Introduction

The Math Test Specifications provide an overview of the structure and content of Ohio's State Test. This overview includes a description of the test design as well as information on the types of items that will appear on the test. Also included is a test blueprint, a document that identifies the range and distribution of points grouped into various reporting categories (e.g., Fractions, Ratios and Proportions, Functions, Probability). The specifications also provide specific guidelines for the development of all items used for Ohio's math tests.
This document is a resource not only for item writers and test designers, but also for Ohio educators and other stakeholders who are interested in a deeper understanding of the test.

Overview of Structure and Content

Ohio's Learning Standards

In 2017, Ohio adopted revisions to Ohio's Learning Standards for Mathematics which include standards for mathematical content and mathematical practice. Then, based on the 2017 Standards, Ohio adopted revisions to the Model Curriculum, a document that connects standards to instruction. The mathematics assessment items (test questions) align to the 2017 Standards.

Standards for Mathematical Practice

The Standards for Mathematical Practice (SMP) describe skills that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The design of each item on Ohio's state tests encourages students to use one or more Standards for Mathematical Practice. Below is a list of the mathematical practices.

Mathematics 2 Standards for Mathematical Practice
1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

Blueprint

Test blueprints serve as a guide for test construction and provide an outline of the content and skills to be measured on the test. They contain information about the number of points of opportunity students will encounter in each reporting category on the math test. The following test blueprint displays the distribution of the content standards and depth of knowledge across the entire test and the categories for reporting test results for Mathematics 2.

Reporting Category	Standards				Approximate Portion of Test
Number Quantitites, Equations and Expressions	A.SSE.1	A.CED.1	A.REI.4ab	A.APR.1a	25% – 33% 14 – 18 points
	A.SSE.2	A.CED.2b	A.REI.7		
	A.SSE.3	A.CED.4c	A.REI.11		
Functions	F.IF.4b	F.IF.8aibi	F.BF.1aii	F.LE.3	19% – 24% 11 – 13 points
	F.IF.5b	F.IF.9b	F.BF.3a		
	F.IF.7b				
Geometry	G.SRT.1	G.SRT.7	G.GPE.6	G.MG.1	30% – 41% 17 – 22 points
	G.SRT.2	G.SRT.8a	G.GMD.1	G.MG.2	
	G.SRT.3	G.C.1	G.GMD.3	G.MG.3	
	G.SRT.4	G.C.5	G.GMD.4		
	G.SRT.5	G.GPE.1	G.GMD.5		
	G.SRT.6	G.GPE.4	G.GMD.6		
Probability	S.CP.1	S.CP.4	S.CP.6		18% – 22% 10 – 12 points
	S.CP.2	S.CP.5	S.CP.7		
	S.CP.3				
				Total Test	54 – 56 points

Modeling and Reasoning* (minimum 20%)

Depth of Knowledge (DOK) Level	Approximate Portion of Test
1	8 – 16 points
2	25 – 40 points
3	8 – 16 points

Modeling and Reasoning

Modeling and Reasoning are included in the eight Standards for Mathematical Practice within Ohio's Learning Standards. Each grade's blueprint identifies modeling and reasoning as an independent reporting category that will account for a minimum of 20 percent of the overall points on that grade's test.

Modeling is best interpreted not as a collection of isolated topics but in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (★).

Depth of Knowledge (DOK)

DOK refers to the complexity of thinking required to complete a task in a given item. Items with a DOK 1 designation focus on the recall of information, such as definitions and terms, and simple procedures. Items with a DOK 2 designation require students to make decisions, solve routine problems, perform calculations, or recognize patterns. Items with a DOK 3 designation feature higher-order cognitive tasks. These DOK 3 tasks include but are not limited to: critiquing a statement and forming a conclusion; explaining, justifying, or proving a statement; or approaching abstract, complex, open-ended, and non-routine problems. Each grade's blueprint contains information about the number of points of opportunity students will encounter at each DOK level.

