ISASP IOWA STATEWIDE ASSESSMENT of STUDENT PROGRESS

ISASP Test Specifications
Mathematics
Spring 2026

Prepared By
Iowa Testing Programs

ISASP Specifications 2026

Mathematics – Grades 3-8

The Iowa Statewide Assessment of Student Progress (ISASP) Mathematics tests emphasize understanding, discovery, and quantitative thinking in mathematics.

Major, Supporting, and Additional Work

In 2024, new Iowa Academic Standards for Mathematics were adopted. One key area introduced into the new standards was an emphasis on clusters. Clusters consist of groups of related standards, and the Academic Standards organize clusters into three classifications: Major, Supporting, and Additional. As a result, the 2026 ISASP Math specifications represent a balance that is consistent with the statement "at least 65% and up to 85% of class time should be dedicated to the Major Work… " (IA Standards, p. 4). In addition, Supporting and Additional Clusters also contribute to the test specifications.

ISASP specifications have been designed so that at least 65% of the items on each test are aligned to standards within the Major Clusters. To that end, an additional seven items have been added to the Grades 3-8 tests from the previous specifications to increase coverage of Major Clusters. Additionally, to be consistent with the Iowa Academic Standards and the requirements of alignment for ISASP, ISASP specifications will continue to support reporting at each domain level.

Adaptive Testing

For the 2026 administration, Mathematics tests in grades 3-8 will move to an adaptive design, allowing for greater precision for measuring student performance across the entire performance continuum.

Specification Tables

Table 1 provides the items totals for Mathematics by grade. Although ISASP is an untimed test, Table 2 provides recommended administration times. Table 3 provides the percentage of items on each test form aligned to each Depth-of-Knowledge (DOK) level. Tables 4-9 provide domain, cluster, and standards-level specifications.

- The reporting structure for ISASP emphasizes both total test score and domain-level information. The specifications provide the information necessary to evaluate the domain-level information.
- ISASP is an annual summative assessment designed to assess proficiency of grade-level standards. Given this purpose, the specifications reflect the breadth and depth of the clusters and standards within domain. Domain-level ranges are used for test assembly

purposes. The ranges of clusters and standards within a domain provide guidance at a more detailed level.

Table 10 provides alignment information to the Major, Supporting, and Additional Clusters.

- These ranges represent the minimum and maximum numbers of items from each cluster type that could appear on a test.

Table 1. Item Totals, ISASP Mathematics Grades 3-8

Grade	Operational Item Total	Field Test item Total	Total Items
3	42	6	48
4	44	6	50
5	47	6	53
6	49	6	55
7	52	6	58
8	54	6	60

Table 2. Recommended Testing Time (in Minutes), ISASP Mathematics Grades 3-8

Grades	Recommended Testing Time
3-5	85
6-8	80

Table 3. Depth-of-Knowledge levels, ISASP Mathematics Grades 3-8

Grades	Depth-of-Knowledge Level	Percent of Operational Items
3-8	DOK 1	20-35%
	DOK 2	45-65%
	DOK 3	10-25%

Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
OA			**Operations and Algebraic Thinking**	**16-18**	**38-43%**
	A		**Represent and solve problems involving multiplication and division.**	**4-8**	**10-19%**
		3.OA.A.1	Interpret products of whole numbers. *For example, interpret* 5×7 *as the total number of objects in 5 groups of 7 objects each; describe a context in which a total number of objects can be expressed as* 5×7.	0-3	0-7%
		3.OA.A.2	Interpret whole-number quotients of whole numbers as the number of groups or the number in each group in situations of equal groups. *For example, describe a context involving equal groups of objects in which the number of groups or the number in each group can be expressed as* $56 \div 8$.	0-3	0-7%
		3.OA.A.3	Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, with unknowns in all positions. *For example, by using drawings and equations with a symbol for the unknown number to represent the problem.*	0-4	0-10%
		3.OA.A.4	Be able to represent a word problem by writing an equation with a symbol for the unknown whole number and determine the unknown whole number in a multiplication or division equation relating to three whole numbers. *For example, determine the unknown number that makes the equation true in each of the equations* $8 \times \square = 48, 5 = \square \div 3, 6 \times 6 = \square$.	0-4	0-10%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		**Use properties of operations and the relationship between multiplication and division.**	**2-5**	**5-12%**
		3.OA.B.5	Use properties of operations as strategies to multiply and divide. *For example, if* $6 \times 4 = 24$ *is known, then* $4 \times 6 = 24$ *is also known. (Commutative property of multiplication)* $3 \times 5 \times 2$ *can be found by* $3 \times 5 = 15$, *then* $15 \times 2 = 30$, *or by* $5 \times 2 = 10$, *then* $3 \times 10 = 30$. *(Associative property of multiplication) Knowing that* $8 \times 5 = 40$ *and* $8 \times 2 = 16$, *one can find* 8×7 *as* $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$. *(Distributive property)*	0-3	0-7%
		3.OA.B.6	Understand division as an unknown-factor problem. *For example, find* $32 \div 8$ *by finding (or remembering) the number that makes* 32 *when multiplied by* 8 ($\square \times 8 = 32$).	0-3	0-7%
	C		**Multiply and divide within 100.**	**2-5**	**5-12%**
		3.OA.C.7	Fluently multiply and divide within 100, using strategies such as the relationship between multiplication and division or properties of operations. *For example, knowing that* $8 \times 5 = 40$, *one knows* $40 \div 5 = 8$. By the end of Grade 3, flexibly, efficiently, and accurately find all products of two one-digit numbers.	2-5	5-12%
	D		**Solve problems involving the four operations, and identify and explain patterns in arithmetic.**	**2-5**	**5-12%**
		3.OA.D.8	Solve two-step word problems using the four operations. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	1-5	2-12%
		3.OA.D.9	Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations. *For example, observe that* 4 *times a number is always even, and explain why* 4 *times a number can be decomposed into two equal addends.*	0-3	0-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
NBT			**Numbers and Operations in Base Ten**	**4-6**	**10-14%**
	A		Use place value understanding and properties of operations to perform multi-digit arithmetic.	4-6	10-14%
		3.NBT.A.1	Round whole numbers to the nearest 10 or 100 within the range of 0–1,000. *For example, rounding 643 to the nearest 10 would be 640; to the nearest 100 would be 600.*	0-3	0-7%
		3.NBT.A.2	Fluently add and subtract within 1,000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. *For example,* $412 - 13 = 412 - 12 - 1 = 400 - 1 = 399$; $505 + 70 = 575$.	0-3	0-7%
		3.NBT.A.3	Use place value and properties of operations to multiply one-digit whole numbers by multiples of 10 in the range $10-90$. *For example,* $9 \times 80, 5 \times 60$.	0-3	0-7%
NF			**Numbers and Operations - Fractions**	**6-8**	**14-19%**
	A		**Understand fractions as numbers.**	**6-8**	**14-19%**
		3.NF.A.1	Understand a fraction $\frac{1}{b}$ as the quantity formed by 1 part when a whole is partitioned into b equal parts; understand a fraction $\frac{a}{b}$ as the quantity formed by a parts of size $\frac{1}{b}$.	0-3	0-7%

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Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		3.NF.A.2	Understand a fraction as a number on the number line; represent fractions on a number line diagram. a. Represent a fraction $\frac{1}{b}$ on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size $\frac{1}{b}$ and that the endpoint of the part based at 0 locates the number $\frac{1}{b}$ on the number line. b. Represent a fraction $\frac{a}{b}$ on a number line diagram by marking off a lengths $\frac{1}{b}$ from 0. Recognize that the resulting interval has size $\frac{a}{b}$ and that its endpoint locates the number $\frac{a}{b}$ on the number line.	0-4	0-10%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		3.NF.A.3	Explain equivalence of fractions in special cases and compare fractions by reasoning about their size. a. Understand two fractions as equivalent (equal) if they are the same size, or the same point on a number line. b. Recognize and generate simple equivalent fractions. *For example,* $\frac{1}{2} = \frac{2}{4}$, $\frac{4}{6} = \frac{2}{3}$. Explain why the fractions are equivalent. *For example, by using a visual fraction model.* c. Express whole numbers as fractions and recognize fractions that are equivalent to whole numbers. *For example, express* 3 *in the form* $3 = \frac{3}{1}$; *recognize that* $\frac{6}{1} = 6$; *locate* $\frac{4}{4}$ *and* 1 *at the same point of a number line diagram.* d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusion. *For example, by using a visual fraction model.*	1-5	2-12%
MD			**Measurement and Data**	**8-10**	**19-24%**
	A		**Solve problems with time and measured quantities.**	**3-6**	**7-14%**
		3.MD.A.1	Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes. *For example, by representing the problem on a number line.*	1-3	2-7%

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Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		3.MD.A.2	Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). (Excludes compound units such as cubic centimeters and finding the geometric volume of a container.) Add, subtract, multiply, or divide to solve one-step word problems involving measured quantities (masses and liquid volumes). Excludes multiplicative comparison problems involving notions of "times as much"; problems do not require unit conversion.	1-3	2-7%
	B		Represent and interpret data.	1-4	2-10%
		3.MD.B.3	Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.	0-3	0-7%
		3.MD.B.4	Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	0-3	0-7%
	C		**Geometric measurement: understand concepts of area and relate area to multiplication and to addition.**	**3-5**	**7-12%**
		3.MD.C.5	Recognize area as an attribute of plane figures and understand concepts of area measurement. a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by *n* unit squares is said to have an area of *n* square units.	0-2	0-5%
		3.MD.C.6	Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).	0-2	0-5%

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Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		3.MD.C.7	Relate area to the operations of multiplication and addition. a. Find the area of a rectangle with whole-number side lengths by tiling it and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems. c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and $b + c$ is the sum of $a \times b$ and $a \times c$. Use area models to represent the distributive property in mathematical reasoning. d. Recognize area as additive. Find areas of figures that can be decomposed into non-overlapping rectangles and add the areas of the non-overlapping parts, applying this technique to solve real world problems.	1-4	2-10%
	D		Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.	0-2	0-5%
		3.MD.D.8	Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.	0-2	0-5%

