



# Smarter Balanced Assessment Consortium Claims, Targets, and Standard Alignment for Math



The Smarter Balanced Assessment Consortium (SBAC) has created a hierarchy comprised of claims and targets that together can be used to make statements about student achievement. The claim is a broad statement that will outline the outcomes achieved with mastery of the standards within it. Within each claim are a variety of assessment targets that further clarify the knowledge and specific skills that cross over a cluster of standards.

The following tables layout the claims and targets for claims 1-4. Each target may feature a standard or a variety of standards that make up the skill(s) of the target. Each target also features a Depth of Knowledge level(s) and item type(s) in which the target may be assessed.

## Item Types:

- MC – Multiple Choice, Single Correct Response
- MS – Multiple Choice, Multiple Correct Response
- EQ – Equation/Numeric
- MA – Matching Tables
- TI – Fill-in tables
- DD – Drag and Drop
- HS – Hot Spot
- G – Graphing
- GI – Graphing Interaction
- ST – Short Text

## Depth of Knowledge:

- 1 - Recall
- 2 - Skill/Concept
- 3 - Strategic Thinking
- 4 - Extended Thinking

## Work:

Not all content in a given grade is emphasized equally in the standards. Some clusters require greater emphasis than others based on the depth of ideas, the time they take to master, and/or their importance to future mathematics or the demands of college and career readiness. The following tables identify the additional and supporting work for the grade by shading. If no shading is included, all standards listed are part of the major work for that level.



Claim	Target	DOK	Standards	Item Types
<b>1: Concepts and Procedures:</b> Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.	<b>A:</b> Extend the properties of exponents to rational exponents.	1, 2	<b>N.RN.2:</b> Rewrite expressions involving radicals and rational exponents using the properties of exponents.	MC, EQ
	<b>B:</b> Use properties of rational and irrational numbers.	1, 2, 3	<b>N.RN.3:</b> Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.	MS, MA
	<b>C:</b> Reason quantitatively and use units to solve problems.	1, 2	<b>N.Q.1:</b> Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	MC, MS, DD, MA
	<b>D:</b> Interpret the structure of expressions.	1, 2	<b>A.SSE.2:</b> Use the structure of an expression to identify ways to rewrite it. For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$ , thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$ .	MC, MA, DD
	<b>E:</b> Write expressions in equivalent forms to solve problems.	1, 2	<b>A.SSE.3:</b> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. <b>A.SSE.3a:</b> Factor a quadratic expression to reveal the zeros of the function it defines. <b>A.SSE.3b:</b> Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. <b>A.SSE.3c:</b> Use the properties of exponents to transform expressions for exponential functions. For example, the expression $1.15t$ can be rewritten as $(1.15^{1/12})^{12t} \approx 1.012^{12t}$ to reveal the approximate equivalent monthly interest rate if the annual rate is 15%.	EQ, MC, HS

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Claim	Target	DOK	Standards	Item Types
<b>1: Concepts and Procedures:</b> Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.	F: Perform arithmetic operations on polynomials.	2	<b>A.APR.1:</b> Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	EQ
	G: Create equations that describe numbers or relationships.	1, 2	<b>A.CED.1:</b> Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions. <b>A.CED.2:</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	EQ, G
	H: Understand solving equations as a process of reasoning and explain the reasoning.	1, 2	<b>A.REI.2:</b> Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	MC, EQ, MA
	I: Solve equations and inequalities in one variable.	1, 2	<b>A.REI.3:</b> Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. <b>A.REI.4:</b> Solve quadratic equations in one variable. <b>A.REI.4a:</b> Use the method of completing the square to transform any quadratic equation in $x$ into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. <b>A.REI.4b:</b> Solve quadratic equations by inspection (e.g., for $x^2 = 49$ ), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers $a$ and $b$ .	MC, EQ, DD, HS, G, MA