Test Design

The assessment is a two-part test, developed in a computer-based format and a paper-based format. Its purpose is to measure student progress and provide information to parents, teachers, and building, district and state administrators. The test will contain technology-enhanced items that require the student to enter a response into the computer interface. The test will be administered near the end of the academic school year or the end of a semester (for high school). The test can be administered in one or two sessions. After the student has completed both parts of the test, his or her scores will be combined to yield a comprehensive test score. Test results are reported back to schools by June 30th.

Performance Level Descriptors (PLDs)

At each grade level/course, PLDs are general statements describing what students should know or be able to do at each performance level.

After the Ohio State Mathematics test is scored, each student's performance level is identified based on the combined scores (Part 1 and Part 2). Districts and schools are sent item level reports and the performance level for each student along with the performance level descriptors. Teachers and math coaches can use this information for their instructional design.

Calculator

Calculators are **not** permitted for use on either the paper-based or computer-based mathematics test for grades 3-5. Grades 6 and 7 have a non-calculator part and a calculator part for both the paper-based and the computer-based mathematics test. The calculator designation for items in grades 6 and 7 is decided during development on an item-by-item basis. A calculator may be used on the entire grade 8 and high school End of Course (EOC) paper-based or computer-based mathematics tests. Note that calculator usage may differ for those students with an Individualized Education Plan (IEP) or 504 plan that specifies a calculator accommodation.

- Guidance on Desmos Calculator for Grades 3-8
- Grades 3-8 Handheld Calculator Guidance

- Guidance on Desmos Calculator for High School
- High School Handheld Calculator Guidance

Reference Sheets

A reference sheet may be used on the Ohio State Mathematics Tests by all students in grades four and above. For paper-based testers, the math reference sheets will be included within the student test booklet. For online testers, the math reference sheet is embedded within the testing platform.

Interaction Types

Ohio's State Tests are composed of several interaction types. Currently, there are ten interaction types that may appear on a math computer-based assessment:

- Equation Item (EQ)
- Gap Match Item (GM)
- Grid Item (GI)
- Hot Text Item (HT)
- Inline Choice Item (IC)
- Matching Item (MI)
- Multiple Choice Item (MC)
- Multi Select Item (MS)
- Simulation Item (Sim)
- Table Item (TI)

For paper-based assessments (including those for students with an IEP or 504 plan that specifies a paper-based accommodation), the items may be modified so that they can be scanned and scored electronically or hand-scored.

Interaction Type	Description
Equation Item (EQ)	The student is presented with a keypad that includes a variety of mathematical symbols that can be used to create a response. Responses may be in the form of a number, variable, expression, or equation, as appropriate to the test item. The student enters their response in the response box which may be on a line by itself, or embedded in a sentence or phrase. For paper-based assessments, this interaction type may be replaced with a modified version of the item that can be scanned and scored electronically or the student may be given an answer box to write their answer.
Gap Match Item (GM)	Given a set of options (e.g., numbers, words, phrases, or sentences) the student hovers over the options which then highlight, indicating that the option is selectable. The student can then click on the object, hold down the mouse button, and drag it to an answer area, indicated by a dotted box, in a graphic, table, or paragraph. For paper-based assessments, the options are associated with a letter, and students write a letter for their response in each response area.
Grid Item (GI)	The student may select numbers, words, phrases, or images to display their response. The student may also use the drag-and-drop feature to place objects into a response area. This interaction type may also require the student to use the point, line, or arrow tools to create a response on a graph or gridded area. For paper-based assessments, the student may be given the response space to draw their answer, or this interaction type may be replaced with another interaction type that assesses the same standard at the same level of difficulty and can be scanned and scored electronically.
Hot Text Item (HT)	**Selectable Hot Text -** Given a set of options (e.g., phrases, sentences, or numbers) the student hovers over the options which then highlight, indicating that the text is selectable ("hot"). The student can then click on an option to select it as their response. For paper-based assessments, a "selectable" hot text item is modified so that it can be scanned and scored electronically. The student fills in a circle to indicate the correct response.
	Drag-and-Drop Hot Text - Given a set of options (e.g., numbers, words, phrases, or sentences) the student hovers over the options which then highlight, indicating that the option is selectable ("hot"). The student can then click on the object, hold down the mouse button, and drag it to a graphic, table, or paragraph. For paper-based assessments, the options are associated with a letter, and students write a letter for their response in each response area.

