Grades 6-8 Mathematics Item Specification Claim 2	
Problem solving, which of course builds on a foundation of knowledge and procedural proficiency, sits at the core of *doing* mathematics. Proficiency at problem solving requires students to choose to use concepts and procedures from across the content domains and check their work using alternative methods. As problem solving skills develop, student understanding of and access to mathematical concepts becomes more deeply established. (*Mathematics Content Specifications, p.56*)	
Primary Claim 2: Problem Solving Students can solve a range of well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.	
Secondary Claim(s): Items/tasks written primarily to assess Claim 2 will necessarily involve some Claim 1 content targets. Related Claim 1 targets should be listed below the Claim 2 targets in the item form. If Claim 3 or 4 targets are also directly related to the item/task, list those following the Claim 1 targets in order of prominence.	
Primary Content Domain: Each item/task should be classified as having a primary, or dominant, content focus. The content should draw upon the knowledge and skills articulated in the progression of standards leading up to and including the targeted grade within and across domains.	
Secondary Content Domain(s): While tasks developed to assess Claim 2 will have a primary content focus, components of these tasks will likely produce enough evidence for other content domains that a separate listing of these content domains needs to be included where appropriate. The standards in the NS domain in grades 6-8 can be used to construct higher difficulty items for the adaptive pool. The integration of the RP, EE, and G domains with NS allows for higher content limits within the grade level than might be allowed when staying within the primary content domain.	
DOK Levels	1, 2, 3
Allowable Response Types	**Response Types:** Multiple Choice, single correct response (MC); Multiple Choice, multiple correct response (MS); Equation/Numeric (EQ); Drag and Drop, Hot Spot, and Graphing (GI); Matching Tables (MA); Fill-in Table (TI) No more than six choices in MS and MA items. Short Text – Performance tasks only **Scoring:** Scoring rules and answer choices will focus on students' ability to solve problems and/or to apply appropriate strategies to solve problems. For some problems, multiple correct responses and/or strategies are possible. • MC will be scored as correct/incorrect (1 point) • If MS and MA items require two skills, they will be scored as:

	o All correct choices (2 points); at least ½ but less than all correct choices (1 point) o Justification[1] for more than 1 point **must be** clear in the scoring rules o Where possible, include a "disqualifier" option that if selected would result in a score of 0 points, whether or not the student answered ½ correctly. o Numeric items scored as correct/incorrect (1 point) • GI,TI, and EQ items will be scored as: o Single requirement items: will be scored as correct/incorrect (1 point) o Multiple requirement items: All components correct (2 points); at least ½ but less than all correct (1 point) o Justification for more than 1 point **must be** clear in the scoring rules
Allowable Stimulus Materials	Effort must be made to minimize the reading load in problem situations. Use tables, diagrams with labels, and other strategies to lessen reading load. Use simple subject-verb-object (SVO) sentences; use contexts that are familiar and relevant to students at the targeted grade level. Target-specific stimuli will be derived from the Claim 1 targets used in the problem situation. All real-world problem contexts will be relevant to the age of the students. Stimulus guidelines specific to task models are given below.
Construct-Relevant Vocabulary	Refer to the Claim 1 specifications to determine construct-relevant vocabulary associated with specific content standards.
Allowable Tools	Any mathematical tools appropriate to the problem situation and the Claim 1 target(s). Some tools are identified in Standard for Mathematical Practice 5 and others can be found in the language of specific standards.
Target-Specific Attributes:	CAT items should take from 2 to 5 minutes to solve; Claim 2 items that are part of a performance task may take 5 to 10 minutes.

[1] For a CAT item to score multiple points, either distinct skills must be demonstrated that earn separate points or distinct levels of understanding of a complex skill must be tied directly to earning one or more points.