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Claim	Target	DOK	Standards	Item Types
<p><b>1: Concepts and Procedures:</b> Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.</p>	<p><b>J:</b> Represent and solve equations and inequalities graphically.</p>	<p>1, 2</p>	<p><b>A.REI.10:</b> Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p>	<p>MC, MS, HS, G, DD, EQ</p>
			<p><b>A.REI.11:</b> Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p>	
<p><b>A.REI.12:</b> Graph the solutions to a linear inequality in two variables as a half plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p>				
<p><b>K:</b> Understand the concept of a function and use function notation.</p>	<p><b>K:</b> Understand the concept of a function and use function notation.</p>	<p>1, 2</p>	<p><b>F.IF.1:</b> Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p>	<p>MC, MS, MA, G</p>
			<p><b>F.IF.3</b> Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by <math>f(0) = f(1) = 1</math>, <math>f(n+1) = f(n) + f(n-1)</math> for <math>n \geq 1</math>.</p>	

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Claim	Target	DOK	Standards	Item Types
<p><b>1: Concepts and Procedures:</b> Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.</p>	<p><b>L:</b> Interpret functions that arise in applications in terms of a context.</p>	<p>1, 2</p>	<p><b>F.IF.4:</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</p>	<p>MA, MC, MS, EQ, HS, G</p>
			<p><b>F.IF.5:</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</p>	
			<p><b>F.IF.6:</b> Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.</p>	

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Claim	Target	DOK	Standards	Item Types
<p><b>1: Concepts and Procedures:</b> Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.</p>	<p><b>M:</b> Analyze functions using different representations.</p>	<p>1, 2</p>	<p><b>F.IF.7:</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p>	<p>G, MA, HS, MS, EQ</p>
			<p><b>F.IF.7a:</b> Graph linear and quadratic functions and show intercepts, maxima, and minima.</p>	
			<p><b>F.IF.7b:</b> Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.</p>	
			<p><b>F.IF.7c:</b> Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.</p>	
			<p><b>F.IF.7e:</b> Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.</p>	
			<p><b>F.IF.8:</b> Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p>	
			<p><b>F.IF.8a:</b> Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.</p>	
			<p><b>F.IF.8b:</b> Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as <math>y = (1.02)^t</math>, <math>y = (0.97)^t</math>, <math>y = (1.10)^{12t}</math>, <math>y = (1.2)^{t/10}</math>, and classify them as representing exponential growth or decay.</p>	
<p><b>F.IF.9:</b> Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</p>				

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Claim	Target	DOK	Standards	Item Types
<b>1: Concepts and Procedures:</b> Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.	<b>N:</b> Build a function that models a relationship between two quantities.	2	<b>F.BF.1:</b> Write a function that describes a relationship between two quantities.	MC, EQ, MA, TI
			<b>F.BF.1a:</b> Determine an explicit expression, a recursive process, or steps for calculation from a context.	
			<b>F.BF.2:</b> Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.	
	<b>O:</b> Define trigonometric ratios and solve problems involving right triangles.	1, 2	<b>G.SRT.6:</b> Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.	MC, MS, EQ, MA
			<b>G.SRT.7:</b> Explain and use the relationship between the sine and cosine of complementary angles.	
			<b>G.SRT.8:</b> Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.	
	<b>P:</b> Summarize, represent, and interpret data on a single count or measurement variable.	1, 2	<b>S.ID.1:</b> Represent data with plots on the real number line (dot plots, histograms, and box plots).	MC, HS, MA, DD
			<b>S.ID.2:</b> Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	
			<b>S.ID.3:</b> Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	

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Claim	Target/DOK	Standards	Item Types
<p><b>2: Problem Solving:</b> Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>	<p><b>A:</b> Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (2, 3)</p> <p><b>B:</b> Select and use appropriate tools strategically. (1, 2)</p> <p><b>C:</b> Interpret results in the context of a situation. (2)</p> <p><b>D:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>N.Q.1:</b> Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p>	<p>MC, MS, EQ, GI, MA, TI</p>
		<p><b>N.Q.2:</b> Define appropriate quantities for the purpose of descriptive modeling.</p>	
		<p><b>N.Q.3:</b> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p>	
		<p><b>A.SSE.1:</b> Interpret parts of an expression, such as terms, factors, and coefficients.</p>	
		<p><b>A.SSE.2:</b> Use the structure of an expression to identify ways to rewrite it. For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</p>	
		<p><b>A.SSE.3:</b> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p>	
		<p><b>A.SSE.4:</b> Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.</p>	
		<p><b>A.CED.1:</b> Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</p>	
<p><b>A.CED.2:</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p>			