Interaction Type	Description
Inline Choice Item (IC)	Given a sentence, paragraph, or table, the student clicks a blank box embedded within a sentence or table which reveals a drop-down menu containing options for completing a sentence or table. The student then selects an option from the drop-down menu to respond. For paper-based assessments, the interaction is modified so that it can be scanned and scored electronically. The student fills in a circle to indicate the correct response.
Matching Item (MI)	Given column and row headers in a table format, the student checks a box to indicate if information from a column header matches information from a row header. For paper-based assessments, the interaction is modified so that it can be scanned and scored electronically. The student fills in a circle to indicate the correct response.
Multiple Choice Item (MC)	The student selects one correct answer from four options. For paper-based assessments, the student fills in a circle to indicate the correct response.
Multi Select Item (MS)	The student is directed to either select an indicated number of correct answers or to select all of the correct answers. Students in grades 3-5 always select an indicated number of correct answers; students in grades 6-8 select an indicated number of correct answers on 50% of the items and select all on 50% of the items; and students taking high school end-of-course tests are always directed to select all correct answers. These items are different from multiple choice items, and require the student to select 2 or more correct answers. For paper-based assessments, the student fills in circles to indicate the correct responses.
Simulation Item (Sim)	Given a set of instructions, the student may interact with any of the following controls to generate data: radio buttons, drop-down menus, slide bars, or selecting a number by clicking arrows. Once the student has set the parameters, they click the start button to begin the simulation and generate a data set. Once the student has enough data, they may answer questions about the data using a different interaction type. For paper-based assessments, this interaction will be replaced with another interaction type that assesses the same standard at the same level of difficulty and can be scanned and scored electronically.
Table Item (TI)	The student types numeric values into a given table. The student may complete the entire table or portions of the table depending on what is being asked. For paper-based assessments, the student writes their responses in the blank boxes of the table.

Specific Guidelines for Item Development

Standards are presented according to reporting categories as shown on grade level or course blueprints.

