic operations with expressions involving absolute value.	1-3-c	100%	0%	0%	0%	0%	0%
		Describe the effect of multiplying and dividing by numbers including the effect of multiplying or dividing a real number by zero, or a number less than zero, or a number between zero and one, or one, or a number greater than one.	1-3-d	95%	0%	0%	0%	0%	5%
		Solve application problems involving numbers, including rational and common irrationals.	1-3-f	15%	5%	75%	5%	0%	0%
	Ratios and proportional reasoning	Use proportions to solve problems (including rates of change).	1-4-c	10%	0%	30%	0%	40%	20%
		Solve multistep problems involving percentages, including compound percentages.	1-4-d	30%	0%	45%	5%	5%	15%
	Properties of number and operations	Solve problems using factors, multiples, or prime factorization.	1-5-c	65%	5%	5%	5%	20%	0%
		Use divisibility or remainders in problem settings.	1-5-d	75%	5%	0%	5%	15%	0%
		Apply basic properties of operations, including conventions about the order of operations.	1-5-e	30%	5%	5%	25%	25%	10%
	Mathematical reasoning using number	Recognize properties of the number system (whole numbers, integers, rational numbers, real numbers, and complex numbers) and how they are related to each other, and identify examples of each type of number.	1-5-f	85%	0%	10%	0%	0%	5%
Give a mathematical argument to establish the validity of a simple numerical property or relationship.		1-6-a	95%	0%	0%	0%	0%	5%	
Measurement	Measuring physical attributes	Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	1-6-b	100%	0%	0%	0%	0%	0%
		Determine the effect of proportions and scaling on length, area, and volume.	2-1-b	85%	0%	0%	0%	5%	10%
		Estimate or compare perimeters or areas of two-dimensional geometric figures.	2-1-c	95%	0%	0%	0%	5%	0%
		Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.	2-1-d	95%	0%	0%	0%	5%	0%
		Solve problems involving perimeter or area of plane figures such as polygons, circles, or composite figures.	2-1-f	90%	5%	0%	0%	5%	0%
		Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.	2-1-h	95%	0%	0%	0%	0%	5%
	Systems of measurement	Solve problems involving rates such as speed, density, population density, or flow rates.	2-1-i	45%	5%	0%	0%	45%	5%
		Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.	2-2-a	40%	0%	0%	5%	40%	15%
		Solve problems involving conversions within or between measurement systems, given the relationship between the units.	2-2-b	10%	5%	0%	5%	40%	40%
		Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation, and must be assigned units of measurement.	2-2-d	35%	5%	5%	10%	35%	10%
		Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	2-2-e	60%	0%	5%	5%	25%	5%
		Construct or solve problems involving scale drawings.	2-2-f	95%	0%	0%	0%	5%	0%
	Measurement in triangles	Solve problems involving indirect measurement.	2-3-a	100%	0%	0%	0%	0%	0%
		Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	2-3-b	95%	0%	0%	0%	5%	0%
		Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	2-3-c	95%	0%	0%	0%	5%	0%
		Interpret and use the identity $\sin^2 \theta + \cos^2 \theta = 1$ for angles $\theta$ between $0^\circ$ and $90^\circ$ ; recognize this identity as a special representation of the Pythagorean theorem.	2-3-d	100%	0%	0%	0%	0%	0%
		Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.	2-3-e	100%	0%	0%	0%	0%	0%
		Use trigonometric formulas such as addition and double angle formulas.	2-3-f	100%	0%	0%	0%	0%	0%
Geometry	Dimension and shape	Use the law of cosines and the law of sines to find unknown sides and angles of a triangle.	2-3-g	100%	0%	0%	0%	0%	0%
		Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	3-1-c	95%	5%	0%	0%	0%	0%
		Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	3-1-d	100%	0%	0%	0%	0%	0%
		Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	3-1-e	90%	0%	0%	0%	10%	0%
	Transformation of shapes and preservation of properties	Analyze properties of three-dimensional figures including spheres and hemispheres.	3-1-f	100%	0%	0%	0%	0%	0%
		Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	3-2-a	100%	0%	0%	0%	0%	0%
		Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	3-2-b	100%	0%	0%	0%	0%	0%
		Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, and dilations).	3-2-c	100%	0%	0%	0%	0%	0%
		Identify transformations, combinations, or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	3-2-d	100%	0%	0%	0%	0%	0%
		Justify relationships of congruence and similarity and apply these relationships using scaling and proportional reasoning.	3-2-e	100%	0%	0%	0%	0%	0%
	Relationships between geometric figures	Perform or describe the effects of successive transformations.	3-2-g	100%	0%	0%	0%	0%	0%
		Apply geometric properties and relationships to solve problems in two and three dimensions.	3-3-b	90%	10%	0%	0%	0%	0%
		Represent problem situations with geometric models to solve mathematical or real-world problems.	3-3-c	95%	5%	0%	0%	0%	0%
		Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.	3-3-d	100%	0%	0%	0%	0%	0%
		Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel perpendicular and intersecting lines and associated angle relationships.	3-3-e	95%	5%	0%	0%	0%	0%
		Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.	3-3-f	100%	0%	0%	0%	0%	0%
	Position, direction, and coordinate geometry	Analyze properties and relationships of parallel, perpendicular, or intersecting lines including the angle relationships that arise in these cases.	3-3-g	100%	0%	0%	0%	0%	0%
		Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, and chords).	3-3-h	100%	0%	0%	0%	0%	0%
Solve problems involving the coordinate plane such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.		3-4-a	95%	0%	0%	0%	5%	0%	
Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.		3-4-b	100%	0%	0%	0%	0%	0%	
Describe or identify conic sections and other cross sections of solids.		3-4-c	100%	0%	0%	0%	0%	0%	
Represent two-dimensional figures algebraically using coordinates and/or equations.		3-4-d	95%	0%	0%	0%	5%	0%	
Mathematical reasoning in geometry	Use vectors to represent velocity and direction; multiply a vector by a scalar and add vectors both algebraically and graphically.	3-4-e	100%	0%	0%	0%	0%	0%	
	Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.	3-4-f	100%	0%	0%	0%	0%	0%	
	Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.	3-4-g	100%	0%	0%	0%	0%	0%	
	Represent situations and solve problems involving polar coordinates.	3-4-h	100%	0%	0%	0%	0%	0%	
	Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counter examples.	3-5-a	100%	0%	0%	0%	0%	0%	
Mathematical reasoning in geometry	Determine the role of hypotheses, logical implications, and conclusion in proofs of geometric theorems.	3-5-b	100%	0%	0%	0%	0%	0%	
	Analyze or explain a geometric argument by contradiction.	3-5-c	100%	0%	0%	0%	0%	0%	
	Analyze or explain a geometric proof of the Pythagorean theorem.	3-5-d	100%	0%	0%	0%	0%	0%	
	Prove basic theorems about congruent and similar triangles and circles.	3-5-e	100%	0%	0%	0%	0%	0%	



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NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
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<b>Note</b>	Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework		PT (Intro)					
		Objective	KSA ID	NA	App-NI	App-I	App-NC	New	NC
Data analysis, statistics, and probability	Data representation	Read or interpret graphical or tabular representations of data.	4-1-a	75%	0%	0%	10%	15%	0%
		For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, and line graphs).	4-1-b	90%	0%	0%	5%	5%	0%
		Solve problems involving univariate or bivariate data.	4-1-c	100%	0%	0%	0%	0%	0%
		Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	4-1-d	100%	0%	0%	0%	0%	0%
		Compare and contrast different graphical representations of univariate and bivariate data.	4-1-e	100%	0%	0%	0%	0%	0%
		Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	4-1-f	100%	0%	0%	0%	0%	0%
	Characteristics of data sets	Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median), position (quartiles, percentiles), and spread (range, interquartile range, variance, and standard deviation).	4-2-a	95%	0%	0%	0%	5%	0%
		Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	4-2-b	100%	0%	0%	0%	0%	0%
		Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	4-2-c	100%	0%	0%	0%	0%	0%
		Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation) describing the same characteristic for two different populations or subsets of the same population.	4-2-d	100%	0%	0%	0%	0%	0%
		Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line and use the line or equation to make predictions.	4-2-e	100%	0%	0%	0%	0%	0%
		Recognize that the correlation coefficient is a number from -1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5, or 1.0) of a scatterplot.	4-2-f	100%	0%	0%	0%	0%	0%
	Experiments and samples	Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).	4-2-g	100%	0%	0%	0%	0%	0%
		Identify possible sources of bias in sample surveys and describe how such bias can be controlled and reduced.	4-3-a	100%	0%	0%	0%	0%	0%
		Recognize and describe a method to select a simple random sample.	4-3-b	100%	0%	0%	0%	0%	0%
		Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."	4-3-c	100%	0%	0%	0%	0%	0%
		Identify or evaluate the characteristics of a good survey or of a well-designed experiment.	4-3-d	100%	0%	0%	0%	0%	0%
		Recognize the differences in design and in conclusions between randomized experiments and observational studies.	4-3-e	100%	0%	0%	0%	0%	0%
	Probability	Recognize whether two events are independent or dependent.	4-4-a	100%	0%	0%	0%	0%	0%
		Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	4-4-b	100%	0%	0%	0%	0%	0%
		Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	4-4-c	100%	0%	0%	0%	0%	0%
		Use theoretical probability to evaluate or predict experimental outcomes.	4-4-d	100%	0%	0%	0%	0%	0%
		Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	4-4-e	100%	0%	0%	0%	0%	0%
		Determine the probability of independent and dependent events.	4-4-h	100%	0%	0%	0%	0%	0%
	Mathematical reasoning with data	Determine conditional probability using two-way tables.	4-4-i	100%	0%	0%	0%	0%	0%
		Interpret and apply probability concepts to practical situations.	4-4-j	100%	0%	0%	0%	0%	0%
		Use the binomial theorem to solve problems.	4-4-k	100%	0%	0%	0%	0%	0%
		Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.	4-5-a	100%	0%	0%	0%	0%	0%
		Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.	4-5-b	85%	0%	0%	0%	15%	0%
		Recognize, use, and distinguish between the processes of mathematical (deterministic) and statistical modeling.	4-5-c	100%	0%	0%	0%	0%	0%
Algebra	Patterns, relations, and functions	Recognize when arguments based on data confuse correlation with causation.	4-5-d	100%	0%	0%	0%	0%	0%
		Recognize and explain the potential errors caused by extrapolating from data.	4-5-e	100%	0%	0%	0%	0%	0%
		Recognize, describe, or extend numerical patterns, including arithmetic and geometric progressions.	5-1-a	100%	0%	0%	0%	0%	0%
		Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.	5-1-b	100%	0%	0%	0%	0%	0%
		Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	5-1-e	100%	0%	0%	0%	0%	0%
		Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	5-1-g	100%	0%	0%	0%	0%	0%
	Algebraic representations	Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.	5-1-h	100%	0%	0%	0%	0%	0%
		Determine the domain and range of functions given in various forms and contexts.	5-1-i	100%	0%	0%	0%	0%	0%
		Given a function, determine its inverse if it exists and explain the contextual meaning of the inverse for a given situation.	5-1-j	100%	0%	0%	0%	0%	0%
		Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	5-2-a	90%	0%	0%	0%	0%	10%
		Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	5-2-b	90%	0%	0%	5%	0%	5%
		Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	5-2-d	100%	0%	0%	0%	0%	0%
	Variables, expressions, and operations	Make inferences or predictions using an algebraic model of a situation.	5-2-e	100%	0%	0%	0%	0%	0%
		Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	5-2-f	100%	0%	0%	0%	0%	0%
		Solve problems involving exponential growth and decay.	5-2-g	100%	0%	0%	0%	0%	0%
		Analyze properties of exponential, logarithmic, and rational functions.	5-2-h	100%	0%	0%	0%	0%	0%