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Claim	Target/DOK	Standards	Item Types
<p><b>2: Problem Solving:</b> Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>	<p><b>A:</b> Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (2, 3)</p> <p><b>B:</b> Select and use appropriate tools strategically. (1, 2)</p> <p><b>C:</b> Interpret results in the context of a situation. (2)</p> <p><b>D:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>A.CED.3:</b> Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</p>	<p>MC, MS, EQ, GI, MA, TI</p>
		<p><b>A.CED.4:</b> Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</p>	
		<p><b>A.REI.2:</b> Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p>	
		<p><b>A.REI.3:</b> Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p>	
		<p><b>A.REI.4:</b> Solve quadratic equations in one variable.</p>	
		<p><b>A.REI.5:</b> Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.</p>	
		<p><b>A.REI.6:</b> Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>	
		<p><b>A.REI.7:</b> Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</p>	
		<p><b>A.REI.8:</b> Represent a system of linear equations as a single matrix equation in a vector variable.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>2: Problem Solving:</b> Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>	<p><b>A:</b> Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (2, 3)</p> <p><b>B:</b> Select and use appropriate tools strategically. (1, 2)</p> <p><b>C:</b> Interpret results in the context of a situation. (2)</p> <p><b>D:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>A.REI.9:</b> Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension <math>3 \times 3</math> or greater).</p>	<p>MC, MS, EQ, GI, MA, TI</p>
		<p><b>A.REI.10:</b> Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p>	
		<p><b>A.REI.11:</b> Explain why the x-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p>	
		<p><b>A.REI.12:</b> Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.</p>	
		<p><b>F.IF.1:</b> Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p>	
		<p><b>F.IF.2:</b> Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>2: Problem Solving:</b> Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>	<p><b>A:</b> Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (2, 3)</p> <p><b>B:</b> Select and use appropriate tools strategically. (1, 2)</p> <p><b>C:</b> Interpret results in the context of a situation. (2)</p> <p><b>D:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>F.IF.3</b> Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. For example, the Fibonacci sequence is defined recursively by <math>f(0) = f(1) = 1</math>, <math>f(n+1) = f(n) + f(n-1)</math> for <math>n \geq 1</math>.</p>	<p>MC, MS, EQ, GI, MA, TI</p>
		<p><b>F.IF.4:</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</p>	
		<p><b>F.IF.5:</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</p>	
		<p><b>F.IF.6:</b> Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.</p>	
		<p><b>F.IF.7:</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases</p>	
		<p><b>F.IF.8:</b> Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p>	
		<p><b>F.IF.9:</b> Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>2: Problem Solving:</b> Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>	<p><b>A:</b> Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (2, 3)</p> <p><b>B:</b> Select and use appropriate tools strategically. (1, 2)</p> <p><b>C:</b> Interpret results in the context of a situation. (2)</p> <p><b>D:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>F.BF.1:</b> Write a function that describes a relationship between two quantities.</p>	MC, MS, EQ, GI, MA, TI
		<p><b>F.BF.2:</b> Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p>	
		<p><b>G.SRT.6:</b> Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.</p>	
		<p><b>G.SRT.7:</b> Explain and use the relationship between the sine and cosine of complementary angles.</p>	
		<p><b>G.SRT.8:</b> Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.</p>	
		<p><b>S.ID.7:</b> Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.</p>	
		<p><b>S.ID.8:</b> Compute (using technology) and interpret the correlation coefficient of a linear fit.</p>	
		<p><b>S.ID.9:</b> Distinguish between correlation and causation.</p>	
<p><b>S.CP.1:</b> Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not").</p>			