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Table 4. Mathematics Grade 3 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
G			**Geometry**	**4-5**	**10-12%**
	A		Reason with shapes and their attributes.	4-5	10-12%
		3.G.A.1	Understand that shapes in different categories *(for example, rhombuses, rectangles, and others)* may share attributes *(for example, having four sides)*, and that the shared attributes can define a larger category *(for example, quadrilaterals)*. Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.	1-3	2-7%
		3.G.A.2	Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as $\frac{1}{4}$ of the area of the shape*.	1-3	2-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			Operations and Algebraic Thinking	**10-12**	**23-27%**
OA	**A**		**Use the four operations with whole numbers to solve problems.**	**8-10**	**18-23%**
		4.OA.A.1	Interpret a multiplication equation as a comparison and represent verbal statements of multiplicative comparisons as multiplication equations. *For example, write* $35 = 7 \times 5$ *to represent the statement that a 35-foot-long whale shark is 7 times as long as a 5-foot-long reef shark*.	0-4	0-9%
		4.OA.A.2	Multiply or divide to solve word problems involving multiplicative comparison, distinguishing multiplicative comparison from additive comparison. Be able to use drawings and equations with a variable for the unknown number to represent the problem. *For example, Tom's pencil is 4 times as long as Julie's pencil. Tom's pencil is 8 inches long. How long is Julie's pencil? (multiplicative comparison) For example, Julie's pencil is 2 inches long. Tom's pencil is 8 inches long. How much longer is Tom's pencil than Julie's pencil? (additive comparison)*	0-5	0-11%
		4.OA.A.3	Solve multistep word problems posed with whole numbers and whole-number answers using the four operations, including problems in which remainders must be interpreted. Be able to represent word problems with mathematical diagrams and with equations in which a letter stands for an unknown quantity and be able to assess the reasonableness of answers using mental computation and estimation strategies including rounding.	0-5	0-11%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		Gain familiarity with factors and multiples.	1-3	2-7%
		4.OA.B.4	Be able to find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1–100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.	1-3	2-7%
	C		Analyze a number sequence that follows a given rule.	0-3	0-7%
		4.OA.C.5	Given the rule for a sequence of numbers, identify apparent features of the sequence that were not explicit in the rule itself; explain informally why the numbers will continue to alternate in this way. *For example, given the rule "Add* 3*" and the number sequence* 1, 4, 7, 10, 13 *observe that the terms appear to alternate between odd and even numbers.*	0-3	0-7%
NBT			**Numbers and Operations in Base Ten**	**9-11**	**20-25%**
	A		**Generalize place value understanding for multi-digit whole numbers up to 1,000,000.**	**4-8**	**9-18%**
		4.NBT.A.1	Recognize that in a multi-digit whole number, a digit in one place represents ten times what that same digit represents in the place to its right. *For example, recognize that* $700 \div 70 = 10$ *by applying concepts of place value and division.*	0-3	0-7%
		4.NBT.A.2	Read and write whole multi-digit numbers using base-ten numerals (standard form), number names (word form), and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	0-3	0-7%
		4.NBT.A.3	Use place value understanding to round multi-digit whole numbers to any place. *For example,* 435,450 *rounded to the nearest ten-thousands place is* 440,000 *because it is more than halfway between* 430,000 *and* 440,000.	0-3	0-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		**Calculate with multi-digit numbers.**	**4-8**	**9-18%**
		4.NBT.B.4	Fluently add and subtract multi-digit whole numbers up to 1,000,000 using an algorithm. Algorithms may include the standard algorithm, partial sums, partial differences, counting or adding up in increments.	0-3	0-7%
		4.NBT.B.5	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Be able to illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	0-3	0-7%
		4.NBT.B.6	Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	0-3	0-7%
NF			**Numbers and Operations - Fractions**	**12-14**	**27-32%**
	A		**Extend understanding of fraction equivalence and ordering.**	**3-5**	**7-11%**
		4.NF.A.1	Illustrate and explain numerical statements of fraction equivalence by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and write equivalent fractions.	0-3	0-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		4.NF.A.2	Compare two fractions with different numerators and different denominators by creating common denominators or numerators, comparing to a benchmark fraction such as $\frac{1}{2}$ and/or by using a visual fraction model. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions.	0-3	0-7%
	B		**Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.**	**4-6**	**9-14%**
		4.NF.B.3	Understand a fraction $\frac{a}{b}$ with $a > 1$ as a sum of fractions $\frac{1}{b}$. *For example,* $\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$. a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Be able to justify decompositions. *For example, by using a visual fraction model. For example:* $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} = \frac{1}{8} + \frac{2}{8}; \frac{21}{8} = 1 + 1 + \frac{1}{8} = \frac{8}{8} + \frac{8}{8} + \frac{1}{8}$. c. Add and subtract mixed numbers with like denominators and show sums and differences of mixed numbers on a number line diagram. d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, by using visual fraction models and or equations to represent the problem.	0-3	0-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		4.NF.B.4	Apply and extend earlier understandings of multiplication to multiply a fraction by a whole number. a. Using a visual fraction model, understand a fraction with a numerator greater than 1 is a multiple of a unit fraction. *For example, using a number line to show* $\frac{5}{4}$ *as the product of* $5 \times \frac{1}{4}$. b. Multiply a fraction by a whole number using the principle that the product is the whole number times the numerator of the fraction with the same denominator. c. Solve word problems involving multiplication of a fraction by a whole number. Use visual fraction models and/or equations to represent the problem.	0-3	0-7%
	C	`	**Understand decimal notation for fractions for tenths and hundredths.**	**3-5**	**7-11%**
		4.NF.C.5	Express a fraction with denominator 10 as an equivalent fraction with denominator 100 and use this technique to add two fractions with respective denominators 10 and 100. *For example, express* $\frac{3}{10}$ *as* $\frac{30}{100}$*, and add* $\frac{3}{10} + \frac{4}{100} = \frac{34}{100}$.	0-2	0-5%
		4.NF.C.6	Use decimal notation for fractions with denominators 10 or 100. *For example, rewrite* 0.62 *as* $\frac{62}{100}$ *and locate* 0.62 *on a number line.*	0-2	0-5%
		4.NF.C.7	Compare two decimals to hundredths by reasoning about their size, recording the results of comparisons with the symbols >, =, or <. Recognize that comparisons are valid only when the two decimals refer to the same whole. Show decimals on a number line diagram and be able to justify numerical statements of decimal comparison by using a visual fraction model.	0-2	0-5%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
MD			**Measurement and Data**	**7-9**	**16-20%**
	A		Solve problems involving conversion of measurements from a larger unit to a smaller unit.	1-5	2-11%
		4.MD.A.1	Know relative sizes of measurement units within one system of measurement, including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit by using multiplication. *For example, record measurement equivalents in a two-column table, know that* 1 *ft is* 12 *times as long as* 1 *in or express the length of a* 4 *ft snake as* 48 *in.*	0-2	0-5%
		4.MD.A.2	Use the four operations to solve word problems involving distances, intervals of time (including elapsed time), liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.	0-2	0-5%
		4.MD.A.3	Apply the area and perimeter formulas for rectangles in real world and mathematical problems. *For example, find the width of a rectangular room given the area of the flooring and the length, by viewing the area formula as a multiplication equation with an unknown factor.*	0-2	0-5%
	B		Represent and interpret data using a line plot.	0-2	0-5%
		4.MD.B.4	Make a line plot to display a data set of measurements using the fractions of a unit. $\left(\frac{1}{2}, \frac{1}{4}, \frac{1}{8}\right)$. • $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}, \frac{8}{8}$ • $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}$ • $\frac{1}{2}, \frac{2}{2}$ Solve problems involving addition and subtraction of fractions by using information presented in line plots. *For example, from a line plot find and interpret the difference in length between the longest and shortest pencils in a collection.*	0-2	0-5%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	C		Geometric measurement: understand the concept of angle and measure angles.	1-4	2-9%
		4.MD.C.5	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. An angle is measured with reference to a circle with its center at the common endpoint of the angle's rays. An angle that turns through $\frac{1}{360}$ of a circle is called a "one-degree angle," and can be used to measure angles. b. An angle that turns through *n* one-degree angles is said to have an angle measure of *n*°. *For example, an angle that turns through* 45 *one-degree angles has an angle measure of* 45 *degrees.*	0-2	0-5%
		4.MD.C.6	Draw and measure angles in whole-number degrees (1–180°) using a protractor. Sketch angles of specified measure.	0-2	0-5%
		4.MD.C.7	Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems. *For example, by using an equation with a symbol for the unknown angle measure.*	0-2	0-5%
G			**Geometry**	**4-6**	**9-14%**
	A		Draw and identify lines and angles, and classify shapes by properties of their lines and angles.	4-6	9-14%
		4.G.A.1	Draw points, lines, line segments, rays, angles (acute, right, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	0-2	0-5%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 5. Mathematics Grade 4 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		4.G.A.2	Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category and identify right triangles.	0-2	0-5%
		4.G.A.3	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.	0-2	0-5%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
OA			**Operations and Algebraic Thinking**	**5-7**	**11-15%**
	A		Write and interpret numerical expressions.	3-6	6-13%
		5.OA.A.1	Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols, including expressions in which whole numbers and fractions appear.	0-3	0-6%
		5.OA.A.2	Write simple expressions that record calculations with numbers and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by* $\frac{1}{2}$ *as* $\frac{1}{2} \times (8 + 7)$. *Recognize that* $3 \times \left(\frac{18}{19} + \frac{2}{3}\right)$ *is three times as large as* $\frac{18}{19} + \frac{2}{3}$, *without having to calculate the indicated sum or product.*	0-3	0-6%
	B		Analyze a pair of number sequences.	1-4	2-9%
		5.OA.B.3	Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns and graph the ordered pairs on a coordinate plane; explain informally why this is so. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence.*	1-4	2-9%
NBT			**Numbers and Operations in Base Ten**	**14-16**	**30-34%**
	A		**Understand the place value system.**	**6-9**	**13-19%**
		5.NBT.A.1	Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		5.NBT.A.2	Explain and use patterns in the number of zeros of the product when multiplying a number by powers of 10 and use patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.	0-3	0-6%
		5.NBT.A.3	Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form. *For example,* $347.392 = 300 + 40 + 7 + 0.3 + 0.09 + 0.002$. b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	0-4	0-9%
		5.NBT.A.4	Use place value understanding to round decimals to any place. *For example,* 5.43 *rounded to the tenths is* 5.4 *because the last digit must be in the place the decimal is rounded to.*	0-3	0-6%
	B		**Perform operations with multi-digit whole numbers and with decimals to hundredths.**	**6-9**	**13-19%**
		5.NBT.B.5	Fluently multiply whole multi-digit numbers including using an algorithm. Algorithms may include the standard algorithm, partial products, and area model.	0-3	0-6%
		5.NBT.B.6	Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division, including the standard algorithm. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	0-3	0-6%
		5.NBT.B.7	Add, subtract, multiply, and divide decimals to hundredths. Be able to illustrate and explain using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
NF			**Numbers and Operations - Fractions**	**14-16**	**30-34%**
	A		**Use equivalent fractions as a strategy to add and subtract fractions.**	**6-9**	**13-19%**
		5.NF.A.1	Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example,* $\frac{2}{3}+\frac{5}{4}=\frac{8}{12}+\frac{15}{12}=\frac{23}{12}$. (*In general,* $\frac{a}{b}+\frac{c}{d}=\frac{(ad+bc)}{bd}$).	1-5	2-11%
		5.NF.A.2	Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. *For example, by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, my friend and I each have some lemons. We need* 1 *cup of lemon juice to make lemonade. If I squeeze* $\frac{1}{2}$ *cup of lemon juice and my friend squeezes* $\frac{2}{5}$ *cup of lemon juice, how much lemon juice do we have? Is it enough?*	1-5	2-11%
	B		**Apply and extend previous understandings of multiplication and division to multiply and divide fractions.**	**6-9**	**13-19%**
		5.NF.B.3	Interpret that a fraction is the division of the numerator by the denominator $\left(\frac{a}{b}=a\div b\right)$. Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, by using visual fraction models or equations to represent the problem. *For example, if* 9 *people want to share a* 50*-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*	0-2	0-4%

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Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		5.NF.B.4	Apply and extend earlier understandings of multiplication to multiply a fraction or whole number by a fraction. (This standard does not include mixed numbers.) a. Interpret the product $\left(\frac{a}{b}\right) \times q$ as a part of a partition of *q* into *b* equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$. Recognize that $\frac{1}{b} \times q = q \div b$ (dividing by a whole is the same as multiplying by the reciprocal. *For example, use a visual fraction model to show* $\left(\frac{2}{3}\right) \times 4 = \frac{8}{3}$, *and create a story context for this equation. Do the same with* $\left(\frac{2}{3}\right) \times \left(\frac{4}{5}\right) = \frac{8}{15}$. (*In general,* $\left(\frac{a}{b}\right) \times \left(\frac{c}{d}\right) = \frac{ac}{bd}$.) b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles and represent fraction products as rectangular areas.	0-3	0-6%

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Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		5.NF.B.5	Interpret multiplication as scaling (resizing) by: a. Comparing the size of a product to the size of one factor based on the size of the other factor, without performing the indicated multiplication. b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $\frac{a}{b} = \frac{n \times a}{n \times b}$ to the effect of multiplying $\frac{a}{b}$ by 1.	0-3	0-6%
		5.NF.B.6	Solve real world problems involving multiplication of fractions and mixed numbers. *For example, by using visual fraction models or equations to represent the problem.*	0-3	0-6%

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Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		5.NF.B.7	Apply and extend earlier understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (This standard does not include dividing fractions by fractions.) a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, create a story context for* $\left(\frac{1}{3}\right) \div 4$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $\left(\frac{1}{3}\right) \div 4 = \frac{1}{12}$ *because* $\left(\frac{1}{12}\right) \times 4 = \frac{1}{3}$. b. Interpret division of a whole number by a unit fraction and compute such quotients. *For example, create a story context for* $4 \div \left(\frac{1}{5}\right)$*, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $4 \div \left(\frac{1}{5}\right) = 20$ *because* $20 \times \left(\frac{1}{5}\right) = 4$. c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions. *For example, by using visual fraction models and equations to represent the problem: How much chocolate will each person get if* 3 *people share* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{1}{3}$ *cup servings are in* 2 *cups of raisins?*	0-3	0-6%
MD			**Measurement and Data**	**7-9**	**15-19%**
	A		Convert like measurement units within a given measurement system.	1-3	2-6%
		5.MD.A.1	Convert among different-sized standard measurement units within a given measurement system and use these conversions in solving multi-step, real world problems. *For example, (convert* 5 *cm to* 0.05 *m)*.	1-3	2-6%

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Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		Represent and interpret data.	0-2	0-4%
		5.MD.B.2	Make a line plot to display a data set of measurements in fractions of a unit $\left(\frac{1}{2}, \frac{1}{4}, \frac{1}{8}\right)$. Use operations on fractions to solve problems involving information presented in line plots. • $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}, \frac{8}{8}$ • $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \frac{4}{4}$ • $\frac{1}{2}, \frac{2}{2}$	0-2	0-4%
	C		**Geometric measurement: understand concepts of volume and relate volume to multiplication and addition.**	**3-5**	**6-11%**
		5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement. a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume. b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.	0-2	0-4%
		5.MD.C.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	0-2	0-4%