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.SSE SEEING STRUCTURE IN EXPRESSIONS*** **Interpret the structure of expressions.** ***A.SSE.1*** Interpret expressions that represent a quantity in terms of its context. ★ ***A.SSE.1a*** Interpret parts of an expression, such as terms, factors, and coefficients. ***A.SEE.1b*** Interpret complicated expressions by viewing one or more of their parts as a single entity.
Content Limits	• Quadratic expressions
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.SSE SEEING STRUCTURE IN EXPRESSIONS*** **Interpret the structure of expressions.** ***A.SSE.2*** Use the structure of an expression to identify ways to rewrite it. *For example, to factor 3x(x − 5) + 2(x − 5), students should recognize that the "x − 5" is common to both expressions being added, so it simplifies to (3x + 2)(x − 5); or 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 $(x^2 - y^2)(x^2 + y^2)$.*
Content Limits	• Quadratic expressions or expressions quadratic in form (e.g. $x^4 - y^4$) • When factoring general quadratic trinomials (except for special forms) that contain no common factors, the emphasis is on cases where the leading coefficient is 1. Items may also use other leading coefficients such as –1, ±2, or ±3. • When factoring special forms of polynomials that contain no common factors (e.g., perfect square trinomials or difference of squares), the leading coefficient may be any suitable rational number. • A quadratic polynomial resulting from factoring out a greatest common factor (that may be any rational number), should follow one of the two above bullets.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.SSE SEEING STRUCTURE IN EXPRESSIONS*** **Write expressions in equivalent forms to solve problems.** ***A.SSE.3*** Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.★ ***A.SSE.3a*** Factor a quadratic expression to reveal the zeros of the function it defines. ***A.SSE.3b*** Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. ***A.SSE.3c*** Use the properties of exponents to transform expressions for exponential functions. *For example, 8^t can be written as 2^{3t}.*
Content Limits	• When factoring general quadratic trinomials (except for special forms) that contain no common factors, the emphasis is on cases where the leading coefficient is 1. Items may also use other leading coefficients such as –1, ±2, or ±3. • When factoring special forms of polynomials that contain no common factors (e.g., perfect square trinomials or difference of squares), the leading coefficient may be any suitable rational number. • A quadratic polynomial resulting from factoring out a greatest common factor (that may be any rational number), should follow one of the two above bullets. • When completing the square, the emphasis is on cases where the leading coefficient is 1. When items use a leading coefficient other than 1 (such as –1, ±2, or ±3), the linear coefficient *b* is an integer evenly divisible by the leading coefficient *a*. • Exponents in exponential expressions will not contain fractions when a student is asked to create an equivalent expression in the form a^t, where *a* is a nonzero variable.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.CED CREATING EQUATIONS*** **Create equations that describe numbers or relationships.** ***A.CED.1*** Create equations and inequalities in one variable and use them to solve problems. *Include equations and inequalities arising from linear, quadratic, simple rational, and exponential functions.*★ b. Focus on applying simple quadratic expressions. (A1, M2)
Content Limits	• Quadratic equations and inequalities
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.CED CREATING EQUATIONS*** **Create equations that describe numbers or relationships.** ***A.CED.2*** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.★ b. Focus on applying simple quadratic expressions. (A1, M2)
Content Limits	• Quadratic equations
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.CED CREATING EQUATIONS*** **Create equations that describe numbers or relationships.** ***A.CED.4*** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.★ c. Focus on formulas in which the variable of interest is linear or square. *For example, rearrange the formula for the area of a circle $A = (\pi)r^2$ to highlight radius r.* (M2)
Content Limits	• The variable of interest should be linear or square.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.REI REASONING WITH EQUATIONS AND INEQUALITIES*** **Solve equations and inequalities in one variable.** ***A.REI.4*** Solve quadratic equations in one variable. ***A.REI.4a*** 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. ***A.REI.4b*** Solve quadratic equations as appropriate to the initial form of the equation by inspection, e.g., for $x^2 = 49$; taking square roots; completing the square; applying the quadratic formula; or utilizing the Zero-Product Property after factoring.
Content Limits	• For 4a, the emphasis is on cases where the leading coefficient is 1. When items use a leading coefficient other than 1 (such as –1, ±2, or ±3), the linear coefficient b is an integer evenly divisible by the leading coefficient a. • For 4b, the emphasis is on cases where the leading coefficient is 1. Items may also use a leading coefficient other than 1 such as –1, ±2, or ±3. • Equations have real solutions.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.REI REASONING WITH EQUATIONS AND INEQUALITIES*** **Solve systems of equations.** ***A.REI.7*** 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 $y = -3x$ and the circle $x^2 + y^2 = 3$.*