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Claim	Target/DOK	Standards	Item Types
<p><b>2: Problem Solving:</b> Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.</p>	<p><b>A:</b> Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>S.CP.2:</b> Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.</p>	<p>MC, MS, EQ, GI, MA, TI</p>
	<p><b>B:</b> Select and use appropriate tools strategically. (1, 2)</p>	<p><b>S.CP.3:</b> Understand the conditional probability of A given B as <math>P(A \text{ and } B)/P(B)</math>, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B.</p>	
	<p><b>C:</b> Interpret results in the context of a situation. (2)</p>	<p><b>S.CP.4:</b> Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.</p>	
	<p><b>D:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>S.CP.5:</b> Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>3: Communicating Reasoning:</b> Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p><b>A:</b> Test propositions or conjectures with specific examples. (2)</p>	<p><b>N.RN.1:</b> Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. For example, we define <math>5^{1/3}</math> to be the cube root of 5 because we want <math>(5^{1/3})^3 = 5^{(1/3) \cdot 3}</math> to hold, so <math>(5^{1/3})^3</math> must equal 5.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p><b>N.RN.2:</b> Rewrite expressions involving radicals and rational exponents using the properties of exponents.</p>	
	<p><b>C:</b> State logical assumptions being used. (2, 3)</p>	<p><b>N.RN.3:</b> Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.</p>	
	<p><b>D:</b> Use the technique of breaking an argument into cases. (2, 3)</p>	<p><b>A.SSE.2:</b> Use the structure of an expression to identify ways to rewrite it. For example, see <math>x^4 - y^4</math> as <math>(x^2)^2 - (y^2)^2</math>, thus recognizing it as a difference of squares that can be factored as <math>(x^2 - y^2)(x^2 + y^2)</math>.</p>	
	<p><b>E:</b> Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is. (2, 3, 4)</p>	<p><b>A.APR.1:</b> Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.</p>	
	<p><b>F:</b> Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2, 3)</p>	<p><b>A.APR.2:</b> Know and apply the Remainder Theorem: For a polynomial <math>p(x)</math> and a number <math>a</math>, the remainder on division by <math>x - a</math> is <math>p(a)</math>, so <math>p(a) = 0</math> if and only if <math>(x - a)</math> is a factor of <math>p(x)</math>.</p>	
	<p><b>G:</b> At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not for all plane figures.) (3, 4)</p>	<p><b>A.APR.3:</b> Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.</p>	
		<p><b>A.APR.4:</b> Prove polynomial identities and use them to describe numerical relationships. For example, the polynomial identity <math>(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2</math> can be used to generate Pythagorean triples.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>3: Communicating Reasoning:</b> Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p><b>A:</b> Test propositions or conjectures with specific examples. (2)</p>	<p><b>A.APR.6:</b> Rewrite simple rational expressions in different forms; write <math>a(x)/b(x)</math> in the form <math>q(x) + r(x)/b(x)</math>, where <math>a(x)</math>, <math>b(x)</math>, <math>q(x)</math>, and <math>r(x)</math> are polynomials with the degree of <math>r(x)</math> less than the degree of <math>b(x)</math>, using inspection, long division, or, for the more complicated examples, a computer algebra system.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p><b>A.REI.1:</b> Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>	
	<p><b>C:</b> State logical assumptions being used. (2, 3)</p>	<p><b>A.REI.2:</b> Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p>	
	<p><b>D:</b> Use the technique of breaking an argument into cases. (2, 3)</p>	<p><b>A.REI.5:</b> Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.</p>	
	<p><b>E:</b> Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is. (2, 3, 4)</p>	<p><b>A.REI.6:</b> Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>	
	<p><b>F:</b> Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2, 3)</p>	<p><b>A.REI.7:</b> Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</p>	
	<p><b>G:</b> At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not for all plane figures.) (3, 4)</p>	<p><b>A.REI.8:</b> Represent a system of linear equations as a single matrix equation in a vector variable.</p>	
		<p><b>A.REI.9:</b> Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension <math>3 \times 3</math> or greater).</p>	
		<p><b>A.REI.10:</b> Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>3: Communicating Reasoning:</b> Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p><b>A:</b> Test propositions or conjectures with specific examples. (2)</p>	<p><b>A.REI.11:</b> Explain why the <math>x</math>-coordinates of the points where the graphs of the equations <math>y = f(x)</math> and <math>y = g(x)</math> intersect are the solutions of the equation <math>f(x) = g(x)</math>; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where <math>f(x)</math> and/or <math>g(x)</math> are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p><b>F.IF.1:</b> Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If <math>f</math> is a function and <math>x</math> is an element of its domain, then <math>f(x)</math> denotes the output of <math>f</math> corresponding to the input <math>x</math>. The graph of <math>f</math> is the graph of the equation <math>y = f(x)</math>.</p>	
	<p><b>C:</b> State logical assumptions being used. (2, 3)</p>	<p><b>F.IF.5:</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</p>	
	<p><b>D:</b> Use the technique of breaking an argument into cases. (2, 3)</p>	<p><b>F.IF.9:</b> Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</p>	
	<p><b>E:</b> Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is. (2, 3, 4)</p>	<p><b>F.BF.3:</b> Identify the effect on the graph of replacing <math>f(x)</math> by <math>f(x) + k</math>, <math>k f(x)</math>, <math>f(kx)</math>, and <math>f(x + k)</math> for specific values of <math>k</math> (both positive and negative); find the value of <math>k</math> given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.</p>	
	<p><b>F:</b> Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2, 3)</p>		
	<p><b>G:</b> At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not for all plane figures.) (3, 4)</p>		