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Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		5.MD.C.5	Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume. a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes and show that the volume is the same as would be if found by multiplying the edge lengths or equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes to represent the associative property of multiplication. b. Apply the formulas $V = l \times w \times h$ and $V = B \times h$ (where B stands for the area of the base) for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts (composite figures), applying this technique to solve real world problems. *For example, find the volume of composite figures.*	0-3	0-6%

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Table 6. Mathematics Grade 5 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
G			**Geometry**	**5-7**	**11-15%**
	A		Graph points on the coordinate plane to solve real-world and mathematical problems.	1-4	2-9%
		5.G.A.1	Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Plot points in the first quadrant of a coordinate plane. Understand that the first number indicates how far to travel from the origin in the direction of the *x*-axis, and the second number indicates how far to travel in the direction of the *y*-axis, with the convention that the names of the two axes and the coordinates correspond (x, y).	0-2	0-4%
		5.G.A.2	Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane and interpret coordinate values of points in the context of the situation.	0-2	0-4%
	B		Classify two-dimensional figures into categories based on their properties.	1-4	2-9%
		5.G.B.3	Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. *For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles.*	0-3	0-6%
		5.G.B.4	Classify two-dimensional figures in a hierarchy based on properties.	0-3	0-6%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
RP			**Ratios and Proportional Relationships**	**10-12**	**20-25%**
	A		**Apply ratio concepts and use ratio reasoning to solve problems.**	**10-12**	**20-25%**
		6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *For example, "The ratio of wings to beaks in the bird house at the zoo was* 2:1*, because for every* 2 *wings there was* 1 *beak." "For every vote candidate A received, candidate C received nearly three votes."*	0-4	0-8%
		6.RP.A.2	Understand the concept of a unit rate $\frac{a}{b}$ associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship. *For example, "This recipe has a ratio of* 3 *cups of flour to* 4 *cups of sugar, so there is* $\frac{3}{4}$ *cup of flour for each cup of sugar." "We paid* $75 *for* 15 *hamburgers, which is a rate of* $5 *per hamburger." Expectations for unit rates in this grade are limited to non-complex fractions.*	0-4	0-8%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems, by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations. a. Make tables of equivalent ratios relating quantities with whole-number measurements, find missing values in the tables, and plot the pairs of values on the coordinate plane. Use tables to compare ratios. b. Use unit rates and scaling to solve problems about proportional relationships, including problems involving unit pricing and constant speed. c. Find a percentage of a quantity as a rate per 100; solve problems involving finding the whole, given a part and the percentage. *For example,* 30% *of a quantity means* $\frac{30}{100}$ *times the quantity.* d. Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.	3-9	6-18%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
NS			**The Number System**	**9-11**	**18-22%**
	A		**Apply and extend previous understandings of multiplication and division to divide fractions by fractions.**	**1-4**	**2-8%**
		6.NS.A.1	Use and interpret models to compute quotients of fractions. Solve word problems involving division of fractions by fractions. Be able to use visual fraction models and equations to represent the problem. *For example, create a story context for* $\left(\frac{2}{3}\right) \div \left(\frac{3}{4}\right)$ *and use a visual fraction - model to show the quotient; use the relationship between multiplication and division to explain that* $\left(\frac{2}{3}\right) \div \left(\frac{3}{4}\right) = \frac{8}{9}$ *because* $\frac{3}{4}$ *of* $\frac{8}{9}$ *is* $\frac{2}{3}$. *(In general,* $\left(\frac{a}{b}\right) \div \left(\frac{c}{d}\right) = \frac{ad}{bc}$*). If* $\frac{2}{3}$ *of a shoelace is* $\frac{1}{2}$ *meter long, how many meters long is the shoelace? How many* $\frac{3}{4}$ *cup servings are in* $\frac{2}{3}$ *of a cup of yogurt? How wide is a rectangular strip of land with length* $\frac{3}{4}$ *mi and area* $\frac{1}{2}$ *square mile?*	1-4	2-8%
	B		Compute with multi-digit numbers and find common factors and multiples.	1-4	2-8%
		6.NS.B.2	Divide multi-digit numbers using the standard algorithm. For at least 4 digits by 1-digit division by hand; more complicated cases using technology. *For example,* $\frac{6{,}389}{7}$.	0-3	0-6%
		6.NS.B.3	Add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation. For more complex cases, use technology.	0-3	0-6%
		6.NS.B.4	Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. *For example, express* $36 + 8$ *as* $4(9 + 2)$.	0-2	0-4%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	C		**Apply and extend previous understandings of numbers to the system of rational numbers.**	**5-8**	**10-16%**
		6.NS.C.5	Describe quantities having opposite directions or values using positive and negative numbers: temperature above/below zero, elevation above/below sea level, credits/debits, and positive/negative electric charge. Use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.	0-3	0-6%
		6.NS.C.6	Represent a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from earlier grades to represent points on the line and in the plane with negative number coordinates. a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself. *For example,* $-(-3) = 3$*, and that* 0 *is its own opposite.* b. Describe locations in the coordinate plane using signed numbers in ordered pairs; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.	0-3	0-6%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		6.NS.C.7	Compare, order and describe the absolute value of rational numbers. a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. *For example, interpret* $-3 > -7$ *as a statement that* -3 *is located to the right of* -7 *on a number line oriented from left to right.* b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. *For example, write* $-3°C > -7°C$ *to express the fact that* $-3° C$ *is warmer than* $-7°C$. c. Describe the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. *For example, for an account balance of* -30 *dollars, write* $\|-30\| = 30$ *to describe the size of the debt in dollars.* d. Distinguish comparisons of absolute value from statements about order. *For example, recognize that an account balance less than* -30 *dollars represents a debt greater than* 30 *dollars.*	0-3	0-6%
		6.NS.C.8	Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.	0-3	0-6%
EE			**Expressions and Equations**	**16-18**	**33-37%**
	A		**Apply and extend previous understandings of arithmetic to algebraic expressions.**	**5-9**	**10-18%**
		6.EE.A.1	Write and evaluate numerical expressions involving whole-number exponents.	0-3	0-6%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		6.EE.A.2	Write, read, and evaluate expressions in which letters stand for numbers. a. Write expressions that record operations with numbers and with letters standing for numbers. *For example, express the calculation "Subtract y from 5" as $5 - y$.* b. Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); view one or more parts of an expression as a single entity. *For example, describe the expression $2(8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms.* c. Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). *For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = \frac{1}{2}$.*	0-4	0-8%
		6.EE.A.3	Apply the properties of operations to generate equivalent expressions. Know that expressions are called equivalent when they name the same number regardless of which value is substituted into them. *For example, apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.*	0-4	0-8%
		6.EE.A.4	Describe the properties of operations used to show two expressions are equivalent. *For example, show that $3c + 3cd$ and $3c(1 + d)$ are equivalent.*	0-3	0-6%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		**Reason about and solve one-variable equations and inequalities.**	**5-9**	**10-18%**
		6.EE.B.5	Use substitution to determine whether a given number in a specified set makes an equation or inequality true. Solving an equation or inequality is a process of answering a question: Which values from a specified set, if any, make the equation or inequality true?	0-3	0-6%
		6.EE.B.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or depending on the purpose at hand, any number in a specified set.	0-3	0-6%
		6.EE.B.7	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.	0-3	0-6%
		6.EE.B.8	Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that an inequality of the form $x > c$ or $x < c$ has infinitely many solutions; use a number line diagram to represent infinitely many solutions of such an inequality.	0-3	0-6%
	C		**Represent and analyze quantitative relationships between dependent and independent variables.**	**1-4**	**2-8%**
		6.EE.C.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity in terms of the other quantity. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation* $d = 65t$ *to represent the relationship between distance and time.*	1-4	2-8%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
G			**Geometry**	**5-7**	**10-14%**
	A		Solve real-world and mathematical problems involving area, surface area, and volume.	5-7	10-14%
		6.G.A.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.	0-3	0-6%
		6.G.A.2	Find the volume of a right rectangular prism with fractional edge lengths by packing it with unit cubes of the appropriate unit fraction edge lengths and show that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = Bh$ (where B stands for the area of the base) to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems.	0-3	0-6%
		6.G.A.3	Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.	0-3	0-6%
		6.G.A.4	Represent three-dimensional figures using nets made up of rectangles and triangles and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	0-3	0-6%
SP			**Statistics and Probability**	**5-7**	**10-14%**
	A		Develop understanding of statistical variability.	0-3	0-6%
		6.SP.A.1	Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. *For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.*	0-2	0-4%