		Write algebraic expressions, equations, or inequalities to represent a situation.	5-3-b	50%	0%	0%	0%	30%	20%
		Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.	5-3-c	90%	0%	5%	0%	5%	0%
	Equations and inequalities	Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.	5-3-d	90%	0%	0%	0%	0%	10%
		Evaluate algebraic expressions including polynomials and rational expressions.	5-3-e	85%	0%	0%	0%	10%	5%
		Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.	5-3-f	100%	0%	0%	0%	0%	0%
		Determine the sum of finite and infinite arithmetic and geometric series.	5-3-g	100%	0%	0%	0%	0%	0%
		Use basic properties of exponents and *logarithms to solve problems.	5-3-h	95%	0%	0%	5%	0%	0%
		Solve linear, rational, or quadratic equations or inequalities, including those involving absolute value.	5-4-a	65%	0%	10%	25%	0%	0%
	Mathematical reasoning in algebra	Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	5-4-c	55%	5%	0%	0%	40%	0%
		Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	5-4-d	95%	5%	0%	0%	0%	0%
		Solve problems involving special formulas such as $A = P(1 + r)^t$ , $A = Pert$ .	5-4-e	45%	0%	0%	0%	40%	15%
		Solve an equation or formula involving several variables for one variable in terms of the others.	5-4-f	95%	0%	0%	0%	5%	0%
		Solve quadratic equations with complex roots.	5-4-g	100%	0%	0%	0%	0%	0%
		Use algebraic properties to develop a valid mathematical argument.	5-5-a	100%	0%	0%	0%	0%	0%
	Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.	5-5-b	100%	0%	0%	0%	0%	0%	
	Explain the use of relational conjunctions (and, or) in algebraic arguments.	5-5-c	100%	0%	0%	0%	0%	0%	

<b>Key</b>	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached
<b>Note</b>	Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework Objective	KSA ID	PT (Concluding)						
				NA	App-NI	App-I	App-NC	New	NC	
Number properties and operations	Number sense	Represent, interpret, or compare expressions for real numbers, including expressions using exponents and logarithms.	1-1-d	60%	13%	7%	20%	0%	0%	
		Represent or interpret expressions involving very large or very small numbers in scientific notation.	1-1-f	87%	0%	0%	0%	13%	0%	
		Represent, interpret, or compare expressions or problem situations involving absolute values.	1-1-g	100%	0%	0%	0%	0%	0%	
		Order or compare real numbers including very large and very small real numbers.	1-1-i	87%	0%	0%	0%	13%	0%	
	Estimation	Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze the effect of the estimation method on the accuracy of results.	1-2-b	87%	0%	13%	0%	0%	0%	
		Verify solutions or determine the reasonableness of results in a variety of situations.	1-2-c	73%	0%	0%	0%	27%	0%	
		Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	1-2-d	100%	0%	0%	0%	0%	0%	
	Number operations	Find integral or simple fractional powers of real numbers.	1-3-a	100%	0%	0%	0%	0%	0%	
		Perform arithmetic operations with real numbers, including common irrational numbers.	1-3-b	60%	0%	40%	0%	0%	0%	
		Perform arithmetic operations with expressions involving absolute value.	1-3-c	100%	0%	0%	0%	0%	0%	
	Ratios and proportional reasoning	Describe the effect of multiplying and dividing by numbers including the effect of multiplying or dividing a real number by zero, or a number less than zero, or a number between zero and one, or one, or a number greater than one.	1-3-d	93%	0%	0%	7%	0%	0%	
		Solve application problems involving numbers, including rational and common irrationals.	1-3-f	53%	0%	40%	7%	0%	0%	
		Use proportions to solve problems (including rates of change).	1-4-c	0%	7%	20%	13%	47%	13%	
	Properties of number and operations	Solve multistep problems involving percentages, including compound percentages.	1-4-d	53%	0%	33%	7%	0%	7%	
		Solve problems using factors, multiples, or prime factorization.	1-5-c	87%	7%	0%	0%	7%	0%	
		Use divisibility or remainders in problem settings.	1-5-d	67%	7%	13%	0%	7%	7%	
	Mathematical reasoning using number	Apply basic properties of operations, including conventions about the order of operations.	1-5-e	0%	0%	73%	13%	0%	13%	
		Recognize properties of the number system (whole numbers, integers, rational numbers, real numbers, and complex numbers) and how they are related to each other, and identify examples of each type of number.	1-5-f	100%	0%	0%	0%	0%	0%	
Give a mathematical argument to establish the validity of a simple numerical property or relationship.		1-6-a	100%	0%	0%	0%	0%	0%		
Measurement	Measuring physical attributes	Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	1-6-b	100%	0%	0%	0%	0%	0%	
		Determine the effect of proportions and scaling on length, area and volume.	2-1-b	100%	0%	0%	0%	0%	0%	
		Estimate or compare perimeters or areas of two-dimensional geometric figures.	2-1-c	100%	0%	0%	0%	0%	0%	
		Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.	2-1-d	100%	0%	0%	0%	0%	0%	
	Systems of measurement	Solve problems involving perimeter or area of plane figures such as polygons, circles, or composite figures.	2-1-f	100%	0%	0%	0%	0%	0%	
		Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.	2-1-h	100%	0%	0%	0%	0%	0%	
		Solve problems involving rates such as speed, density, population density, or flow rates.	2-1-i	7%	0%	0%	20%	73%	0%	
		Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.	2-2-a	27%	7%	7%	0%	53%	7%	
		Solve problems involving conversions within or between measurement systems, given the relationship between the units.	2-2-b	0%	0%	20%	20%	60%	0%	
		Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation, and must be assigned units of measurement.	2-2-d	27%	0%	40%	7%	20%	7%	
	Measurement in triangles	Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	2-2-e	53%	0%	0%	13%	33%	0%	
		Construct or solve problems involving scale drawings.	2-2-f	100%	0%	0%	0%	0%	0%	
		Solve problems involving indirect measurement.	2-3-a	100%	0%	0%	0%	0%	0%	
		Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	2-3-b	100%	0%	0%	0%	0%	0%	
		Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	2-3-c	100%	0%	0%	0%	0%	0%	