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Claim	Target/DOK	Standards	Item Types
<p><b>3: Communicating Reasoning:</b> Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p><b>A:</b> Test propositions or conjectures with specific examples. (2)</p>	<p><b>F.BF.4a:</b> Solve an equation of the form <math>f(x) = c</math> for a simple function <math>f</math> that has an inverse and write an expression for the inverse. For example, <math>f(x) = 2x^3</math> or <math>f(x) = (x+1)/(x-1)</math> for <math>x \neq 1</math>.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p><b>F.TF.1:</b> Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.</p>	
	<p><b>C:</b> State logical assumptions being used. (2, 3)</p>	<p><b>F.TF.2:</b> Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.</p>	
	<p><b>D:</b> Use the technique of breaking an argument into cases. (2, 3)</p>	<p><b>F.TF.8:</b> Prove the Pythagorean identity <math>\sin^2(\theta) + \cos^2(\theta) = 1</math> and use it to find <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> given <math>\sin(\theta)</math>, <math>\cos(\theta)</math>, or <math>\tan(\theta)</math> and the quadrant of the angle.</p>	
	<p><b>E:</b> Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is. (2, 3, 4)</p>	<p><b>G.CO.1:</b> Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.</p>	
	<p><b>F:</b> Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2, 3)</p>	<p><b>G.CO.2:</b> Represent transformations in the plane using, e.g., transparencies and geometry software; describe transformations as functions that take points in the plane as inputs and give other points as outputs. Compare transformations that preserve distance and angle to those that do not (e.g., translation versus horizontal stretch).</p>	
	<p><b>G:</b> At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not for all plane figures.) (3, 4)</p>	<p><b>G.CO.3:</b> Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.</p>	
		<p><b>G.CO.4:</b> Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.</p>	
		<p><b>G.CO.5:</b> Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>3: Communicating Reasoning:</b> Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p><b>A:</b> Test propositions or conjectures with specific examples. (2)</p>	<p><b>G.CO.6:</b> Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p><b>G.CO.7:</b> Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.</p>	
	<p><b>C:</b> State logical assumptions being used. (2, 3)</p>	<p><b>G.CO.8:</b> Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.</p>	
	<p><b>D:</b> Use the technique of breaking an argument into cases. (2, 3)</p>	<p><b>G.CO.9:</b> Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.</p>	
	<p><b>E:</b> Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is. (2, 3, 4)</p>	<p><b>G.CO.10:</b> Prove theorems about triangles. Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.</p>	
	<p><b>F:</b> Base arguments on concrete referents such as objects, drawings, diagrams, and actions. (2, 3)</p>	<p><b>G.CO.11:</b> Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.</p>	
	<p><b>G:</b> At later grades, determine conditions under which an argument does and does not apply. (For example, area increases with perimeter for squares, but not for all plane figures.) (3, 4)</p>		