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Table 7. Mathematics Grade 6 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		6.SP.A.2	Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	0-2	0-4%
		6.SP.A.3	Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.	0-2	0-4%
	B		Summarize and describe distributions.	1-5	2-10%
		6.SP.B.4	Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	0-3	0-6%
		6.SP.B.5	Summarize numerical data sets in relation to their context, such as by: a. Reporting the number of observations. b. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. c. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered. d. Relating the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	0-4	0-8%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
RP			**Ratios and Proportional Relationships**	**11-14**	**21-27%**
	A		**Analyze proportional relationships and use them to solve real-world and mathematical problems.**	**11-14**	**21-27%**
		7.RP.A.1	Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. *For example, if a person walks* $\frac{1}{2}$ *mile in each* $\frac{1}{4}$ *hour, compute the unit rate as the complex fraction* $\frac{\frac{1}{2}}{\frac{1}{4}}$ *miles per hour, equivalently 2 miles per hour. Give a reason it is a better value to buy a supply of an item at a cost of* $22.50 *for ten pounds than at a cost of* $1.50 *for* $\frac{1}{2}$ *pound.*	0-3	0-6%
		7.RP.A.2	Recognize and represent proportional relationships between quantities. a. Decide whether two quantities are in a proportional relationship. *For example, by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.* b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number* n *of items bought at a constant price* p*, the relationship between the total cost and the number of items can be expressed as* $t = pn$. d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0,0)$ and $(1, r)$ where r is the unit rate.	1-6	2-12%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		7.RP.A.3	Use proportional relationships to solve multistep ratio and percent problems. *For example: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*	3-9	6-17%
NS			**The Number System**	**10-13**	**19-25%**
	A		**Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.**	**10-13**	**19-25%**
		7.NS.A.1	Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram. a. Describe situations in which opposite quantities combine to make 0. *For example, a hydrogen atom has* 0 *charge because its two constituents are oppositely charged.* b. Use a model to describe $p + q$ as a number located a distance $\|q\|$ from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts. c. Use a model to describe subtraction of rational numbers as adding the additive inverse, $p - q = p + (-q)$. Show that the distance between two rational numbers on the number line is the absolute value of their difference and apply this principle in real-world contexts. d. Apply properties of operations as strategies to add and subtract rational numbers.	1-5	2-10%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		7.NS.A.2	Apply and extend earlier understandings of multiplication and division and of fractions to multiply and divide rational numbers. a. Use properties of operations, particularly the distributive property, leading to generalizations for products such as $(-1)(-1) = 1$ for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts. b. Use properties of operations, particularly the distributive property, leading to generalizations for quotients of integers (provided that the divisor is not zero). If p and q are integers, then $-\left(\frac{p}{q}\right) = \frac{(-p)}{q} = \frac{p}{(-q)}$. Interpret quotients of rational numbers by describing real-world contexts. c. Multiply and divide rational numbers. d. Convert a rational number to a decimal; know that the decimal form of a rational number terminates in 0s or eventually repeats.	1-5	2-10%
		7.NS.A.3	Solve real-world and mathematical problems involving the four operations with rational numbers. Computations with rational numbers extend the rules for manipulating fractions to complex fractions, a fraction within a fraction.	2-8	4-15%
EE			**Expressions and Equations**	**13-15**	**25-29%**
	A		**Use properties of operations to generate equivalent expressions.**	**4-6**	**8-12%**
		7.EE.A.1	Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients.	0-4	0-8%
		7.EE.A.2	Describe how rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. *For example,* $a + 0.05a = 1.05a$ *means that "increase by* 5%*" is the same as "multiply by* 1.05*."*	0-4	0-8%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		**Solve real-life and mathematical problems using numerical and algebraic expressions and equations.**	**9-11**	**17-21%**
		7.EE.B.3	Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. *For example, If someone making* $25 *an hour gets a* 10% *raise, that is an additional* $\frac{1}{10}$ *of their salary an hour, or* $2.50*, for a new salary of* $27.50*. If you want to place a towel bar* $9\frac{3}{4}$ *inches long in the center of a door that is* $27\frac{1}{2}$ *inches wide, you will need to place the bar about* 9 *inches from each edge; this estimate can be used as a check on the exact computation.*	2-8	4-15%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		7.EE.B.4	Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities. a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. *For example, the perimeter of a rectangle is* 54 *cm. Its length is* 6 *cm. What is its width?* b. Solve word problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. *For example, as a salesperson, you are paid* $50 *per week plus* $3 *per sale. This week you want your pay to be at least* $100. *Write an inequality for the number of sales you need to make and describe the solutions.* $px + q > r$	2-8	4-15%
G			**Geometry**	**8-10**	**15-19%**
	A		Draw, construct, and describe geometrical figures and describe the relationships between them.	2-5	4-10%
		7.G.A.1	Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.	0-2	0-4%
		7.G.A.2	Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on constructing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.	0-2	0-4%
		7.G.A.3	Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and right rectangular pyramids.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.	3-6	6-12%
		7.G.B.4	Choose the formula needed and use it to solve problems involving the area and circumference of a circle. *For example, a* 15.1 *in long wire is bent into the shape of a circle to make a wreath with* 2.9 *in left over. To the nearest* 0.1 *in, what is the diameter of the circle?*	0-3	0-6%
		7.G.B.5	Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and solve simple equations for an unknown angle in a figure.	0-3	0-6%
		7.G.B.6	Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.	0-3	0-6%
SP			**Statistics and Probability**	**5-7**	**10-13%**
	A		Use random sampling to draw inferences about a population.	0-2	0-4%
		7.SP.A.1	Describe how statistics can be used to gain information about a population by examining a sample of the population, recognizing that generalizations about a population from a sample are valid only if the sample is representative of that population. Explain that random sampling tends to produce representative samples and support valid inferences.	0-2	0-4%
		7.SP.A.2	Use data from a random sample to draw inferences about a population with an unknown characteristic of interest. Generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions. *For example, estimate the mean word length in a book by randomly sampling words from the book; predict the winner of a school election based on randomly sampled survey data and observe the variation in predictions across multiple surveys.*	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	B		Draw informal comparative inferences about two populations.	0-2	0-4%
		7.SP.B.3	Informally assess the degree of visual overlap of two numerical data distributions with similar variability, measuring the difference between the centers by expressing it as a multiple of a measure of variability. *For example, the mean height of players on the basketball team is* 10 *cm greater than the mean height of players on the soccer team, about twice the variability (mean absolute deviation) on either team; on a dot plot, the separation between the two distributions of heights is noticeable.*	0-2	0-4%
		7.SP.B.4	Use measures of center (*for example, mode, median, mean*) and measures of variability (*for example, range, interquartile range, mean absolute deviation*) for numerical data from random samples to draw informal comparative inferences about two populations. *For example, decide whether the words in a chapter of a seventh-grade science book are generally longer than the words in a chapter of a fourth-grade science book.*	0-2	0-4%
	C		Investigate and model chance processes.	1-5	2-10%
		7.SP.C.5	Describe the probability of a chance event as a number between 0 and 1 that expresses the likelihood of the event occurring. *For example, larger numbers indicate greater likelihood. A probability near* 0 *indicates an unlikely event, a probability around* $\frac{1}{2}$ *indicates an event that is neither unlikely nor likely, and a probability near* 1 *indicates a likely event.*	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 8. Mathematics Grade 7 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		7.SP.C.6	Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency. Given the probability of a chance event, predict the approximate relative frequency that will be observed, and collect data to assess the agreement between the probability and the observed frequency. *For example, collect data to approximate the probability that a tossed paper cup will land open-end down. Your friend calculated that the probability of "rolling double sixes" with a pair of number cubes is* $\frac{1}{6}$ *(which is the wrong answer). Collect data to see how well this probability agrees with the observation frequency.*	0-2	0-4%
		7.SP.C.7	Calculate probabilities of simple events under an assumption of equal probability for all outcomes. *For example, suppose that one student in seventh grade will be chosen to speak at a school assembly. On the assumption that every student is equally likely to be chosen, calculate the probability that the youngest seventh grader will be chosen and the probability that a member of Homeroom* 701 *will be chosen. Calculate the probability of a spinner landing on a certain color, assuming that all of the colors are equally likely outcomes.*	0-2	0-4%
		7.SP.C.8	Calculate probabilities of compound events using organized lists, tables, tree diagrams, and simulation. *For example, Calculate the probability of "rolling double sixes." Use a simulation to approximate the answer to the question. For example, if* 40% *of blood donors have type A blood, what is the probability that it will take at least* 4 *blood donors to find one with type A blood?*	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
NS			**The Number System**	**4-6**	**7-11%**
	A		Work with numbers that are not rational, and approximate them by rational numbers.	4-6	7-11%
		8.NS.A.1	Classify and explain numbers as rational or irrational. For rational numbers, show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.	0-3	0-6%
		8.NS.A.2	Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions. *For example, estimate the value of* $\sqrt{2}$. *By truncating the decimal expansion of* $\sqrt{2}$, *show that* $\sqrt{2}$ *is between* 1 *and* 2, *then between* 1.4 *and* 1.5, *and explain how to continue on to get better approximations.*	0-3	0-6%
EE			**Expressions and Equations**	**16-18**	**30-33%**
	A		**Work with radicals and integer exponents.**	**5-10**	**9-19%**
		8.EE.A.1	Apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = \frac{1}{3^3} = \frac{1}{27}$.	0-4	0-7%
		8.EE.A.2	Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Students evaluate square roots of small perfect squares and cube roots of small perfect cubes. Use bases 1 through 5 and 10 for cubes.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		8.EE.A.3	Use numbers expressed in the form of a single digit times an integer power of 10 to estimate exceptionally large or small quantities and to express how many times as much one is than another. *For example, estimate the population of the United States as* 3 *times* 10^8 *and the population of the world as* 7 *times* 10^9*, and determine that the world population is more than* 20 *times larger.*	0-3	0-6%
		8.EE.A.4	Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of convenient size for quantities. *For example, use millimeters per year for seafloor spreading. Interpret scientific notation that has been generated by technology.*	0-3	0-6%
	B		**Understand the connections between proportional relationships, lines, and linear equations.**	**2-4**	**4-7%**
		8.EE.B.5	Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*	0-3	0-6%
		8.EE.B.6	Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane. a. Derive from this principle the equation $y = mx$ for a line through the origin. b. Derive from this principle the equation $y = mx + b$ for a line intercepting the vertical axis at b.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	C		**Analyze and solve linear equations and pairs of simultaneous linear equations.**	**6-10**	**11-19%**
		8.EE.C.7	Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a, a = a,$ or $a = b$ results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.	2-8	4-15%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		8.EE.C.8	Analyze and solve pairs of simultaneous linear equations. a. Describe how the solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. b. Solve systems of two linear equations in two variables algebraically and estimate solutions by graphing the equations. Solve simple (by inspection) cases. *For example,* $3x + 2y = 5$ *and* $3x + 2y = 6$ *have no solution because* $3x + 2y$ *cannot simultaneously be* 5 *and* 6*;* $x - y = 11$ *and* $2x + y = 19$. c. Solve real-world and mathematical problems leading to two linear equations in two variables. *For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.*	1-4	2-7%
F			**Functions**	**11-13**	**20-24%**
	A		**Define, evaluate, and compare functions.**	**5-8**	**9-15%**
		8.F.A.1	Describe a function as a rule that assigns to each input exactly one output, and the graph of a function is the set of ordered pairs consisting of an input and the corresponding output. Function notation is not required in grade 8.	0-4	0-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		8.F.A.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*	0-4	0-7%
		8.F.A.3	Interpret the equation $y = mx + b$ as defining a function that assigns to each input value x the output value $mx + b$; this is a linear function whose graph is a straight line. Give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points $(1,1)$, $(2,4)$ and $(3,9)$, which are not on a straight line.*	0-4	0-7%
	B		**Use functions to model relationships between quantities.**	**5-8**	**9-15%**
		8.F.B.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values.	2-8	4-15%
		8.F.B.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph. *For example, identify where the function is increasing or decreasing, and if it is linear or nonlinear. Sketch a graph that shows the qualitative features of a function that has been described verbally.*	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
G			**Geometry**	**9-11**	**17-20%**
	A		**Demonstrate congruence and similarity using physical models, patty paper, or geometry software.**	**6-8**	**11-15%**
		8.G.A.1	Verify experimentally the properties of rotations, reflections, and translations: a. Lines are taken to lines, and line segments to line segments of the same length. b. Angles are taken to angles of the same measure. c. Parallel lines are taken to parallel lines.	0-3	0-6%
		8.G.A.2	Explain that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations. Given two congruent figures, describe a sequence of rigid transformations that proves the congruence between them.	0-3	0-6%
		8.G.A.3	Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.	0-3	0-6%
		8.G.A.4	Explain that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that demonstrates the similarity between them.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		8.G.A.5	Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*	0-4	0-7%
	B		**Explain and apply the Pythagorean Theorem.**	**2-4**	**4-7%**
		8.G.B.6	Explain a proof of the Pythagorean Theorem and a proof of its converse.	0-1	0-2%
		8.G.B.7	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two- and three-dimensions.	0-3	0-6%
		8.G.B.8	Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.	0-3	0-6%
	C		Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.	1-3	2-6%
		8.G.C.9	Apply the formulas for the volume of cones, cylinders, and spheres to solve real-world and mathematical problems.	1-3	2-6%
SP			**Statistics and Probability**	**4-9**	**7-17%**
	A		Investigate patterns of association in bivariate data.	4-9	7-17%
		8.SP.A.1	Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 9. Mathematics Grade 8 Specifications

Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		8.SP.A.2	For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.	0-3	0-6%
		8.SP.A.3	Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of* $1.5\,\frac{cm}{hr}$ *as meaning that an additional hour of sunlight each day is associated with an additional* $1.5\ cm$ *in mature plant height.*	0-3	0-6%
		8.SP.A.4	Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew on school nights and whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to have chores?*	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 10. Alignment to Cluster Types, Mathematics Grades 3-8

Grade	Cluster Type	Number of Operational Items	Percent of Operational Items
3	Major	28-36	65-85%
	Supporting + Additional	6-15	15-35%
4	Major	29-37	65-85%
	Supporting + Additional	6-15	15-35%
5	Major	31-40	65-85%
	Supporting + Additional	7-17	15-35%
6	Major	32-42	65-85%
	Supporting + Additional	7-17	15-35%
7	Major	34-44	65-85%
	Supporting + Additional	8-18	15-35%
8	Major	35-46	65-85%
	Supporting + Additional	8-19	15-35%

At least 65% of the items on each test will be aligned to standards from Major Clusters.

ISASP Specifications 2026

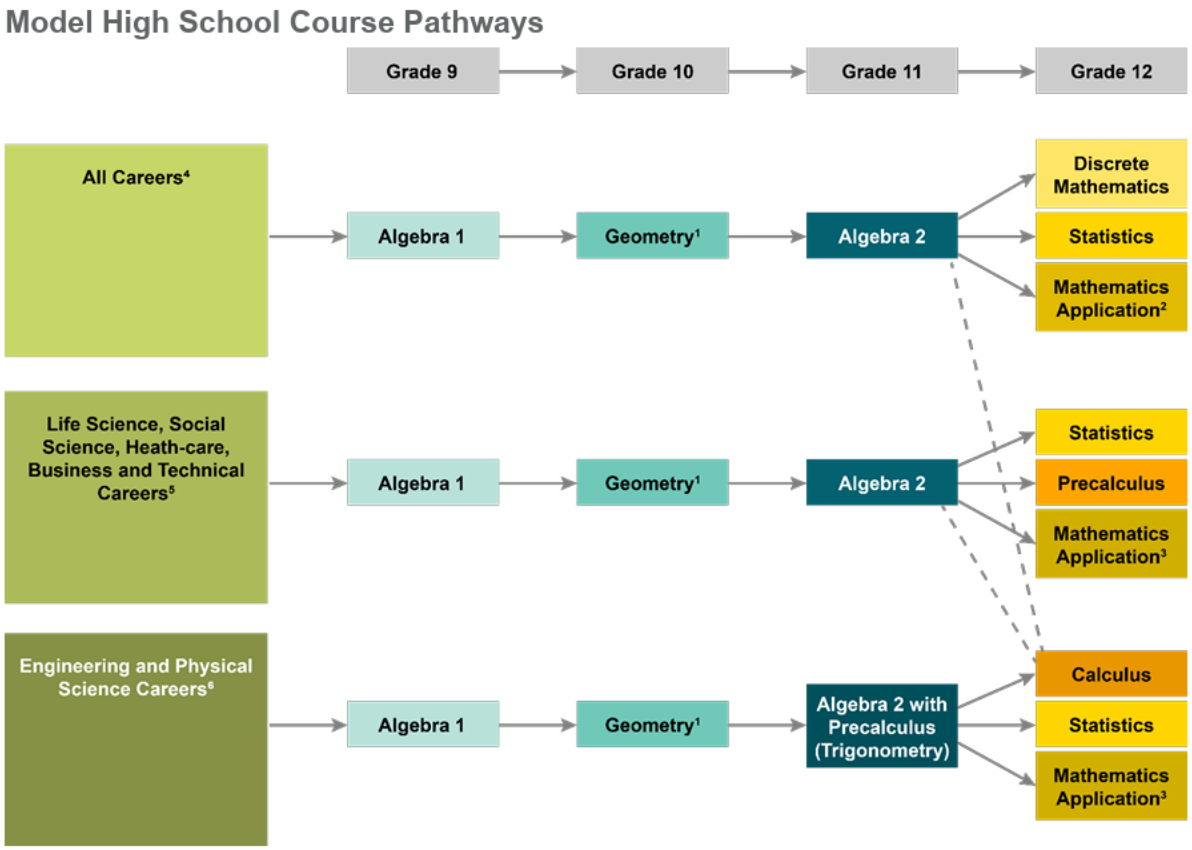
Mathematics – Grades 9-11

The ISASP Mathematics tests emphasize understanding, discovery, and quantitative thinking in mathematics.