Content Limits	• One equation of the system should be linear and the other equation should be quadratic. The equations for other conic sections may not be used.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.REI REASONING WITH EQUATIONS AND INEQUALITIES*** **Represent and solve equations and inequalities graphically.** ***A.REI.11*** Explain why the *x*-coordinates of the points where the graphs of the equation *y = f(x)* and *y = g(x)* intersect are the solutions of the equation *f(x) = g(x)*; find the solutions approximately, e.g., using technology to graph the functions, making tables of values, or finding successive approximations.
Content Limits	• Equations will be quadratic in two variables.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**NUMBER QUANTITIES, EQUATIONS AND EXPRESSIONS**
Content Standard	***A.APR ARITHMETIC WITH POLYNOMIALS AND RATIONAL EXPRESSIONS*** **Perform arithmetic operations on polynomials.** ***A.APR.1*** Understand that polynomials form a system analogous to the integers, namely, that they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. a. Focus on polynomial expressions that simplify to forms that are linear or quadratic. (A1, M2)
Content Limits	• Once the indicated operations have been performed, the result is usually a linear or quadratic polynomial.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.IF INTERPRETING FUNCTIONS*** **Interpret functions that arise in applications in terms of the context.** ***F.IF.4*** 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 the following: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*★(A2, M3) b. Focus on linear, quadratic, and exponential functions. (A1, M2)
Content Limits	• Functions may be linear, simple exponential, or quadratic. • Key features include, intercepts; increasing, decreasing, positive, or negative intervals; relative maximums and minimums; symmetries; and end behavior.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.IF INTERPRETING FUNCTIONS*** **Interpret functions that arise in applications in terms of the context.** ***F.IF.5*** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*★ b. Focus on linear, quadratic, and exponential functions. (A1, M2)
Content Limits	• Functions may be linear, simple exponential, or quadratic. • Include items connecting context, graphs, and tables
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.IF INTERPRETING FUNCTIONS*** **Analyze functions using different representations.** ***F.IF.7*** Graph functions expressed symbolically and indicate key features of the graph, by hand in simple cases and using technology for more complicated cases. Include applications and how key features relate to characteristics of a situation, making selection of a particular type of function model appropriate.★ ***F.IF.7b*** Graph quadratic functions and indicate intercepts, maxima, and minima. (A1, M2)
Content Limits	• Functions are quadratic. • The emphasis of items is on creating graphs.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.IF INTERPRETING FUNCTIONS*** **Analyze functions using different representations.** ***F.IF.8*** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. ***F.IF.8a*** 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. (A2, M3) i. Focus on completing the square to quadratic functions with the leading coefficient of 1. (A1, M2) ***F.IF.8b*** Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as* $y = (1.02)^t$, *and* $y = (0.97)^t$ *and classify them as representing exponential growth or decay.* (A2, M3)) i. Focus on exponential functions evaluated at integer inputs. (A1, M2)
Content Limits	• When factoring general quadratic trinomials (except for special forms) that contain no common factors, the emphasis is on cases where the leading coefficient is 1. Items may also use other leading coefficients such as –1, ±2, or ±3. • When factoring special forms of polynomials that contain no common factors (e.g., perfect square trinomials or difference of squares), the leading coefficient may be any suitable rational number. • A quadratic polynomial resulting from factoring out a greatest common factor (that may be any rational number), should follow one of the two above bullets. • When completing the square, the emphasis is on cases where the leading coefficient is 1. When items use a leading coefficient other than 1 (such as –1, ±2, or ±3), the linear coefficient *b* is an integer evenly divisible by the leading coefficient *a*. • Exponents in exponential expressions will not contain fractions when a student is asked to create an equivalent expression in the form a^t, where *a* is a nonzero variable.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.IF INTERPRETING FUNCTIONS*** **Analyze functions using different representations.** ***F.IF.9*** 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.* (A2, M3) b. Focus on linear, quadratic, and exponential functions. (A1, M2)
Content Limits	• Functions may be linear, simple exponential, or quadratic. • Must use at least two different representations
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.BF BUILDING FUNCTIONS*** **Build a function that models a relationship between two quantities.** ***F.BF.1*** Write a function that describes a relationship between two quantities.★ ***F.BF.1a*** Determine an explicit expression, a recursive process, or steps for calculation from context. ii. Focus on situations that exhibit quadratic or exponential relationships. (A1, M2)
Content Limits	• Items may use function notation or show some of the terms that appear in a sequence. • Functions may be simple exponential or quadratic. Other relationships may also be modeled (e.g., the Fibonacci sequence).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.BF BUILDING FUNCTIONS*** **Build new functions from existing functions.** ***F.BF.3*** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. (A2, M3) a. Focus on transformations of graphs of quadratic functions, except for $f(kx)$; (A1, M2)