		Interpret and use the identity $\sin^2 \theta + \cos^2 \theta = 1$ for angles $\theta$ between $0^\circ$ and $90^\circ$ ; recognize this identity as a special representation of the Pythagorean theorem.	2-3-d	100%	0%	0%	0%	0%	0%	
	Geometry	Dimension and shape	Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.	2-3-e	100%	0%	0%	0%	0%	0%
			Use trigonometric formulas such as addition and double angle formulas.	2-3-f	100%	0%	0%	0%	0%	0%
Use the law of cosines and the law of sines to find unknown sides and angles of a triangle.			2-3-g	100%	0%	0%	0%	0%	0%	
Transformation of shapes and preservation of properties		Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	3-1-c	100%	0%	0%	0%	0%	0%	
		Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	3-1-d	100%	0%	0%	0%	0%	0%	
		Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	3-1-e	93%	0%	0%	0%	7%	0%	
		Analyze properties of three-dimensional figures including spheres and hemispheres.	3-1-f	100%	0%	0%	0%	0%	0%	
		Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	3-2-a	100%	0%	0%	0%	0%	0%	
		Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	3-2-b	100%	0%	0%	0%	0%	0%	
Relationships between geometric figures		Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations and dilations).	3-2-c	100%	0%	0%	0%	0%	0%	
		Identify transformations, combinations, or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	3-2-d	100%	0%	0%	0%	0%	0%	
		Justify relationships of congruence and similarity and apply these relationships using scaling and proportional reasoning.	3-2-e	100%	0%	0%	0%	0%	0%	
		Perform or describe the effects of successive transformations.	3-2-g	100%	0%	0%	0%	0%	0%	
		Apply geometric properties and relationships to solve problems in two and three dimensions.	3-3-b	100%	0%	0%	0%	0%	0%	
		Represent problem situations with geometric models to solve mathematical or real-world problems.	3-3-c	100%	0%	0%	0%	0%	0%	
Position, direction, and coordinate geometry		Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.	3-3-d	100%	0%	0%	0%	0%	0%	
		Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel, perpendicular and intersecting lines, and associated angle relationships.	3-3-e	100%	0%	0%	0%	0%	0%	
		Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.	3-3-f	100%	0%	0%	0%	0%	0%	
	Analyze properties and relationships of parallel, perpendicular, or intersecting lines including the angle relationships that arise in these cases.	3-3-g	100%	0%	0%	0%	0%	0%		
	Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, and chords).	3-3-h	100%	0%	0%	0%	0%	0%		
	Solve problems involving the coordinate plane such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.	3-4-a	100%	0%	0%	0%	0%	0%		
Mathematical reasoning in geometry	Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.	3-4-b	100%	0%	0%	0%	0%	0%		
	Describe or identify conic sections and other cross sections of solids.	3-4-c	100%	0%	0%	0%	0%	0%		
	Represent two-dimensional figures algebraically using coordinates and/or equations.	3-4-d	100%	0%	0%	0%	0%	0%		
	Use vectors to represent velocity and direction; multiply a vector by a scalar and add vectors both algebraically and graphically.	3-4-e	100%	0%	0%	0%	0%	0%		
	Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.	3-4-f	100%	0%	0%	0%	0%	0%		
	Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.	3-4-g	100%	0%	0%	0%	0%	0%		
	Represent situations and solve problems involving polar coordinates.	3-4-h	100%	0%	0%	0%	0%	0%		
	Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counter examples.	3-5-a	100%	0%	0%	0%	0%	0%		
	Determine the role of hypotheses, logical implications, and conclusion in proofs of geometric theorems.	3-5-b	100%	0%	0%	0%	0%	0%		
	Analyze or explain a geometric argument by contradiction.	3-5-c	100%	0%	0%	0%	0%	0%		
	Analyze or explain a geometric proof of the Pythagorean theorem.	3-5-d	100%	0%	0%	0%	0%	0%		
	Prove basic theorems about congruent and similar triangles and circles.	3-5-e	100%	0%	0%	0%	0%	0%		

<b>Key</b>	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached
<b>Note</b>	Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".

Domain	Standard	NAEP Framework Objective	KSA ID	PT (Concluding)				
				NA	App-NI	App-I	App-NC	New NC
Data analysis, statistics, and probability	Data representation	Read or interpret graphical or tabular representations of data.	4-1-a	93%	0%	7%	0%	0%
		For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, and line graphs).	4-1-b	100%	0%	0%	0%	0%
		Solve problems involving univariate or bivariate data.	4-1-c	100%	0%	0%	0%	0%
		Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	4-1-d	100%	0%	0%	0%	0%
		Compare and contrast different graphical representations of univariate and bivariate data.	4-1-e	100%	0%	0%	0%	0%
		Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	4-1-f	100%	0%	0%	0%	0%
	Characteristics of data sets	Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median), position (quartiles, percentiles), and spread (range, interquartile range, variance, and standard deviation).	4-2-a	100%	0%	0%	0%	0%
		Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	4-2-b	100%	0%	0%	0%	0%
		Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	4-2-c	100%	0%	0%	0%	0%
		Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation) describing the same characteristic for two different populations or subsets of the same population.	4-2-d	100%	0%	0%	0%	0%
		Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line and use the line or equation to make predictions.	4-2-e	100%	0%	0%	0%	0%
		Recognize that the correlation coefficient is a number from -1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5 or 1.0) of a scatterplot.	4-2-f	100%	0%	0%	0%	0%
		Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).	4-2-g	100%	0%	0%	0%	0%
	Experiments and samples	Identify possible sources of bias in sample surveys and describe how such bias can be controlled and reduced.	4-3-a	100%	0%	0%	0%	0%
		Recognize and describe a method to select a simple random sample.	4-3-b	100%	0%	0%	0%	0%
		Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."	4-3-c	100%	0%	0%	0%	0%