High School Course Pathways

High school Mathematics standards are not grade-based but use "**pathways**" to present models for how mathematics instruction might best serve high school students with differing career goals (see Figure 1 below (Iowa Academic Standards in Mathematics, p. 98)). Although model high school pathways are not mandated, each pathway also suggests that students must take coursework that exposes them to Algebra I, Geometry, and Algebra II content.

Figure 1.



To align with the pathways approach in the 2024 standards and to ensure coverage of the content of the required high school standards, the Spring 2026 assessment was increased by approximately 19 items per grade. This length is consistent with the length of the ISASP Mathematics test in grade 8. The pathways' emphases on certain courses at grades 9, 10, and 11 were used to determine the balance of content in the test specifications.

Major, Supporting, and Additional Work

In 2024, new Iowa Academic Standards for Mathematics were adopted. One key area introduced into the new standards was an emphasis on clusters. Clusters consist of groups of related standards and the Academic Standards organize clusters into three classifications: Major, Supporting, and Additional. As a result, the 2026 ISASP Math specifications will represent a balance that is consistent with the statement "at least 65% and up to 85% of class time should be dedicated to the Major Work…" (IA Standards, p. 4). In addition, Supporting and Additional Clusters will also contribute to the test specifications.

ISASP specifications have been designed so that at least 65% of the items are aligned with standards within the Major Clusters. Additionally, to be consistent with the Iowa Academic Standards and the requirements of alignment for ISASP, ISASP specifications will continue to support reporting at each domain level.

Adaptive Testing

Beginning in Spring 2026 all high school Mathematics tests will move to an adaptive design, allowing for greater precision for measuring student performance across the entire performance continuum. Utilizing the adaptive design will help ensure that students have had an opportunity to learn the content they encounter and that the content is appropriately rigorous.

Specifications Tables

The revised test specifications will continue to report domain (Conceptual Category) scores, with a greater proportion of items on a form coming from required standards. The specifications will emphasize certain courses at certain grades according to the model high school course pathways (IA Standards, p. 97):

- Grade 9 – Algebra I
- Grade 10 – Geometry
- Grade 11 – Algebra II

Table 11 provides the items totals for Mathematics by grade. Although ISASP is an untimed test, Table 12 provides recommended administration times. Table 13 provides the percentage of items on each test form aligned to each Depth-of-Knowledge (DOK) level. Tables 14-16 provide domain, cluster, and standards-level specifications. Domain-level specifications can be used to

better understand domain coverage on all operational ISASP tests and to support interpretation of student scores.

- The reporting structure for ISASP emphasizes both total test score and domain-level (Conceptual Category) information. The specifications provide the information necessary to evaluate the domain-level (Conceptual Category) information.
- ISASP is an annual summative assessment designed to assess proficiency of grade-level standards. Given this purpose, the specifications reflect the breadth and depth of the clusters and standards within domain. Reviewers of the specifications should note that the domain-level ranges are used for test assembly purposes. The ranges of clusters and standards within a domain provide guidance at a more detailed level.

Table 17 provides alignment information to the Major, Supporting, and Additional Clusters in the High School Mathematics standards.

- These ranges represent the minimum and maximum numbers of items from each cluster type that could appear on a test.

Table 11. Item Totals, ISASP Mathematics Grades 9-11

Grades	Operational Item Total	Field Test item Total	Total Items
9 -11	54	6	60

Table 12. Recommended Testing Time (in Minutes), ISASP Mathematics Grades 9-11

Grades	Recommended Testing Time
9-11	80

Table 13. Depth-of-Knowledge levels, ISASP Mathematics Grades 9-11

Grades	Depth-of-Knowledge Level	Percent of Operational Items
9-11	DOK 1	20-35%
	DOK 2	45-65%
	DOK 3	10-25%

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
N				**Number and Quantity**	**5-7**	**9-13%**
	N-RN			The Real Number System	0-2	0-4%
		A		**Extend the properties of exponents to rational exponents.**	**0-2**	**0-4%**
			A2.N-RN.A.1	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* $5^{\frac{1}{3}}$ *to be the cube root of* 5 *because we want* $\left[5^{\frac{1}{3}}\right]^3 = 5^{\left[\left(\frac{1}{3}\right)(3)\right]}$ *to hold, so* $\left[5^{\frac{1}{3}}\right]^3$ *must equal* 5.	0-2	0-4%
			A2.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.	0-2	0-4%
		B		Use properties of rational and irrational numbers.	0-2	0-4%
			A1.N-RN.B.3	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.	0-2	0-4%
	N-Q			Quantities	4-7	7-13%
		A		Reason quantitatively and use units to solve problems.	4-7	7-13%
			A1.N-Q.A.1	Use units 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.	0-3	0-6%
			A1.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.	0-4	0-7%
			A1.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	N-CN			The Complex Number System	0	0%
		A		Perform arithmetic operations with complex numbers.	0	0%
			A2.N-CN.A.1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	0	0%
			A2.N-CN.A.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	0	0%
		C		Use complex numbers in polynomial identities and equations.	0	0%
			A2.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.	0	0%
A				**Algebra**	**18-24**	**33-44%**
	A-SSE			Seeing Structure in Expressions and Equations	2-6	4-11%
		A		**Interpret the structure of expressions.**	**2-6**	**4-11%**
			A1.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.	1-4	2-7%
			A2.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. *For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.*	0-1	0-2%
			A1.A-SSE.A.2	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 $(x^2 - y^2)(x^2 + y^2)$.*	1-4	2-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Write expressions and equations in equivalent forms to solve problems.**	**0-2**	**0-4%**
			A1.A-SSE.B.3	Choose and produce an equivalent form of an expression or equation to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic equation to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 3^x *can be rewritten as* $(1+2)^x$ *to reveal the growth rate is* 200%.	0-2	0-4%
			A2.A-SSE.B.4	Apply 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.*	0-1	0-2%
	A-CED			Creating Equations	5-8	9-15%
		A		**Create equations that describe numbers or relationships.**	**5-8**	**9-15%**
			A1.A-CED.A.1	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.	1-3	2-6%
			A1.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	1-3	2-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-CED.A.3	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.	1-3	2-6%
			A1.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance, R.* *For example, rearrange the formula for the area of a trapezoid, $A = \frac{(b_1 + b_2)}{2}h$, for the length of one of the bases.*	1-3	2-6%
	A-REI			Reasoning with Equations and Inequalities	5-10	9-19%
		A		**Understand solving equations as a process of reasoning and explain the reasoning.**	**1-3**	**2-6%**
			A1.A-REI.A.1	Explain each step in solving equations 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.	0-3	0-6%
			A1.A-REI.A.2	Solve rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	0-3	0-6%
		B		**Solve equations and inequalities in one variable.**	**2-5**	**4-9%**
			A1.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	1-4	2-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-REI.B.4	Solve quadratic equations in one variable. a. 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. b. Solve quadratic equations with real solutions using any method.	0-2	0-4%
		C		Solve systems of equations.	0-2	0-4%
			A1.A-REI.C.5	Explain how the strategy of elimination results in finding solution(s) to a system of equations.	0-1	0-2%
			A1.A-REI.C.6	Solve systems of linear equations exactly and approximately. *For example, with graphs, focusing on pairs of linear equations in two variables.*	0-2	0-4%
			A1.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	0-1	0-2%
		D		**Represent and solve equations and inequalities graphically.**	**2-4**	**4-7%**
			A1.A-REI.D.10	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).	0-2	0-4%
			A1.A-REI.D.11	Explain why the solution(s) of a system of equations is/are the point(s) of intersection on a coordinate plane. Find the solutions approximately. *For example, using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are quadratic, exponential, rational, absolute value, polynomial, exponential, and logarithmic functions.*	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-REI.D.12	Graph and interpret (with the use of technology) 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.	0-2	0-4%
	A-APR			Arithmetic with Polynomials and Rational Expressions	0-3	0-6%
		A		**Perform arithmetic operations on polynomials.**	**0-2**	**0-4%**
			A2.A-APR.A.1	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.	0-2	0-4%
		B		**Understand the relationship between zeros and factors of polynomials.**	**0-1**	**0-2%**
			A2.A-APR.B.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.	0	0%
			A2.A-APR.B.3	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.	0-1	0-2%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		D		Rewrite rational expressions.	0-1	0-2%
			A2.A-APR.D.6	Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, where $a(x), b(x), q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$. *For example, in the same way one may view* $\frac{11}{7}$ *as* $\frac{(7+4)}{7} = 1 + \frac{4}{7}$*, one can view* $\frac{(x+7)}{(x+3)}$ *as* $\frac{((x+3)+4)}{(x+3)} = 1 + \frac{4}{(x+3)}$.	0-1	0-2%
F				**Functions**	**14-18**	**26-33%**
	F-IF			Interpreting Functions	9-16	17-30%
		A		**Understand the concept of a function and use function notation.**	**3-8**	**6-15%**
			A1.F-IF.A.1	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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.	1-4	2-9%
			A1.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	1-4	2-9%
			A1.F-IF.A.3	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* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Interpret functions that arise in applications in terms of the context.**	**3-8**	**6-15%**
			A1.F-IF.B.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 may include intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximum and minimum; and symmetries.	0-3	0-6%
			A1.F-IF.B.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.*	0-3	0-6%
			A1.F-IF.B.6	Calculate and interpret the average rate of change of a nonlinear function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	0-2	0-4%
		C		Analyze functions using different representations.	1-4	2-7%
			A1.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases, including intercepts, maxima, and minima if they exist.	0-3	0-6%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A2.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. d. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	0-1	0-2%
			A1.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. *For example, 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. For example, rewrite rational expressions to show the vertical transformation.*	0-2	0-4%
			A2.F-IF.C.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.*	0-2	0-4%
	F-BF			Building Functions	1-4	2-7%
		A		**Build a function that models a relationship between two quantities.**	**1-4**	**2-7%**
			A1.F-BF.A.1	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.	1-4	2-7%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A2.F-BF.A.1	Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	0-1	0-2%
			A1.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Note: Interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.	0-1	0-2%
		B		Build new functions from existing functions.	0-1	0-2%
			A1.F-BF.B.3	Identify the effect on linear and quadratic graphs 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.	0-1	0-2%
			A2.F-BF.B.4	Find inverse functions. a. Solve an equation of the form $f(x) = c$ for a simple function f that has an inverse, and write an expression for the inverse. *For example,* $f(x) = 2x^3$, *or* $f(x) = \frac{(x+1)}{(x-1)}$ *for* $x \neq 1$.	0	0%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	F-LE			Linear, Quadratic, and Exponential Models	1-4	2-7%
		A		Construct and compare linear, quadratic, and exponential models, and solve problems.	1-3	2-6%
			A1.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	0-2	0-4%
			A1.F-LE.A.2	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).	0-2	0-4%
			A1.F-LE.A.3	Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	0-1	0-2%
			A2.F-LE.A.4	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a, c,$ and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	0	0%
		B		Interpret expressions for functions in terms of the situation they model.	0-2	0-4%
			A1.F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	F-TF			Trigonometric Functions	0	0%
		A		Extend the domain of trigonometric functions using the unit circle.	0	0%
			A2.F-TF.A.1	Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	0	0%
			A2.F-TF.A.2	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.	0	0%
			A2.F-TF.A.3	Use special triangles to determine geometrically the values of sine and cosine for $\frac{\pi}{3}, \frac{\pi}{4}$, and $\frac{\pi}{6}$, and use the unit circle to express the values of sine and cosine for $\pi - x, \pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number. Note: Does not include tangent.	0	0%
			A2.F-TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	0	0%
		B		Model periodic phenomena with trigonometric functions.	0	0%
			A2.F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	0	0%
S				**Statistics and Probability**	**5-7**	**9-13%**
	S-ID			Interpreting Categorical and Quantitative Data	5-7	9-13%
		A		Summarize, represent, and interpret data on a single count or measurement variable.	1-3	2-6%
			A1.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots) in a modeling context.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.S-ID.A.2	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.	0-2	0-4%
			A1.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	0-2	0-4%
			A2.S-ID.A.4	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.	0	0%
		B		Summarize, represent, and interpret data on two categorical and quantitative variables.	1-3	2-6%
			A1.S-ID.B.5	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.	0-2	0-4%
			A1.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		C		**Interpret linear models.**	**2-5**	**4-9%**
			A1.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	1-3	0-6%
			A1.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.	0-2	0-4%
			A1.S-ID.C.9	Distinguish between correlation and causation.	0-2	0-4%
	S-CP			Conditional Probability and the Rules of Probability	0-1	0-2%
		A		Use independence and conditional probability to interpret data.	0-1	0-2%
			G.S-CP.A.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”).	0-1	0-2%
			G.S-CP.A.2	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.	0-1	0-2%
			G.S-CP.A.3	Understand the conditional probability of A given B as $\frac{P(A \text{ and } B)}{P(B)}$, 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.	0-1	0-2%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.S-CP.A.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.*	0-1	0-2%
			G.S-CP.A.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.*	0-1	0-2%
		B		Use the rules of probability to compute probabilities of compound events in a uniform probability model.	0-1	0-2%
			G.S-CP.B.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.	0-1	0-2%
			G.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.	0-1	0-2%
	S-MD			Using Probability to Make Decisions	0	0%
		B		Use probability to evaluate outcomes of decisions.	0	0%
			G.S-MD.B.7	Analyze decisions and strategies using probability concepts. *For example, product testing, medical testing, pulling a hockey goalie at the end of a game.*	0	0%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	S-IC			Making Inferences and Justifying Conclusions	0-1	0-2%
		A		Understand and evaluate random processes underlying statistical experiments.	0-1	0-2%
			A2.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	0-1	0-2%
			A2.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process. *For example, using simulation or a model that says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	0-1	0-2%
		B		**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**	0-1	0-2%
			A2.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	0-1	0-2%
			A2.S-IC.B.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error using simulation models for random sampling.	0-1	0-2%
			A2.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	0-1	0-2%
			A2.S-IC.B.6	Evaluate reports based on data.	0-1	0-2%
G				**Geometry**	**6-8**	**11-15%**
	G-CO			Congruence	1-4	2-7%
		A		Experiment with transformations in the plane.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.G-CO.A.1	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.	0-1	0-2%
			G.G-CO.A.2	Represent transformations in the plane using 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. *For example, translation versus horizontal stretch.*	0-1	0-2%
			G.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	0-1	0-2%
			G.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	0-1	0-2%
			G.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another. *For example, using graph paper, tracing paper, or geometry software.*	0-1	0-2%
		B		**Understand congruence in terms of rigid motions.**	**0-2**	**0-4%**
			G.G-CO.B.6	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.	0-1	0-2%
			G.G-CO.B.7	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.	0-1	0-2%