Content Limits	• Functions are quadratic. • The function f(x) may be replaced by one or more of the following: $f(x) + k$, $kf(x)$, and $f(x + k)$ for specific values of k (both positive and negative). • Items will not require the transformation $f(kx)$. • Questions may require students to perform transformations on graphs or identify transformations applied to graphs either with sentences, function notation (e.g., $f(x) + 3$), or ordered pair notation (e.g., $(x, y) \rightarrow (x + 2, y - 4)$).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**FUNCTIONS**
Content Standard	***F.LE LINEAR, QUADRATIC, AND EXPONENTIAL MODELS*** **Construct and compare linear, quadratic, and exponential models, and solve problems.** ***F.LE.3*** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly or quadratically. ★ (A1, M2)
Content Limits	• Functions may be linear, simple exponential, or quadratic.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Understand similarity in terms of similarity transformations.** ***G.SRT.1*** Verify experimentally the properties of dilations given by a center and a scale factor: ***G.SRT.1a*** 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. ***G.SRT.1b*** The dilation of a line segment is longer or shorter in the ratio given by the scale factor.
Content Limits	• Scale factors are positive. • Items may involve polygons. • Items may require the student to identify or create a rule using ordered pair notation to describe a series of transformations for any point (x, y). • Items may require students to determine an equation of a line that is the result of dilating a given line.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Understand similarity in terms of similarity transformations.** ***G.SRT.2*** 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.
Content Limits	• Transformations limited to the following: ○ dilations with a positive scale factor and an indicated center of dilation ○ translations ○ rotations with an indicated center of rotation ○ reflections across lines (lines of reflections may be lines other than a horizontal line, vertical line, $y = x$, or $y = -x$) • Items may require the student to identify or create a rule using ordered pair notation to describe a series of transformations for any point (*x*, *y*). • Items that describe the connection between similarity and transformations should assess knowledge of this line of reasoning - "Two shapes are similar if one can be mapped onto another using reflections, rotations, translations, and/or dilations on the other. All of these transformations maintain angle measure and ratios of side lengths. Therefore, similar figures have equal corresponding angle measures and corresponding pairs of sides are proportional."
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Understand similarity in terms of similarity transformations.** ***G.SRT.3*** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.
Content Limits	• Transformations limited to the following: ○ dilations with a positive scale factor and an indicated center of dilation ○ translations ○ rotations with an indicated center of rotation ○ reflections across lines (lines of reflections may be lines other than a horizontal line, vertical line, $y = x$, or $y = -x$) • Items may require the student to identify or create a rule using ordered pair notation to describe a series of transformations for any point (*x*, *y*).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Prove and apply theorems both formally and informally involving similarity using a variety of methods.** ***G.SRT.4*** Prove and apply theorems about triangles. *Theorems include but are not restricted to the following: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.*
Content Limits	• Proving methods include, but are not restricted to, two-column proofs, flow chart proofs, paragraph/narrative proofs, indirect proofs, coordinate proofs, and transformational proofs. • The names of properties and theorems is needed to justify statements in proofs.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Prove and apply theorems both formally and informally involving similarity using a variety of methods.** ***G.SRT.5*** Use congruence and similarity criteria for triangles to solve problems and to justify relationships in geometric figures that can be decomposed into triangles.
Content Limits	• Proving methods include, but are not restricted to, two-column proofs, flow chart proofs, paragraph/narrative proofs, indirect proofs, coordinate proofs, and transformational proofs. • The names of properties and theorems is needed to justify statements in proofs. • Items are limited to using SSS, SAS, ASA, AAS, and/or HL for congruence. • Items use AA, SAS (ratios), and/or SSS (ratios) for similarity. • Items may use geometric figures of any shape if the figure can be deconstructed to form a triangle.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Define trigonometric ratios, and solve problems involving right triangles.** ***G.SRT.6*** 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.
Content Limits	• Trigonometric ratios are limited to sine, cosine, and tangent.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Define trigonometric ratios, and solve problems involving right triangles.** ***G.SRT.7*** Explain and use the relationship between the sine and cosine of complementary angles.
Content Limits	None
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.SRT SIMILARITY, RIGHT TRIANGLES, AND TRIGONOMETRY*** **Define trigonometric ratios, and solve problems involving right triangles.** ***G.SRT.8*** Solve problems involving right triangles.★ ***G.SRT.8a*** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems if one of the two acute angles and a side length is given. (G, M2)
Content Limits	• Trigonometric ratios are limited to sine, cosine, and tangent. • Items do not require the student to use inverse trigonometry functions to calculate unknown angle measures.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Required