		Identify or evaluate the characteristics of a good survey or of a well-designed experiment.	4-3-d	100%	0%	0%	0%	0%
	Probability	Recognize the differences in design and in conclusions between randomized experiments and observational studies.	4-3-e	100%	0%	0%	0%	0%
		Recognize whether two events are independent or dependent.	4-4-a	100%	0%	0%	0%	0%
		Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	4-4-b	100%	0%	0%	0%	0%
		Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	4-4-c	100%	0%	0%	0%	0%
		Use theoretical probability to evaluate or predict experimental outcomes.	4-4-d	100%	0%	0%	0%	0%
		Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	4-4-e	100%	0%	0%	0%	0%
		Determine the probability of independent and dependent events.	4-4-h	100%	0%	0%	0%	0%
		Determine conditional probability using two-way tables.	4-4-i	100%	0%	0%	0%	0%
	Mathematical reasoning with data	Interpret and apply probability concepts to practical situations.	4-4-j	100%	0%	0%	0%	0%
		Use the binomial theorem to solve problems.	4-4-k	100%	0%	0%	0%	0%
		Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.	4-5-a	100%	0%	0%	0%	0%
		Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.	4-5-b	87%	0%	13%	0%	0%
		Recognize use and distinguish between the processes of mathematical (deterministic) and statistical modeling.	4-5-c	100%	0%	0%	0%	0%
	Patterns, relations, and functions	Recognize when arguments based on data confuse correlation with causation.	4-5-d	100%	0%	0%	0%	0%
		Recognize and explain the potential errors caused by extrapolating from data.	4-5-e	100%	0%	0%	0%	0%
		Recognize, describe, or extend numerical patterns, including arithmetic and geometric progressions.	5-1-a	100%	0%	0%	0%	0%
		Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.	5-1-b	100%	0%	0%	0%	0%
		Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	5-1-e	100%	0%	0%	0%	0%
		Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	5-1-g	100%	0%	0%	0%	0%
Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.		5-1-h	100%	0%	0%	0%	0%	
Determine the domain and range of functions given in various forms and contexts.		5-1-i	100%	0%	0%	0%	0%	
Given a function, determine its inverse if it exists and explain the contextual meaning of the inverse for a given situation.		5-1-j	100%	0%	0%	0%	0%	
Algebraic representations		Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	5-2-a	87%	0%	0%	0%	13%
	Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	5-2-b	93%	0%	7%	0%	0%	
	Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	5-2-d	100%	0%	0%	0%	0%	
	Make inferences or predictions using an algebraic model of a situation.	5-2-e	100%	0%	0%	0%	0%	
	Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	5-2-f	100%	0%	0%	0%	0%	
	Solve problems involving exponential growth and decay.	5-2-g	100%	0%	0%	0%	0%	
	Analyze properties of exponential, logarithmic, and rational functions.	5-2-h	100%	0%	0%	0%	0%	
	Variables, expressions, and operations	Write algebraic expressions, equations, or inequalities to represent a situation.	5-3-b	20%	0%	7%	20%	47%
		Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.	5-3-c	100%	0%	0%	0%	0%
		Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.	5-3-d	100%	0%	0%	0%	0%
Evaluate algebraic expressions including polynomials and rational expressions.		5-3-e	87%	0%	0%	7%	7%	
Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.		5-3-f	100%	0%	0%	0%	0%	
Determine the sum of finite and infinite arithmetic and geometric series.		5-3-g	100%	0%	0%	0%	0%	
Use basic properties of exponents and *logarithms to solve problems.		5-3-h	100%	0%	0%	0%	0%	
Equations and inequalities		Solve linear, rational, or quadratic equations or inequalities, including those involving absolute value.	5-4-a	93%	0%	7%	0%	0%
		Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	5-4-c	67%	0%	0%	0%	33%
		Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	5-4-d	100%	0%	0%	0%	0%
	Solve problems involving special formulas such as $A = P(1 + r)t$ , $A = Pert$ .	5-4-e	40%	0%	0%	20%	40%	
	Solve an equation or formula involving several variables for one variable in terms of the others.	5-4-f	100%	0%	0%	0%	0%	
Mathematical reasoning in algebra	Solve quadratic equations with complex roots.	5-4-g	100%	0%	0%	0%	0%	
	Use algebraic properties to develop a valid mathematical argument.	5-5-a	100%	0%	0%	0%	0%	
	Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.	5-5-b	100%	0%	0%	0%	0%	
	Explain the use of relational conjunctions (and, or) in algebraic arguments.	5-5-c	100%	0%	0%	0%	0%	

Key	
NA	Not Applicable
App-NI	Applicable, Not Important
App-I	Applicable, Important
App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached
<b>Note</b> Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".	

NAEP Framework		AMT (Pilot)							
Domain	Standard	Objective	ID	NA	App-NI	App-I	App-NC	New	NC
Number properties and operations	Number sense	Represent, interpret, or compare expressions for real numbers, including expressions using exponents and logarithms.	1-1-d	95%	0%	5%	0%	0%	0%
		Represent or interpret expressions involving very large or very small numbers in scientific notation.	1-1-f	95%	5%	0%	0%	0%	0%
		Represent, interpret, or compare expressions or problem situations involving absolute values.	1-1-g	100%	0%	0%	0%	0%	0%
	Estimation	Order or compare real numbers, including very large and very small real numbers.	1-1-i	0%	0%	100%	0%	0%	0%
		Identify situations where estimation is appropriate, determine the needed degree of accuracy, and analyze the effect of the estimation method on the accuracy of results.	1-2-b	86%	10%	5%	0%	0%	0%
		Verify solutions or determine the reasonableness of results in a variety of situations.	1-2-e	86%	5%	10%	0%	0%	0%
		Estimate square or cube roots of numbers less than 1,000 between two whole numbers.	1-2-d	100%	0%	0%	0%	0%	0%
		Find integral or simple fractional powers of real numbers.	1-3-a	100%	0%	0%	0%	0%	0%
		Number operations	Perform arithmetic operations with real numbers, including common irrational numbers.	1-3-b	100%	0%	0%	0%	0%
	Perform arithmetic operations with expressions involving absolute value.		1-3-c	100%	0%	0%	0%	0%	0%