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Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.G-CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	0-1	0-2%
		C		**Prove geometric theorems.**	**1-4**	**2-7%**
			G.G-CO.C.9	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.	0-2	0-4%
			G.G-CO.C.10	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.	0-2	0-4%
			G.G-CO.C.11	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.	0-2	0-4%
		D		Make geometric constructions.	0	0%
			G.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	0	0%
			G.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	0	0%

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Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	G-SRT			Similarity, Right Triangles, and Trigonometry	1-3	2-6%
		A		**Understand similarity in terms of similarity transformations.**	**0-2**	**0-4%**
			G.G-SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor: a. 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. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	0-1	0-2%
			G.G-SRT.A.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.	0-1	0-2%
			G.G-SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	0-1	0-2%
		B		**Prove theorems involving similarity.**	**0-3**	**0-6%**
			G.G-SRT.B.4	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.	0-2	0-4%
			G.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	0-2	0-4%

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Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		C		**Define trigonometric ratios and solve problems involving right triangles.**	**1-2**	**2-4%**
			G.G-SRT.C.6	Define trigonometric ratios using similar triangle ratios and the ratios of corresponding side lengths.	0-1	0-2%
			G.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.	0-1	0-2%
			G.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems, including special right triangles.	0-1	0-2%
	G-C			Circles	0-1	0-2%
		A		Understand and apply theorems about circles.	0-1	0-2%
			G.G-C.A.1	Prove that all circles are similar.	0-1	0-2%
			G.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	0-1	0-2%
			G.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle with technology, and investigate properties of a quadrilateral inscribed in a circle.	0-1	0-2%
		B		Find arc lengths and areas of sectors of circles.	0	0%
			G.G-C.B.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	0	0%

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Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	G-GPE			Expressing Geometric Properties with Equations	1-3	2-6%
		A		Translate between the geometric description and the equation for a conic section.	0	0%
			G.G-GPE.A.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.	0	0%
		B		**Use coordinates to prove simple geometric theorems algebraically.**	**1-3**	**2-6%**
			G.G-GPE.B.4	Use coordinate geometry to prove simple geometric theorems. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle.*	0-1	0-2%
			G.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. *For example, find the equation of a line parallel or perpendicular to a given line that passes through a given point.*	0-1	0-2%
			G.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	0-1	0-2%
			G.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. *For example, use the distance formula to calculate the distance between the two points.*	0-1	0-2%
	G-GMD			Geometric Measurement and Dimension	0-2	0-4%
		A		Explain volume formulas and use them to solve problems.	0-2	0-4%
			G.G-GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	0-2	0-4%
			G.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	0-2	0-4%

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Table 14. Mathematics Grade 9 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		Visualize relationships between two-dimensional and three-dimensional objects.	0-1	0-2%
			G.G-GMD.B.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.	0-1	0-2%
	G-MG			Modeling with Geometry	0-2	0-4%
		A		**Apply geometric concepts with modeling situations.**	**0-2**	**0-4%**
			G.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe and explain objects. *For example, modeling a tree trunk as a cylinder.*	0-2	0-4%
			G.G-MG.A.2	Apply concepts of density based on area and volume in modeling situations. *For example, persons per square mile, BTUs per cubic foot.*	0-2	0-4%
			G.G-MG.A.3	Apply geometric methods to solve design problems. *For example, designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios.*	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
N				**Number and Quantity**	**5-7**	**9-13%**
	N-RN			The Real Number System	0-3	0-6%
		A		**Extend the properties of exponents to rational exponents.**	**0-2**	**0-4%**
			A2.N-RN.A.1	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* $5^{\frac{1}{3}}$ *to be the cube root of* 5 *because we want* $\left[5^{\frac{1}{3}}\right]^3 = 5^{\left[\left(\frac{1}{3}\right)(3)\right]}$ *to hold, so* $\left[5^{\frac{1}{3}}\right]^3$ *must equal* 5.	0-2	0-4%
			A2.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.	0-2	0-4%
		B		Use properties of rational and irrational numbers.	0-2	0-4%
			A1.N-RN.B.3	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.	0-2	0-4%
	N-Q			Quantities	4-7	7-13%
		A		Reason quantitatively and use units to solve problems.	4-7	7-13%
			A1.N-Q.A.1	Use units 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.	0-3	0-6%
			A1.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.	0-4	0-7%
			A1.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	0-3	0-6%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	N-CN			The Complex Number System	0	0%
		A		Perform arithmetic operations with complex numbers.	0	0%
			A2.N-CN.A.1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	0	0%
			A2.N-CN.A.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	0	0%
		C		Use complex numbers in polynomial identities and equations.	0	0%
			A2.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.	0	0%
A				**Algebra**	**10-14**	**19-26%**
	A-SSE			Seeing Structure in Expressions and Equations	1-5	2-9%
		A		**Interpret the structure of expressions.**	**0-3**	**0-6%**
			A1.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.	0-2	0-4%
			A2.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. *For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.*	0-1	0-2%
			A1.A-SSE.A.2	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 $(x^2 - y^2)(x^2 + y^2)$.*	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Write expressions and equations in equivalent forms to solve problems.**	**0-3**	**0-6%**
			A1.A-SSE.B.3	Choose and produce an equivalent form of an expression or equation to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic equation to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 3^x *can be rewritten as* $(1+2)^x$ *to reveal the growth rate is* 200%.	0-3	0-6%
			A2.A-SSE.B.4	Apply 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.*	0-1	0-2%
	A-CED			Creating Equations	1-5	2-9%
		A		**Create equations that describe numbers or relationships.**	**1-5**	**2-9%**
			A1.A-CED.A.1	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.	0-3	0-6%
			A1.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	0-3	0-6%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-CED.A.3	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.	0-3	0-6%
			A1.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance, R.* *For example, rearrange the formula for the area of a trapezoid, $A = \frac{(b_1 + b_2)}{2}h$, for the length of one of the bases.*	0-3	0-6%
	A-REI			Reasoning with Equations and Inequalities	2-6	4-11%
		A		**Understand solving equations as a process of reasoning and explain the reasoning.**	**0-2**	**0-4%**
			A1.A-REI.A.1	Explain each step in solving equations 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.	0-2	0-4%
			A1.A-REI.A.2	Solve rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	0-2	0-4%
		B		**Solve equations and inequalities in one variable.**	**1-4**	**2-7%**
			A1.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	1-4	2-7%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-REI.B.4	Solve quadratic equations in one variable. a. 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. b. Solve quadratic equations with real solutions using any method.	0-1	0-2%
		C		Solve systems of equations.	0-2	0-4%
			A1.A-REI.C.5	Explain how the strategy of elimination results in finding solution(s) to a system of equations.	0-1	0-2%
			A1.A-REI.C.6	Solve systems of linear equations exactly and approximately. *For example, with graphs, focusing on pairs of linear equations in two variables.*	0-2	0-4%
			A1.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	0-1	0-2%
		D		**Represent and solve equations and inequalities graphically.**	**1-4**	**2-7%**
			A1.A-REI.D.10	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).	0-3	0-6%
			A1.A-REI.D.11	Explain why the solution(s) of a system of equations is/are the point(s) of intersection on a coordinate plane. Find the solutions approximately. *For example, using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are quadratic, exponential, rational, absolute value, polynomial, exponential, and logarithmic functions.*	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-REI.D.12	Graph and interpret (with the use of technology) 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.	0-2	0-4%
	A-APR			Arithmetic with Polynomials and Rational Expressions	0-3	0-6%
		A		**Perform arithmetic operations on polynomials.**	**0-2**	**0-4%**
			A2.A-APR.A.1	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.	0-2	0-4%
		B		**Understand the relationship between zeros and factors of polynomials.**	**0-1**	**0-2%**
			A2.A-APR.B.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.	0-1	0-2%
			A2.A-APR.B.3	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.	0-1	0-2%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		D		Rewrite rational expressions.	0-1	0-2%
			A2.A-APR.D.6	Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, where $a(x), b(x), q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$. *For example, in the same way one may view* $\frac{11}{7}$ *as* $\frac{(7+4)}{7} = 1 + \frac{4}{7}$*, one can view* $\frac{(x+7)}{(x+3)}$ *as* $\frac{((x+3)+4)}{(x+3)} = 1 + \frac{4}{(x+3)}$.	0-1	0-2%
F				**Functions**	**7-11**	**13-20%**
	F-IF			Interpreting Functions	4-8	7-15%
		A		**Understand the concept of a function and use function notation.**	**2-5**	**4-9%**
			A1.F-IF.A.1	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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.	0-3	0-6%
			A1.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	0-3	0-6%
			A1.F-IF.A.3	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* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.	0-1	0-2%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Interpret functions that arise in applications in terms of the context.**	**1-4**	**2-7%**
			A1.F-IF.B.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 may include intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximum and minimum; and symmetries.	0-3	0-6%
			A1.F-IF.B.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.*	0-2	0-4%
			A1.F-IF.B.6	Calculate and interpret the average rate of change of a nonlinear function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	0-2	0-4%
		C		Analyze functions using different representations.	1-4	2-7%
			A1.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases, including intercepts, maxima, and minima if they exist.	0-3	0-6%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A2.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. d. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	0-1	0-2%
			A1.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. *For example, 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. For example, rewrite rational expressions to show the vertical transformation.*	0-2	0-4%
			A2.F-IF.C.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.*	0-1	0-2%
	F-BF			Building Functions	1-5	2-9%
		A		**Build a function that models a relationship between two quantities.**	**1-5**	**2-9%**
			A1.F-BF.A.1	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.	0-4	0-7%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A2.F-BF.A.1	Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	0-1	0-2%
			A1.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Note: Interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.	0-2	0-4%
		B		Build new functions from existing functions.	0-2	0-4%
			A1.F-BF.B.3	Identify the effect on linear and quadratic graphs 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.	0-2	0-4%
			A2.F-BF.B.4	Find inverse functions. a. Solve an equation of the form $f(x)=c$ for a simple function f that has an inverse, and write an expression for the inverse. *For example,* $f(x)=2x^3$, *or* $f(x)=\frac{(x+1)}{(x-1)}$ *for* $x \neq 1$.	0	0%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	F-LE			Linear, Quadratic, and Exponential Models	0-3	0-6%
		A		Construct and compare linear, quadratic, and exponential models, and solve problems.	0-3	0-6%
			A1.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	0-2	0-4%
			A1.F-LE.A.2	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).	0-2	0-4%
			A1.F-LE.A.3	Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	0-2	0-4%
			A2.F-LE.A.4	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a, c,$ and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	0	0%
		B		Interpret expressions for functions in terms of the situation they model.	0-1	0-2%
			A1.F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.	0-1	0-2%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	F-TF			Trigonometric Functions	0	0%
		A		Extend the domain of trigonometric functions using the unit circle.	0	0%
			A2.F-TF.A.1	Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	0	0%
			A2.F-TF.A.2	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.	0	0%
			A2.F-TF.A.3	Use special triangles to determine geometrically the values of sine and cosine for $\frac{\pi}{3}, \frac{\pi}{4}$, and $\frac{\pi}{6}$, and use the unit circle to express the values of sine and cosine for $\pi - x, \pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number. Note: Does not include tangent.	0	0%
			A2.F-TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	0	0%
		B		Model periodic phenomena with trigonometric functions.	0	0%
			A2.F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	0	0%
S				**Statistics and Probability**	**6-8**	**11-15%**
	S-ID			Interpreting Categorical and Quantitative Data	2-5	4-9%
		A		Summarize, represent, and interpret data on a single count or measurement variable.	0-3	0-6%
			A1.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots) in a modeling context.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.S-ID.A.2	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.	0-2	0-4%
			A1.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	0-2	0-4%
			A2.S-ID.A.4	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.	0	0%
		B		Summarize, represent, and interpret data on two categorical and quantitative variables.	0-3	0-6%
			A1.S-ID.B.5	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.	0-2	0-4%
			A1.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		C		**Interpret linear models.**	**0-3**	**0-6%**
			A1.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	0-2	0-4%
			A1.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.	0-2	0-4%
			A1.S-ID.C.9	Distinguish between correlation and causation.	0-2	0-4%
	S-CP			Conditional Probability and the Rules of Probability	2-5	4-9%
		A		Use independence and conditional probability to interpret data.	1-4	2-7%
			G.S-CP.A.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”).	0-2	0-4%
			G.S-CP.A.2	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.	0-2	0-4%
			G.S-CP.A.3	Understand the conditional probability of A given B as $\frac{P(A \text{ and } B)}{P(B)}$, 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.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.S-CP.A.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.*	0-2	0-4%
			G.S-CP.A.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.*	0-2	0-4%
		B		Use the rules of probability to compute probabilities of compound events in a uniform probability model.	0-3	0-6%
			G.S-CP.B.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.	0-2	0-4%
			G.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.	0-2	0-4%
	S-MD			Using Probability to Make Decisions	0-1	0-2%
		B		Use probability to evaluate outcomes of decisions.	0-1	0-2%
			G.S-MD.B.7	Analyze decisions and strategies using probability concepts. *For example, product testing, medical testing, pulling a hockey goalie at the end of a game.*	0-1	0-2%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	S-IC			Making Inferences and Justifying Conclusions	0-2	0-4%
		A		Understand and evaluate random processes underlying statistical experiments.	0-1	0-2%
			A2.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	0-1	0-2%
			A2.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process. *For example, using simulation or a model that says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	0-1	0-2%
		B		**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**	**0-1**	0-2%
			A2.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	0-1	0-2%
			A2.S-IC.B.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error using simulation models for random sampling.	0-1	0-2%
			A2.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	0-1	0-2%
			A2.S-IC.B.6	Evaluate reports based on data.	0-1	0-2%
G				**Geometry**	**18-24**	**33-44%**
	G-CO			Congruence	7-11	13-20%
		A		Experiment with transformations in the plane.	1-5	2-9%
			G.G-CO.A.1	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.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.G-CO.A.2	Represent transformations in the plane using 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. *For example, translation versus horizontal stretch.*	0-2	0-4%
			G.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	0-2	0-4%
			G.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	0-2	0-4%
			G.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another. *For example, using graph paper, tracing paper, or geometry software.*	0-2	0-4%
		B		**Understand congruence in terms of rigid motions.**	**3-6**	**6-11%**
			G.G-CO.B.6	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.	0-3	0-6%
			G.G-CO.B.7	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.	0-3	0-6%
			G.G-CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	0-3	0-6%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		C		**Prove geometric theorems.**	**3-6**	**6-11%**
			G.G-CO.C.9	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.	0-3	0-6%
			G.G-CO.C.10	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.	0-3	0-6%
			G.G-CO.C.11	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.	0-3	0-6%
		D		Make geometric constructions.	0-2	0-4%
			G.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	0-2	0-4%
			G.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	G-SRT			Similarity, Right Triangles, and Trigonometry	6-10	11-19%
		A		**Understand similarity in terms of similarity transformations.**	**2-5**	**4-9%**
			G.G-SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor: a. 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. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	0-3	0-6%
			G.G-SRT.A.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.	0-3	0-6%
			G.G-SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	0-3	0-6%
		B		**Prove theorems involving similarity.**	**2-5**	**4-9%**
			G.G-SRT.B.4	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.	0-3	0-6%
			G.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	0-3	0-6%
		C		**Define trigonometric ratios and solve problems involving right triangles.**	**2-5**	**4-9%**
			G.G-SRT.C.6	Define trigonometric ratios using similar triangle ratios and the ratios of corresponding side lengths.	0-3	0-6%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.	0-1	0-2%
			G.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems, including special right triangles.	0-3	0-6%
	G-C			Circles	0-2	0-4%
		A		Understand and apply theorems about circles.	0-2	0-4%
			G.G-C.A.1	Prove that all circles are similar.	0-1	0-2%
			G.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	0-2	0-4%
			G.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle with technology, and investigate properties of a quadrilateral inscribed in a circle.	0-1	0-2%
		B		Find arc lengths and areas of sectors of circles.	0-2	0-4%
			G.G-C.B.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	0-2	0-4%
	G-GPE			Expressing Geometric Properties with Equations	2-5	4-9%
		A		Translate between the geometric description and the equation for a conic section.	0-2	0-4%
			G.G-GPE.A.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.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Use coordinates to prove simple geometric theorems algebraically.**	**2-5**	**4-9%**
			G.G-GPE.B.4	Use coordinate geometry to prove simple geometric theorems. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle.*	0-2	0-4%
			G.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. *For example, find the equation of a line parallel or perpendicular to a given line that passes through a given point.*	0-2	0-4%
			G.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	0-2	0-4%
			G.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. *For example, use the distance formula to calculate the distance between the two points.*	0-2	0-4%
	G-GMD			Geometric Measurement and Dimension	1-3	2-6%
		A		Explain volume formulas and use them to solve problems.	1-2	2-4%
			G.G-GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	0-2	0-4%
			G.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	0-2	0-4%
		B		Visualize relationships between two-dimensional and three-dimensional objects.	0-2	0-4%
			G.G-GMD.B.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.	0-2	0-4%