Reporting Category	**GEOMETRY**
Content Standard	***G.C CIRCLES*** **Understand and apply theorems about circles.** ***G.C.1*** Prove that all circles are similar using transformational arguments.
Content Limits	• Aside from items that ask the student to find the ratio of dilation between circles, items should focus on the fact that any circle can be obtained by a translation and dilation of any other circle.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.C CIRCLES*** **Find arc lengths and areas of sectors of circles.** ***G.C.5*** Find arc lengths and areas of sectors of circles. ***G.C.5a*** Apply similarity to relate the length of an arc intercepted by a central angle to the radius. Use the relationship to solve problems. ***G.C.5b*** Derive the formula for the area of a sector, and use it to solve problems.
Content Limits	• Items may involve composite shapes.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GPE EXPRESSING GEOMETRIC PROPERTIES WITH EQUATIONS*** **Translate between the geometric description and the equation for a conic section.** ***G.GPE.1*** Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
Content Limits	• All four quadrants of the coordinate plane • Circle centers have integer coordinates. • When completing the square, the emphasis is on cases where the leading coefficient is 1. When items use a leading coefficient other than 1 (such as –1, ±2, or ±3), the linear coefficient *b* is an integer evenly divisible by the leading coefficient *a*. • When completing the square, the leading coefficient of each quadratic trinomial are equal so that both perfect square terms are divisible by the leading coefficient.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GPE EXPRESSING GEOMETRIC PROPERTIES WITH EQUATIONS*** **Use coordinates to prove simple geometric theorems algebraically and to verify specific geometric statements.** ***G.GPE.4*** Use coordinates to prove simple geometric theorems algebraically and to verify geometric relationships algebraically, including properties of special triangles, quadrilaterals, and circles. *For example, determine if a figure defined by four given points in the coordinate plane is a rectangle; determine if a specific point lies on a given circle.* (G, M2)
Content Limits	• All four quadrants of the coordinate plane may be used. • Items may use radical values. • Include simple proofs involving circles, properties of quadrilaterals, and special right triangles (30-60-90 and 45-45-90) • Proving methods include, but are not restricted to, two-column proofs, flow chart proofs, paragraph/narrative proofs, indirect proofs, coordinate proofs, and transformational proofs. • The formal names of properties and theorems need to be recognized to justify statements in some proofs (Note: The Addition Property of Equality and Multiplication Property of Equality can be used instead of the Subtraction Property of Equality and Division Property of Equality, respectively). • Items may require the application of the distance formula.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GPE EXPRESSING GEOMETRIC PROPERTIES WITH EQUATIONS*** **Use coordinates to prove simple geometric theorems algebraically and to verify specific geometric statements.** ***G.GPE.6*** Find the point on a directed line segment between two given points that partitions the segment in a given ratio.
Content Limits	None
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GMD GEOMETRIC MEASUREMENT AND DIMENSION*** **Explain volume formulas, and use them to solve problems.** ***G.GMD.1*** Give an informal argument for the formulas for the circumference of a circle, area of a circle, and volume of a cylinder, pyramid, and cone. *Use dissection arguments, Cavalieri's principle, and informal limit arguments.*
Content Limits	• Students should not be required to know informal arguments (Cavalieri's principle, dissection, etc.) by name.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GMD GEOMETRIC MEASUREMENT AND DIMENSION*** **Explain volume formulas, and use them to solve problems.** ***G.GMD.3*** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.★
Content Limits	• Focus should be on solving real-world problems, not simply finding the volume of given figures. • Items may use composite solids composed of cylinders, pyramids, cones, and spheres.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GMD GEOMETRIC MEASUREMENT AND DIMENSION*** **Visualize relationships between two-dimensional and three-dimensional objects.** ***G.GMD.4*** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects.
Content Limits	• Items may use diagonal cross-sections.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GMD GEOMETRIC MEASUREMENT AND DIMENSION*** **Understand the relationships between lengths, area, and volumes.** ***G.GMD.5*** Understand how and when changes to the measures of a figure (lengths or angles) result in similar and non-similar figures.
Content Limits	None
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.GMD GEOMETRIC MEASUREMENT AND DIMENSION*** **Understand the relationships between lengths, area, and volumes.** ***G.GMD.6*** When figures are similar, understand and apply the fact that when a figure is scaled by a factor of *k*, the effect on lengths, areas, and volumes is that they are multiplied by *k*, k^2, and k^3, respectively.
Content Limits	None
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**GEOMETRY**
Content Standard	***G.MG MODELING WITH GEOMETRY*** **Apply geometric concepts in modeling situations.** ***G.MG.1*** Use geometric shapes, their measures, and their properties to describe objects, e.g., modeling a tree trunk or a human torso as a cylinder.★
Content Limits	None
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Required