	Describe the effect of multiplying and dividing by numbers including the effect of multiplying or dividing a real number by zero, or a number less than zero, or a number between zero and one, or one, or a number greater than one.		1-3-d	100%	0%	0%	0%	0%	0%
	Ratios and proportional reasoning	Solve application problems involving numbers, including rational and common irrationals.	1-3-f	100%	0%	0%	0%	0%	0%
		Use proportions to solve problems (including rates of change).	1-4-c	71%	5%	24%	0%	0%	0%
	Properties of number and operations	Solve multistep problems involving percentages, including compound percentages.	1-4-d	100%	0%	0%	0%	0%	0%
		Solve problems using factors, multiples, or prime factorization.	1-5-c	100%	0%	0%	0%	0%	0%
		Use divisibility or remainders in problem settings.	1-5-d	100%	0%	0%	0%	0%	0%
		Apply basic properties of operations, including conventions about the order of operations.	1-5-e	33%	14%	52%	0%	0%	0%
		Recognize properties of the number system (whole numbers, integers, rational numbers, real numbers, and complex numbers) and how they are related to each other, and identify examples of each type of number.	1-5-f	100%	0%	0%	0%	0%	0%
Mathematical reasoning using number	Give a mathematical argument to establish the validity of a simple numerical property or relationship.	1-6-a	95%	0%	5%	0%	0%	0%	
	Analyze or interpret a proof by mathematical induction of a simple numerical relationship.	1-6-b	100%	0%	0%	0%	0%	0%	
Measurement	Measuring physical attributes	Determine the effect of proportions and scaling on length, area, and volume.	2-1-b	100%	0%	0%	0%	0%	
		Estimate or compare perimeters or areas of two-dimensional geometric figures.	2-1-c	95%	0%	5%	0%	0%	
		Solve problems of angle measure, including those involving triangles or other polygons or parallel lines cut by a transversal.	2-1-d	95%	0%	5%	0%	0%	
		Solve problems involving perimeter or area of plane figures such as polygons, circles, or composite figures.	2-1-f	95%	5%	0%	0%	0%	
		Solve problems by determining, estimating, or comparing volumes or surface areas of three-dimensional figures.	2-1-h	86%	5%	10%	0%	0%	
		Solve problems involving rates such as speed, density, population density, or flow rates.	2-1-i	81%	0%	19%	0%	0%	
	Systems of measurement	Recognize that geometric measurements (length, area, perimeter, and volume) depend on the choice of a unit, and apply such units in expressions, equations, and problem solutions.	2-2-a	81%	0%	19%	0%	0%	
		Solve problems involving conversions within or between measurement systems, given the relationship between the units.	2-2-b	19%	0%	81%	0%	0%	
		Understand that numerical values associated with measurements of physical quantities are approximate, are subject to variation, and must be assigned units of measurement.	2-2-d	5%	14%	76%	0%	0%	
		Determine appropriate accuracy of measurement in problem situations (e.g., the accuracy of measurement of the dimensions to obtain a specified accuracy of area) and find the measure to that degree of accuracy.	2-2-e	81%	0%	19%	0%	0%	
		Construct or solve problems involving scale drawings.	2-2-f	100%	0%	0%	0%	0%	
		Solve problems involving indirect measurement.	2-3-a	100%	0%	0%	0%	0%	
	Measurement in triangles	Solve problems using the fact that trigonometric ratios (sine, cosine, and tangent) stay constant in similar triangles.	2-3-b	100%	0%	0%	0%	0%	
		Use the definitions of sine, cosine, and tangent as ratios of sides in a right triangle to solve problems about length of sides and measure of angles.	2-3-c	100%	0%	0%	0%	0%	
		Interpret and use the identity $\sin^2 \theta + \cos^2 \theta = 1$ for angles $\theta$ between $0^\circ$ and $90^\circ$ ; recognize this identity as a special representation of the Pythagorean theorem.	2-3-d	100%	0%	0%	0%	0%	
		Determine the radian measure of an angle and explain how radian measurement is related to a circle of radius 1.	2-3-e	100%	0%	0%	0%	0%	
		Use trigonometric formulas such as addition and double angle formulas.	2-3-f	100%	0%	0%	0%	0%	
		Use the law of cosines and the law of sines to find unknown sides and angles of a triangle.	2-3-g	100%	0%	0%	0%	0%	
Geometry	Dimension and shape	Give precise mathematical descriptions or definitions of geometric shapes in the plane and in three-dimensional space.	3-1-c	100%	0%	0%	0%	0%	
		Draw or sketch from a written description plane figures and planar images of three-dimensional figures.	3-1-d	100%	0%	0%	0%	0%	
		Use two-dimensional representations of three-dimensional objects to visualize and solve problems.	3-1-e	14%	0%	81%	0%	5%	
	Transformation of shapes and preservation of properties	Analyze properties of three-dimensional figures including spheres and hemispheres.	3-1-f	100%	0%	0%	0%	0%	
		Recognize or identify types of symmetries (e.g., point, line, rotational, self-congruence) of two- and three-dimensional figures.	3-2-a	100%	0%	0%	0%	0%	
		Give or recognize the precise mathematical relationship (e.g., congruence, similarity, orientation) between a figure and its image under a transformation.	3-2-b	100%	0%	0%	0%	0%	
		Perform or describe the effect of a single transformation on two- and three-dimensional geometric shapes (reflections across lines of symmetry, rotations, translations, and dilations).	3-2-c	100%	0%	0%	0%	0%	
		Identify transformations, combinations, or subdivisions of shapes that preserve the area of two-dimensional figures or the volume of three-dimensional figures.	3-2-d	100%	0%	0%	0%	0%	
		Justify relationships of congruence and similarity and apply these relationships using scaling and proportional reasoning.	3-2-e	100%	0%	0%	0%	0%	
	Relationships between geometric figures	Perform or describe the effects of successive transformations.	3-2-g	100%	0%	0%	0%	0%	
		Apply geometric properties and relationships to solve problems in two and three dimensions.	3-3-b	100%	0%	0%	0%	0%	
		Represent problem situations with geometric models to solve mathematical or real-world problems.	3-3-c	100%	0%	0%	0%	0%	
		Use the Pythagorean theorem to solve problems in two- or three-dimensional situations.	3-3-d	100%	0%	0%	0%	0%	