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Table 15. Mathematics Grade 10 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	G-MG			Modeling with Geometry	1-4	2-7%
		A		**Apply geometric concepts with modeling situations.**	**1-4**	**2-7%**
			G.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe and explain objects. *For example, modeling a tree trunk as a cylinder.*	0-2	0-4%
			G.G-MG.A.2	Apply concepts of density based on area and volume in modeling situations. *For example, persons per square mile, BTUs per cubic foot.*	0-2	0-4%
			G.G-MG.A.3	Apply geometric methods to solve design problems. *For example, designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios.*	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
N				**Number and Quantity**	**5-7**	**9-13%**
	N-RN			The Real Number System	2-5	4-9%
		A		**Extend the properties of exponents to rational exponents.**	**2-5**	**4-9%**
			A2.N-RN.A.1	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* $5^{\frac{1}{3}}$ *to be the cube root of* 5 *because we want* $\left[5^{\frac{1}{3}}\right]^3 = 5^{\left[\left(\frac{1}{3}\right)(3)\right]}$ *to hold, so* $\left[5^{\frac{1}{3}}\right]^3$ *must equal* 5.	0-3	0-6%
			A2.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.	0-3	0-6%
		B		Use properties of rational and irrational numbers.	0-2	0-4%
			A1.N-RN.B.3	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.	0-2	0-4%
	N-Q			Quantities	2-5	4-9%
		A		Reason quantitatively and use units to solve problems.	2-5	4-9%
			A1.N-Q.A.1	Use units 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.	0-2	0-4%
			A1.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.	0-2	0-4%
			A1.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	N-CN			The Complex Number System	0-3	0-6%
		A		Perform arithmetic operations with complex numbers.	0-2	0-4%
			A2.N-CN.A.1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a + bi$ with a and b real.	0-2	0-4%
			A2.N-CN.A.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.	0-2	0-4%
		C		Use complex numbers in polynomial identities and equations.	0-2	0-4%
			A2.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.	0-2	0-4%
A				**Algebra**	**16-22**	**30-41%**
	A-SSE			Seeing Structure in Expressions and Equations	3-7	6-13%
		A		**Interpret the structure of expressions.**	**1-4**	**2-7%**
			A1.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.	0-1	0-2%
			A2.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context. *For example, interpret $P(1 + r)^n$ as the product of P and a factor not depending on P.*	0-2	0-4%
			A1.A-SSE.A.2	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 $(x^2 - y^2)(x^2 + y^2)$.*	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Write expressions and equations in equivalent forms to solve problems.**	**1-4**	**2-7%**
			A1.A-SSE.B.3	Choose and produce an equivalent form of an expression or equation to reveal and explain properties of the quantity represented by the expression. a. Factor a quadratic expression to reveal the zeros of the function it defines. b. Complete the square in a quadratic equation to reveal the maximum or minimum value of the function it defines. c. Use the properties of exponents to transform expressions for exponential functions. *For example, the expression* 3^x *can be rewritten as* $(1+2)^x$ *to reveal the growth rate is* 200%.	0-3	0-6%
			A2.A-SSE.B.4	Apply 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.*	0-2	0-4%
	A-CED			Creating Equations	1-5	2-9%
		A		**Create equations that describe numbers or relationships.**	**1-5**	**2-9%**
			A1.A-CED.A.1	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.	0-2	0-4%
			A1.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-CED.A.3	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.	0-2	0-4%
			A1.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law* $V = IR$ *to highlight resistance,* R. *For example, rearrange the formula for the area of a trapezoid,* $A = \frac{(b_1 + b_2)}{2}h$*, for the length of one of the bases.*	0-2	0-4%
	A-REI			Reasoning with Equations and Inequalities	4-8	7-15%
		A		**Understand solving equations as a process of reasoning and explain the reasoning.**	**0-3**	**0-6%**
			A1.A-REI.A.1	Explain each step in solving equations 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.	0-2	0-4%
			A1.A-REI.A.2	Solve rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.	0-2	0-4%
		B		**Solve equations and inequalities in one variable.**	**0-3**	**0-6%**
			A1.A-REI.B.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-REI.B.4	Solve quadratic equations in one variable. a. 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. b. Solve quadratic equations with real solutions using any method.	0-2	0-4%
		C		Solve systems of equations.	0-3	0-6%
			A1.A-REI.C.5	Explain how the strategy of elimination results in finding solution(s) to a system of equations.	0-1	0-2%
			A1.A-REI.C.6	Solve systems of linear equations exactly and approximately. *For example, with graphs, focusing on pairs of linear equations in two variables.*	0-1	0-2%
			A1.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.	0-1	0-2%
		D		**Represent and solve equations and inequalities graphically.**	**1-4**	**2-7%**
			A1.A-REI.D.10	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).	0-2	0-4%
			A1.A-REI.D.11	Explain why the solution(s) of a system of equations is/are the point(s) of intersection on a coordinate plane. Find the solutions approximately. *For example, using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are quadratic, exponential, rational, absolute value, polynomial, exponential, and logarithmic functions.*	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.A-REI.D.12	Graph and interpret (with the use of technology) 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.	0-2	0-4%
	A-APR			Arithmetic with Polynomials and Rational Expressions	2-6	4-11%
		A		**Perform arithmetic operations on polynomials.**	**1-4**	**2-7%**
			A2.A-APR.A.1	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.	1-4	2-7%
		B		**Understand the relationship between zeros and factors of polynomials.**	**1-3**	**2-6%**
			A2.A-APR.B.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a, the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.	0-2	0-4%
			A2.A-APR.B.3	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.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		D		Rewrite rational expressions.	0-1	0-2%
			A2.A-APR.D.6	Rewrite simple rational expressions in different forms; write $\frac{a(x)}{b(x)}$ in the form $q(x) + \frac{r(x)}{b(x)}$, where $a(x), b(x), q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$. *For example, in the same way one may view* $\frac{11}{7}$ *as* $\frac{(7+4)}{7} = 1 + \frac{4}{7}$*, one can view* $\frac{(x+7)}{(x+3)}$ *as* $\frac{((x+3)+4)}{(x+3)} = 1 + \frac{4}{(x+3)}$.	0-1	0-2%
F				**Functions**	**14-18**	**26-33%**
	F-IF			Interpreting Functions	4-10	7-19%
		A		**Understand the concept of a function and use function notation.**	**1-5**	**2-9%**
			A1.F-IF.A.1	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 f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.	0-2	0-4%
			A1.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.	0-2	0-4%
			A1.F-IF.A.3	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* $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ *for* $n \geq 1$.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Interpret functions that arise in applications in terms of the context.**	**2-7**	**4-13%**
			A1.F-IF.B.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 may include intercepts; intervals where the function is increasing, decreasing, positive, or negative; maximum and minimum; and symmetries.	1-4	2-7%
			A1.F-IF.B.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.*	0-2	0-4%
			A1.F-IF.B.6	Calculate and interpret the average rate of change of a nonlinear function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.	0-2	0-4%
		C		Analyze functions using different representations.	1-5	2-9%
			A1.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. a. Graph linear and quadratic functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases, including intercepts, maxima, and minima if they exist.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A2.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph by hand in simple cases and using technology for more complicated cases. b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions. c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. d. d. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	0-2	0-4%
			A1.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. *For example, 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. For example, rewrite rational expressions to show the vertical transformation.*	0-2	0-4%
			A2.F-IF.C.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.*	0-2	0-4%
	F-BF			Building Functions	3-8	6-15%
		A		**Build a function that models a relationship between two quantities.**	**2-7**	**4-13%**
			A1.F-BF.A.1	Write a function that describes a relationship between two quantities. Determine an explicit expression, a recursive process, or steps for calculation from a context.	0-4	0-7%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A2.F-BF.A.1	Write a function that describes a relationship between two quantities. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*	0-4	0-7%
			A1.F-BF.A.2	Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms. Note: Interpret arithmetic sequences as linear functions and geometric sequences as exponential functions.	0-3	0-6%
		B		Build new functions from existing functions.	1-3	2-6%
			A1.F-BF.B.3	Identify the effect on linear and quadratic graphs 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.	0-2	0-4%
			A2.F-BF.B.4	Find inverse functions. a. Solve an equation of the form $f(x)=c$ for a simple function f that has an inverse, and write an expression for the inverse. *For example,* $f(x)=2x^3$, *or* $f(x)=\frac{(x+1)}{(x-1)}$ *for* $x \neq 1$.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	F-LE			Linear, Quadratic, and Exponential Models	1-4	2-7%
		A		Construct and compare linear, quadratic, and exponential models, and solve problems.	0-4	0-7%
			A1.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.	0-2	0-4%
			A1.F-LE.A.2	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).	0-2	0-4%
			A1.F-LE.A.3	Use graphs and tables to show that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.	0-2	0-4%
			A2.F-LE.A.4	For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where $a, c,$ and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.	0-2	0-4%
		B		Interpret expressions for functions in terms of the situation they model.	0-2	0-4%
			A1.F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	F-TF			Trigonometric Functions	0-3	0-6%
		A		Extend the domain of trigonometric functions using the unit circle.	0-3	0-6%
			A2.F-TF.A.1	Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle.	0-2	0-4%
			A2.F-TF.A.2	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.	0-1	0-2%
			A2.F-TF.A.3	Use special triangles to determine geometrically the values of sine and cosine for $\frac{\pi}{3}, \frac{\pi}{4}$, and $\frac{\pi}{6}$, and use the unit circle to express the values of sine and cosine for $\pi - x, \pi + x$, and $2\pi - x$ in terms of their values for x, where x is any real number. Note: Does not include tangent.	0-2	0-4%
			A2.F-TF.A.4	Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	0-2	0-4%
		B		Model periodic phenomena with trigonometric functions.	0-1	0-2%
			A2.F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.	0-1	0-2%
S				**Statistics and Probability**	**5-7**	**9-13%**
	S-ID			Interpreting Categorical and Quantitative Data	1-4	2-7%
		A		Summarize, represent, and interpret data on a single count or measurement variable.	0-3	0-6%
			A1.S-ID.A.1	Represent data with plots on the real number line (dot plots, histograms, and box plots) in a modeling context.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			A1.S-ID.A.2	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.	0-2	0-4%
			A1.S-ID.A.3	Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).	0-2	0-4%
			A2.S-ID.A.4	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.	0-2	0-4%
		B		Summarize, represent, and interpret data on two categorical and quantitative variables.	0-3	0-6%
			A1.S-ID.B.5	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.	0-2	0-4%
			A1.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association.	0-2	0-4%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		C		**Interpret linear models.**	**0-3**	**0-6%**
			A1.S-ID.C.7	Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	0-2	0-4%
			A1.S-ID.C.8	Compute (using technology) and interpret the correlation coefficient of a linear fit.	0-2	0-4%
			A1.S-ID.C.9	Distinguish between correlation and causation.	0-2	0-4%
	S-CP			Conditional Probability and the Rules of Probability	1-4	2-7%
		A		Use independence and conditional probability to interpret data.	0-3	0-6%
			G.S-CP.A.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”).	0-2	0-4%
			G.S-CP.A.2	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.	0-2	0-4%
			G.S-CP.A.3	Understand the conditional probability of A given B as $\frac{P(A \text{ and } B)}{P(B)}$, 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.	0-2	0-4%