Reporting Category	**GEOMETRY**
Content Standard	***G.MG MODELING WITH GEOMETRY*** **Apply geometric concepts in modeling situations.** ***G.MG.2*** Apply concepts of density based on area and volume in modeling situations, e.g., persons per square mile, BTUs per cubic foot.★
Content Limits	• Only some of these items should deal with density of an object. Others should deal with broader applications of the word density, like wolves per square mile.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Required

Reporting Category	**GEOMETRY**
Content Standard	***G.MG MODELING WITH GEOMETRY*** **Apply geometric concepts in modeling situations.** ***G.MG.3*** 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.★
Content Limits	• Items may require the student to use knowledge of other Geometry standards. • Items that use volume should not also assess G.GMD.3 or G.MG.1.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Required

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Understand independence and conditional probability, and use them to interpret data.** ***S.CP.1*** 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").★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may use Venn diagrams, tree diagrams, or frequency tables. • Items may use union and intersection symbols.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Understand independence and conditional probability, and use them to interpret data.** ***S.CP.2*** Understand that two events A and B are independent if and only 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.★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may use Venn diagrams, tree diagrams, or frequency tables. • Items may use union and intersection symbols.
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Understand independence and conditional probability, and use them to interpret data.** ***S.CP.3*** Understand the conditional probability of A given B as $^{P(A \text{ and } B)}/_{P(B)}$, 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.★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may use Venn diagrams, tree diagrams, or frequency tables. • Items may use union and intersection symbols. • Conditional probability may be written as a description (i.e., the student identifies events A and B within context and then translates the information into the form A given B) as well as the symbolic notation P(A | B).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Understand independence and conditional probability, and use them to interpret data.** ***S.CP.4*** 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.*★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may use Venn diagrams, tree diagrams, or frequency tables. • Items may use union and intersection symbols. • Conditional probability may be written as a description (i.e., the student identifies events A and B within context and then translates the information into the form A given B) as well as the symbolic notation P(A | B).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Understand independence and conditional probability, and use them to interpret data.** ***S.CP.5*** 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.*★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may ask to relate Venn diagrams or tree diagrams to frequency tables. • Items may use union and intersection symbols. • Conditional probability may be written as a description (i.e., the student identifies events A and B within context and then translates the information into the form A given B) as well as the symbolic notation P(A | B).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Required

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Use the rules of probability to compute probabilities of compound events in a uniform probability model.** ***S.CP.6*** Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model.★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may ask to relate Venn diagrams or tree diagrams to frequency tables. • Items may use union and intersection symbols. • Conditional probability may be written as a description (i.e., the student identifies events A and B within context and then translates the information into the form A given B) as well as the symbolic notation P(A | B).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional

Reporting Category	**PROBABILITY**
Content Standard	***S.CP CONDITIONAL PROBABILITY AND THE RULES OF PROBABILITY*** **Use the rules of probability to compute probabilities of compound events in a uniform probability model.** ***S.CP.7*** Apply the Addition Rule, P(A or B) = P(A) + P(B) − P(A and B), and interpret the answer in terms of the model.★
Content Limits	• Items use positive rational numbers to represent probabilities. • Items may ask to relate Venn diagrams or tree diagrams to frequency tables. • Items may use union and intersection symbols. • Conditional probability may be written as a description (i.e., the student identifies events A and B within context and then translates the information into the form A given B) as well as the symbolic notation P(A | B).
DOK	1, 2, and/or 3 are eligible. DOK levels are designated on an item-by-item basis.
Context	Context Optional