		Recall and interpret definitions and basic properties of congruent and similar triangles, circles, quadrilaterals, polygons, parallel, perpendicular and intersecting lines, and associated angle relationships.	3-3-e	100%	0%	0%	0%	0%	
		Analyze properties or relationships of triangles, quadrilaterals, and other polygonal plane figures.	3-3-f	100%	0%	0%	0%	0%	
	Position, direction, and coordinate geometry	Analyze properties and relationships of parallel, perpendicular, or intersecting lines including the angle relationships that arise in these cases.	3-3-g	100%	0%	0%	0%	0%	
		Analyze properties of circles and the intersections of lines and circles (inscribed angles, central angles, tangents, secants, and chords).	3-3-h	100%	0%	0%	0%	0%	
		Solve problems involving the coordinate plane such as the distance between two points, the midpoint of a segment, or slopes of perpendicular or parallel lines.	3-4-a	100%	0%	0%	0%	0%	
Describe the intersections of lines in the plane and in space, intersections of a line and a plane, or of two planes in space.		3-4-b	100%	0%	0%	0%	0%		
Describe or identify conic sections and other cross sections of solids.		3-4-c	100%	0%	0%	0%	0%		
Represent two-dimensional figures algebraically using coordinates and/or equations.		3-4-d	100%	0%	0%	0%	0%		
Mathematical reasoning in geometry	Use vectors to represent velocity and direction, multiply a vector by a scalar and add vectors both algebraically and graphically.	3-4-e	100%	0%	0%	0%	0%		
	Find an equation of a circle given its center and radius and, given an equation of a circle, find its center and radius.	3-4-f	100%	0%	0%	0%	0%		
	Graph ellipses and hyperbolas whose axes are parallel to the coordinate axes and demonstrate understanding of the relationship between their standard algebraic form and their graphical characteristics.	3-4-g	100%	0%	0%	0%	0%		
	Represent situations and solve problems involving polar coordinates.	3-4-h	100%	0%	0%	0%	0%		
	Make, test, and validate geometric conjectures using a variety of methods including deductive reasoning and counter examples.	3-5-a	100%	0%	0%	0%	0%		
	Determine the role of hypotheses, logical implications, and conclusion in proofs of geometric theorems.	3-5-b	100%	0%	0%	0%	0%		
	Analyze or explain a geometric argument by contradiction.	3-5-c	100%	0%	0%	0%	0%		
	Analyze or explain a geometric proof of the Pythagorean theorem.	3-5-d	100%	0%	0%	0%	0%		
	Prove basic theorems about congruent and similar triangles and circles.	3-5-e	100%	0%	0%	0%	0%		

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App-NI	Applicable, Not Important
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App-NC	Applicable, No Importance Consensus
New	New Content
NC	No Consensus Reached
<b>Note</b> Combined "Not important" and "A little important" as "Applicable, Not important" and "Important" and "Very important" as "Applicable, Important".	

		NAEP Framework				AMT (Pilot)				
Domain	Standard	Objective	ID	NA	App-NI	App-I	App-NC	New	NC	
Data analysis, statistics, and probability	Data representation	Read or interpret graphical or tabular representations of data.	4-1-a	100%	0%	0%	0%	0%	0%	
		For a given set of data, complete a graph and solve a problem using the data in the graph (histograms, scatterplots, and line graphs).	4-1-b	100%	0%	0%	0%	0%	0%	
		Solve problems involving univariate or bivariate data.	4-1-c	100%	0%	0%	0%	0%	0%	
		Given a graphical or tabular representation of a set of data, determine whether information is represented effectively and appropriately.	4-1-d	100%	0%	0%	0%	0%	0%	
		Compare and contrast different graphical representations of univariate and bivariate data.	4-1-e	100%	0%	0%	0%	0%	0%	
		Organize and display data in a spreadsheet in order to recognize patterns and solve problems.	4-1-f	100%	0%	0%	0%	0%	0%	
	Characteristics of data sets	Calculate, interpret, or use summary statistics for distributions of data including measures of typical value (mean, median), position (quartiles, percentiles), and spread (range, interquartile range, variance, and standard deviation).	4-2-a	100%	0%	0%	0%	0%	0%	
		Recognize how linear transformations of one-variable data affect mean, median, mode, range, interquartile range, and standard deviation.	4-2-b	100%	0%	0%	0%	0%	0%	
		Determine the effect of outliers on mean, median, mode, range, interquartile range, or standard deviation.	4-2-c	100%	0%	0%	0%	0%	0%	
		Compare data sets using summary statistics (mean, median, mode, range, interquartile range, or standard deviation) describing the same characteristic for two different populations or subsets of the same population.	4-2-d	100%	0%	0%	0%	0%	0%	
		Approximate a trend line if a linear pattern is apparent in a scatterplot or use a graphing calculator to determine a least-squares regression line and use the line or equation to make predictions.	4-2-e	100%	0%	0%	0%	0%	0%	
		Recognize that the correlation coefficient is a number from -1 to +1 that measures the strength of the linear relationship between two variables; visually estimate the correlation coefficient (e.g., positive or negative, closer to 0, .5, or 1.0) of a scatterplot.	4-2-f	100%	0%	0%	0%	0%	0%	
	Experiments and samples	Know and interpret the key characteristics of a normal distribution such as shape, center (mean), and spread (standard deviation).	4-2-g	100%	0%	0%	0%	0%	0%	
		Identify possible sources of bias in sample surveys and describe how such bias can be controlled and reduced.	4-3-a	100%	0%	0%	0%	0%	0%	
		Recognize and describe a method to select a simple random sample.	4-3-b	100%	0%	0%	0%	0%	0%	
		Draw inferences from samples, such as estimates of proportions in a population, estimates of population means, or decisions about differences in means for two "treatments."	4-3-c	100%	0%	0%	0%	0%	0%	
		Identify or evaluate the characteristics of a good survey or of a well-designed experiment.	4-3-d	100%	0%	0%	0%	0%	0%	
		Recognize the differences in design and in conclusions between randomized experiments and observational studies.	4-3-e	100%	0%	0%	0%	0%	0%	