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Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.S-CP.A.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.*	0-2	0-4%
			G.S-CP.A.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.*	0-2	0-4%
		B		Use the rules of probability to compute probabilities of compound events in a uniform probability model.	0-2	0-4%
			G.S-CP.B.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.	0-2	0-4%
			G.S-CP.B.7	Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.	0-2	0-4%
	S-MD			Using Probability to Make Decisions	0-1	0-2%
		B		Use probability to evaluate outcomes of decisions.	0-1	0-2%
			G.S-MD.B.7	Analyze decisions and strategies using probability concepts. *For example, product testing, medical testing, pulling a hockey goalie at the end of a game.*	0-1	0-2%

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Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	S-IC			Making Inferences and Justifying Conclusions	1-4	2-7%
		A		Understand and evaluate random processes underlying statistical experiments.	0-3	0-6%
			A2.S-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a random sample from that population.	0-2	0-4%
			A2.S-IC.A.2	Decide if a specified model is consistent with results from a given data-generating process. *For example, using simulation or a model that says a spinning coin falls heads up with probability 0.5. Would a result of 5 tails in a row cause you to question the model?*	0-2	0-4%
		B		**Make inferences and justify conclusions from sample surveys, experiments, and observational studies.**	**1-4**	**2-7%**
			A2.S-IC.B.3	Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.	0-2	0-4%
			A2.S-IC.B.4	Use data from a sample survey to estimate a population mean or proportion; develop a margin of error using simulation models for random sampling.	0-2	0-4%
			A2.S-IC.B.5	Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.	0-2	0-4%
			A2.S-IC.B.6	Evaluate reports based on data.	0-2	0-4%
G				**Geometry**	**8-11**	**15-20%**
	G-CO			Congruence	2-6	4-11%
		A		Experiment with transformations in the plane.	0-3	0-6%
			G.G-CO.A.1	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.	0-2	0-4%

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Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.G-CO.A.2	Represent transformations in the plane using 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. *For example, translation versus horizontal stretch.*	0-2	0-4%
			G.G-CO.A.3	Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	0-2	0-4%
			G.G-CO.A.4	Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	0-2	0-4%
			G.G-CO.A.5	Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure. Specify a sequence of transformations that will carry a given figure onto another. *For example, using graph paper, tracing paper, or geometry software.*	0-2	0-4%
		B		**Understand congruence in terms of rigid motions.**	**0-3**	**0-6%**
			G.G-CO.B.6	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.	0-2	0-4%
			G.G-CO.B.7	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.	0-2	0-4%
			G.G-CO.B.8	Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	0-2	0-4%

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Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		C		**Prove geometric theorems.**	**1-4**	**2-7%**
			G.G-CO.C.9	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.	0-2	0-4%
			G.G-CO.C.10	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.	0-2	0-4%
			G.G-CO.C.11	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.	0-2	0-4%
		D		Make geometric constructions.	0-2	0-4%
			G.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	0-2	0-4%
			G.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	0-2	0-4%

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Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	G-SRT			Similarity, Right Triangles, and Trigonometry	3-7	6-13%
		A		**Understand similarity in terms of similarity transformations.**	**0-2**	**0-4%**
			G.G-SRT.A.1	Verify experimentally the properties of dilations given by a center and a scale factor: a. 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. The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	0-2	0-4%
			G.G-SRT.A.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.	0-2	0-4%
			G.G-SRT.A.3	Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	0-2	0-4%
		B		**Prove theorems involving similarity.**	**1-3**	**2-6%**
			G.G-SRT.B.4	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.	0-3	0-6%
			G.G-SRT.B.5	Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	0-3	0-6%
		C		**Define trigonometric ratios and solve problems involving right triangles.**	**1-4**	**2-7%**
			G.G-SRT.C.6	Define trigonometric ratios using similar triangle ratios and the ratios of corresponding side lengths.	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
			G.G-SRT.C.7	Explain and use the relationship between the sine and cosine of complementary angles.	0-2	0-4%
			G.G-SRT.C.8	Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems, including special right triangles.	0-3	0-6%
	G-C			Circles	0-3	0-6%
		A		Understand and apply theorems about circles.	0-2	0-4%
			G.G-C.A.1	Prove that all circles are similar.	0-1	0-2%
			G.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.	0-2	0-4%
			G.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle with technology, and investigate properties of a quadrilateral inscribed in a circle.	0-1	0-2%
		B		Find arc lengths and areas of sectors of circles.	0-2	0-4%
			G.G-C.B.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.	0-2	0-4%
	G-GPE			Expressing Geometric Properties with Equations	1-4	2-7%
		A		Translate between the geometric description and the equation for a conic section.	0-1	0-2%
			G.G-GPE.A.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.	0-1	0-2%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
		B		**Use coordinates to prove simple geometric theorems algebraically.**	**1-4**	**2-7%**
			G.G-GPE.B.4	Use coordinate geometry to prove simple geometric theorems. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle.*	0-2	0-4%
			G.G-GPE.B.5	Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems. *For example, find the equation of a line parallel or perpendicular to a given line that passes through a given point.*	0-2	0-4%
			G.G-GPE.B.6	Find the point on a directed line segment between two given points that partitions the segment in a given ratio.	0-2	0-4%
			G.G-GPE.B.7	Use coordinates to compute perimeters of polygons and areas of triangles and rectangles. *For example, use the distance formula to calculate the distance between the two points.*	0-2	0-4%
	G-GMD			Geometric Measurement and Dimension	0-3	0-6%
		A		Explain volume formulas and use them to solve problems.	0-2	0-4%
			G.G-GMD.A.1	Give an informal argument for the formulas for the circumference of a circle, area of a circle, volume of a cylinder, pyramid, and cone.	0-2	0-4%
			G.G-GMD.A.3	Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.	0-2	0-4%
		B		Visualize relationships between two-dimensional and three-dimensional objects.	0-1	0-2%
			G.G-GMD.B.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.	0-1	0-2%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 16. Mathematics Grade 11 Specifications

Conceptual Category	Domain	Cluster	Standard	Description	Number of Operational Items	Percent of Operational Items
	G-MG			Modeling with Geometry	1-3	2-6%
		A		**Apply geometric concepts with modeling situations.**	**1-3**	**2-6%**
			G.G-MG.A.1	Use geometric shapes, their measures, and their properties to describe and explain objects. *For example, modeling a tree trunk as a cylinder.*	0-2	0-4%
			G.G-MG.A.2	Apply concepts of density based on area and volume in modeling situations. *For example, persons per square mile, BTUs per cubic foot.*	0-2	0-4%
			G.G-MG.A.3	Apply geometric methods to solve design problems. *For example, designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios.*	0-2	0-4%

Major Clusters are given in bold. At least 65% of the items on each test will be aligned to standards from Major Clusters.

Table 17. Alignment to Cluster Types, Mathematics Grades 9-11

Grade	Cluster Type	Number of Operational Items	Percent of Operational Items
9	Major	35-46	65-85%
	Supporting + Additional	8-19	15-35%
10	Major	35-46	65-85%
	Supporting + Additional	8-19	15-35%
11	Major	35-46	65-85%
	Supporting + Additional	8-19	15-35%

Items aligned to Major Clusters at each grade 9-11 are drawn from all High School domains.