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Claim	Target/DOK	Standards	Item Types
<p><b>3: Communicating Reasoning:</b> Students clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.</p>	<p><b>A:</b> Test propositions or conjectures with specific examples. (2)</p>	<p><b>G.SRT.1:</b> Verify experimentally the properties of dilations given by a center and a scale factor: <b>a.</b> A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. <b>b.</b> The dilation of a line segment is longer or shorter in the ratio given by the scale factor.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning that will justify or refute propositions or conjectures. (3, 4)</p>	<p><b>G.SRT.2:</b> Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides.</p>	
	<p><b>C:</b> State logical assumptions being used. (2, 3)</p>	<p><b>G.SRT.3:</b> Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.</p>	
	<p><b>D:</b> Use the technique of breaking an argument into cases. (2, 3)</p>	<p><b>G.SRT.4:</b> Prove theorems about triangles. Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.</p>	
	<p><b>E:</b> Distinguish correct logic or reasoning from that which is flawed and—if there is a flaw in the argument—explain what it is. (2, 3, 4)</p>	<p><b>G.SRT.5:</b> Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>4: Modeling and data Analysis:</b> Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p>	<p><b>A:</b> Apply mathematics to solve problems arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>N.Q.1:</b> Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. (2, 3, 4)</p>	<p><b>N.Q.2:</b> Define appropriate quantities for the purpose of descriptive modeling.</p>	
	<p><b>C:</b> State logical assumptions being used. (1, 2)</p>	<p><b>N.Q.3:</b> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</p>	
	<p><b>D:</b> Interpret results in the context of a situation. (2, 3)</p>	<p><b>A.SSE.3:</b> Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.</p>	
	<p><b>E:</b> Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. (3, 4)</p>	<p><b>A.SSE.4:</b> Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. For example, calculate mortgage payments.</p>	
	<p><b>F:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>A.CED.1:</b> Create equations and inequalities in one variable and use them to solve problems. Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</p>	
	<p><b>G*:</b> Identify, analyze and synthesize relevant external resources to pose or solve problems. (3, 4)</p>	<p><b>A.CED.2:</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.</p>	
		<p><b>A.CED.3:</b> Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</p>	
		<p><b>A.CED.4:</b> Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law <math>V = IR</math> to highlight resistance <math>R</math>.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>4: Modeling and data Analysis:</b> Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p>	<p><b>A:</b> Apply mathematics to solve problems arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>A.REI.1:</b> Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. (2, 3, 4)</p>	<p><b>A.REI.2:</b> Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.</p>	
	<p><b>C:</b> State logical assumptions being used. (1, 2)</p>	<p><b>A.REI.3:</b> Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.</p>	
	<p><b>D:</b> Interpret results in the context of a situation. (2, 3)</p>	<p><b>A.REI.4:</b> Solve quadratic equations in one variable.</p>	
	<p><b>E:</b> Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. (3, 4)</p>	<p><b>A.REI.5:</b> Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.</p>	
	<p><b>F:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>A.REI.6:</b> Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.</p>	
	<p><b>G*:</b> Identify, analyze and synthesize relevant external resources to pose or solve problems. (3, 4)</p>	<p><b>A.REI.7:</b> Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line <math>y = -3x</math> and the circle <math>x^2 + y^2 = 3</math>.</p>	
		<p><b>A.REI.8:</b> Represent a system of linear equations as a single matrix equation in a vector variable.</p>	
		<p><b>A.REI.9:</b> Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension <math>3 \times 3</math> or greater).</p>	

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<p><b>4: Modeling and data Analysis:</b> Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p>	<p><b>A:</b> Apply mathematics to solve problems arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>F.IF.4:</b> For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. (2, 3, 4)</p>	<p><b>F.IF.5:</b> Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function <math>h(n)</math> gives the number of person-hours it takes to assemble <math>n</math> engines in a factory, then the positive integers would be an appropriate domain for the function.</p>	
	<p><b>C:</b> State logical assumptions being used. (1, 2)</p>	<p><b>F.IF.6:</b> Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.</p>	
	<p><b>D:</b> Interpret results in the context of a situation. (2, 3)</p>	<p><b>F.IF.7:</b> Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.</p>	
	<p><b>E:</b> Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. (3, 4)</p>	<p><b>F.IF.8:</b> Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.</p>	
	<p><b>F:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>F.IF.9:</b> Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.</p>	
	<p><b>G*:</b> Identify, analyze and synthesize relevant external resources to pose or solve problems. (3, 4)</p>		