	Probability	Recognize whether two events are independent or dependent.	4-4-a	100%	0%	0%	0%	0%	0%	
		Determine the theoretical probability of simple and compound events in familiar or unfamiliar contexts.	4-4-b	100%	0%	0%	0%	0%	0%	
		Given the results of an experiment or simulation, estimate the probability of simple or compound events in familiar or unfamiliar contexts.	4-4-c	100%	0%	0%	0%	0%	0%	
		Use theoretical probability to evaluate or predict experimental outcomes.	4-4-d	100%	0%	0%	0%	0%	0%	
		Determine the number of ways an event can occur using tree diagrams, formulas for combinations and permutations, or other counting techniques.	4-4-e	100%	0%	0%	0%	0%	0%	
		Determine the probability of independent and dependent events.	4-4-h	100%	0%	0%	0%	0%	0%	
		Determine conditional probability using two-way tables.	4-4-i	100%	0%	0%	0%	0%	0%	
		Interpret and apply probability concepts to practical situations.	4-4-j	100%	0%	0%	0%	0%	0%	
		Use the binomial theorem to solve problems.	4-4-k	100%	0%	0%	0%	0%	0%	
		Identify misleading uses of data in real-world settings and critique different ways of presenting and using information.	4-5-a	100%	0%	0%	0%	0%	0%	
		Distinguish relevant from irrelevant information, identify missing information, and either find what is needed or make appropriate approximations.	4-5-b	100%	0%	0%	0%	0%	0%	
		Algebra	Patterns, relations, and functions	Recognize, use, and distinguish between the processes of mathematical (deterministic) and statistical modeling.	4-5-c	100%	0%	0%	0%	0%
	Recognize when arguments based on data confuse correlation with causation.			4-5-d	100%	0%	0%	0%	0%	0%
	Recognize and explain the potential errors caused by extrapolating from data.			4-5-e	100%	0%	0%	0%	0%	0%
	Recognize, describe, or extend numerical patterns, including arithmetic and geometric progressions.			5-1-a	100%	0%	0%	0%	0%	0%
	Express linear and exponential functions in recursive and explicit form given a table, verbal description, or some terms of a sequence.			5-1-b	100%	0%	0%	0%	0%	0%
	Algebraic representations		Identify or analyze distinguishing properties of linear, quadratic, rational, exponential, or *trigonometric functions from tables, graphs, or equations.	5-1-e	100%	0%	0%	0%	0%	0%
			Determine whether a relation, given in verbal, symbolic, tabular, or graphical form, is a function.	5-1-g	100%	0%	0%	0%	0%	0%
			Recognize and analyze the general forms of linear, quadratic, rational, exponential, or *trigonometric functions.	5-1-h	100%	0%	0%	0%	0%	0%
			Determine the domain and range of functions given in various forms and contexts.	5-1-i	100%	0%	0%	0%	0%	0%
			Given a function, determine its inverse if it exists and explain the contextual meaning of the inverse for a given situation.	5-1-j	100%	0%	0%	0%	0%	0%
			Create and translate between different representations of algebraic expressions, equations, and inequalities (e.g., linear, quadratic, exponential, or trigonometric) using symbols, graphs, tables, diagrams, or written descriptions.	5-2-a	100%	0%	0%	0%	0%	0%
			Analyze or interpret relationships expressed in symbols, graphs, tables, diagrams (including Venn diagrams), or written descriptions and evaluate the relative advantages or disadvantages of different representations to answer specific questions.	5-2-b	57%	0%	43%	0%	0%	0%
			Perform or interpret transformations on the graphs of linear, quadratic, exponential, and *trigonometric functions.	5-2-d	100%	0%	0%	0%	0%	0%
			Make inferences or predictions using an algebraic model of a situation.	5-2-e	71%	0%	29%	0%	0%	0%
			Given a real-world situation, determine if a linear, quadratic, rational, exponential, logarithmic, or *trigonometric function fits the situation.	5-2-f	95%	0%	5%	0%	0%	0%
	Variables, expressions, and operations	Solve problems involving exponential growth and decay.	5-2-g	100%	0%	0%	0%	0%	0%	
Analyze properties of exponential, logarithmic, and rational functions.		5-2-h	100%	0%	0%	0%	0%	0%		
Write algebraic expressions, equations, or inequalities to represent a situation.		5-3-b	48%	0%	52%	0%	0%	0%		
Perform basic operations, using appropriate tools, on algebraic expressions including polynomial and rational expressions.		5-3-c	95%	0%	5%	0%	0%	0%		
Write equivalent forms of algebraic expressions, equations, or inequalities to represent and explain mathematical relationships.		5-3-d	100%	0%	0%	0%	0%	0%		
Evaluate algebraic expressions including polynomials and rational expressions.		5-3-e	57%	0%	43%	0%	0%	0%		
Use function notation to evaluate a function at a specified point in its domain and combine functions by addition, subtraction, multiplication, division, and composition.		5-3-f	95%	0%	5%	0%	0%	0%		
Equations and inequalities	Determine the sum of finite and infinite arithmetic and geometric series.	5-3-g	100%	0%	0%	0%	0%	0%		
	Use basic properties of exponents and *logarithms to solve problems.	5-3-h	100%	0%	0%	0%	0%	0%		
	Solve linear, rational, or quadratic equations or inequalities, including those involving absolute value.	5-4-a	57%	0%	43%	0%	0%	0%		
	Analyze situations, develop mathematical models, or solve problems using linear, quadratic, exponential, or logarithmic equations or inequalities symbolically or graphically.	5-4-c	67%	0%	33%	0%	0%	0%		
	Solve (symbolically or graphically) a system of equations or inequalities and recognize the relationship between the analytical solution and graphical solution.	5-4-d	57%	0%	43%	0%	0%	0%		
	Solve problems involving special formulas such as $A = P(1 + r)^t$ , $A = Pert$ .	5-4-e	81%	5%	14%	0%	0%	0%		
	Solve an equation or formula involving several variables for one variable in terms of the others.	5-4-f	90%	5%	5%	0%	0%	0%		
Mathematical reasoning in algebra	Solve quadratic equations with complex roots.	5-4-g	100%	0%	0%	0%	0%	0%		
	Use algebraic properties to develop a valid mathematical argument.	5-5-a	95%	0%	5%	0%	0%	0%		
	Determine the role of hypotheses, logical implications, and conclusions in algebraic argument.	5-5-b	100%	0%	0%	0%	0%	0%		
	Explain the use of relational conjunctions (and, or) in algebraic arguments.	5-5-c	100%	0%	0%	0%	0%	0%		