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Claim	Target/DOK	Standards	Item Types
<p><b>4: Modeling and data Analysis:</b> Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p>	<p><b>A:</b> Apply mathematics to solve problems arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>F.BF.1:</b> Write a function that describes a relationship between two quantities.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. (2, 3, 4)</p>	<p><b>F.BF.2:</b> Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.</p>	
	<p><b>C:</b> State logical assumptions being used. (1, 2)</p>	<p><b>S.ID.1:</b> Represent data with plots on the real number line (dot plots, histograms, and box plots).</p>	
	<p><b>D:</b> Interpret results in the context of a situation. (2, 3)</p>	<p><b>S.ID.2:</b> Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.</p>	
	<p><b>E:</b> Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. (3, 4)</p>	<p><b>S.ID.3:</b> Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</p>	
	<p><b>F:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>S.ID.4:</b> Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve.</p>	
	<p><b>G*:</b> Identify, analyze and synthesize relevant external resources to pose or solve problems. (3, 4)</p>	<p><b>S.ID.5:</b> Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.</p>	
		<p><b>S.ID.6:</b> Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.</p>	
		<p><b>S.IC.1:</b> Understand statistics as a process for making inferences about population parameters based on a random sample from that population.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>4: Modeling and data Analysis:</b> Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p>	<p><b>A:</b> Apply mathematics to solve problems arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>S.IC.3:</b> Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. (2, 3, 4)</p>	<p><b>S.IC.4:</b> Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.</p>	
	<p><b>C:</b> State logical assumptions being used. (1, 2)</p>	<p><b>S.IC.5:</b> Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.</p>	
	<p><b>D:</b> Interpret results in the context of a situation. (2, 3)</p>	<p><b>S.IC.6:</b> Evaluate reports based on data.</p>	
	<p><b>E:</b> Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. (3, 4)</p>	<p><b>F.LE.1:</b> Distinguish between situations that can be modeled with linear functions and with exponential functions.</p>	
	<p><b>F:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p>	<p><b>F.LE.2:</b> Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).</p>	
	<p><b>G*:</b> Identify, analyze and synthesize relevant external resources to pose or solve problems. (3, 4)</p>	<p><b>F.LE.3:</b> Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.</p>	
		<p><b>F.LE.4:</b> For exponential models, express as a logarithm the solution to <math>ab^{ct} = d</math> where <math>a</math>, <math>c</math>, and <math>d</math> are numbers and the base <math>b</math> is 2, 10, or <math>e</math>; evaluate the logarithm using technology.</p>	
		<p><b>F.LE.5:</b> Interpret the parameters in a linear or exponential function in terms of a context.</p>	
		<p><b>F.TF.5:</b> Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.</p>	

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Claim	Target/DOK	Standards	Item Types
<p><b>4: Modeling and data Analysis:</b> Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.</p>	<p><b>A:</b> Apply mathematics to solve problems arising in everyday life, society, and the workplace. (2, 3)</p>	<p><b>G.MD.3:</b> Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.</p>	<p>MC, MS, EQ, GI, MA, TI, ST<sup>1</sup></p>
	<p><b>B:</b> Construct, autonomously, chains of reasoning to justify mathematical models used, interpretations made, and solutions proposed for a complex problem. (2, 3, 4)</p>	<p><b>G.MG.1:</b> Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).</p>	
	<p><b>C:</b> State logical assumptions being used. (1, 2)</p>	<p><b>G.MG.2:</b> Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).</p>	
	<p><b>D:</b> Interpret results in the context of a situation. (2, 3)</p> <p><b>E:</b> Analyze the adequacy of and make improvements to an existing model or develop a mathematical model of a real phenomenon. (3, 4)</p> <p><b>F:</b> Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (1, 2, 3)</p> <p><b>G*:</b> Identify, analyze and synthesize relevant external resources to pose or solve problems. (3, 4)</p>	<p><b>G.MG.3:</b> Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).</p>	

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