Accessibility Guidance	Item writers should consider the following Language and Visual Element/Design guidelines[2] when developing items. Language Key Considerations: • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references Visual Elements/Design Key Considerations: • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics Items are selected for a student's test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.[3]
Development Notes	Tasks generating evidence for Claim 2 in a given grade will draw upon knowledge and skills articulated in the progression of standards up through that grade, though more complex problem-solving tasks may draw upon knowledge and skills from lower grade levels. Claim 1 *Specifications* that cover the following standards should be used to help inform an item writer's understanding of the difference between how these standards are measured in Claim 1 versus Claim 2. Development notes have been added to many of the Claim 1 specifications that call out specific topics that should be assessed under Claim 2. There are some other useful distinctions between Claim 1 and Claim 2 in grades 6-8 that have supported the approach to alignment. The following points describe some attributes of items in Claim 2: • Multiple approaches are feasible or a range of responses is expected (e.g., if a student can solve a word problem by identifying a key word or words and selecting

[2] For more information, refer to the General Accessibility Guidelines at: http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/05/TaskItemSpecifications/Guidelines/AccessibilityandAccommodations/GeneralAccessibilityGuidelines.pdf

[3] For more information about student accessibility resources and policies, refer to http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf

	operations, then it is Claim 1.) • The use of tools in Claim 2 is intended to support the problem solving process. In some cases, students may be asked to display their answer on the tool (e.g., by clicking the appropriate point or interval on a number line or ruler). • Assessing the reasonableness of answers to problems is a Claim 2 skill with items that align to Target C. In grades 6-7, Claim 2 tasks should be written to support three key themes: • Solving problems with ratios, rates, and proportions • Solving problems involving understanding of number systems • Solving problems with expressions and equations In grade 8, Claim 2 tasks should be written to support three key themes: • Solving problems with expressions and equations • Solving problems with functions • Solving problems involving geometry At least 80% of the items written to Claim 2 should primarily assess the standards and clusters listed in the table that follows.

Grade 6	**Grade 7**	**Grade 8**
6.RP.A	7.RP.A	8.EE.B
6.NS.A	7.NS.A	8.EE.C
6.NS.C	7.EE.A	8.F.A
6.EE.A	7.EE.B	8.F.B*
6.EE.B	7.G.A*	8.G.A
6.EE.C	7.G.B*	8.G.B
6.G.A*		8.G.C*

* Denotes additional and supporting clusters

Assessment Targets: Any given item/task should provide evidence for two or more Claim 2 assessment targets. Each of the following targets should not lead to a separate task: it is in *using* content from different areas, including work studied in earlier grades, that students demonstrate their problem-solving proficiency. Multiple targets should be listed in order of prominence as related to the item/task.

Target A: Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace. (DOK 1, 2, 3)
Under Claim 2, the problems should be completely formulated, and students should be asked to find a solution path from among their readily available tools.

Target B: Select and use appropriate tools strategically. (DOK 1, 2)
Tasks used to assess this target should allow students to find and choose tools; for example, using a "Search" feature to call up a formula (as opposed to including the formula in the item stem) or using a protractor in physical space.

Target C: Interpret results in the context of a situation. (DOK 2)
Tasks used to assess this target should ask students to link their answer(s) back to the problem's context. In early grades, this might include a judgment by the student of whether to express an answer to a division problem using a remainder or not based on the problem's context. In later grades, this might include a rationalization for the domain of a function being limited to positive integers based on a problem's context (e.g., understanding that the number of buses required for a given situation cannot be 32½, or that the negative values for the independent variable in a quadratic function modeling a basketball shot have no meaning in this context).

Target D: Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas). (DOK 1, 2, 3)
For Claim 2 tasks, this may be a separate target of assessment explicitly asking students to use one or more potential mappings to understand the relationship between quantities. In some cases, item stems might suggest ways of mapping relationships to scaffold a problem for Claim 2 evidence.

What sufficient evidence looks like for Claim 2 (Problem Solving)[4]:

"Although items and tasks designed to provide evidence for this claim must primarily assess the student's ability to identify the problem and to arrive at an acceptable solution, mathematical problems nevertheless require students to apply mathematical concepts and procedures."

Properties of items/tasks that assess Claim 2: The assessment of many relatively discrete and/or single-step problems can be accomplished using short constructed-response items, or even computer-enhanced or selected-response items.

More extensive constructed-response items can effectively assess multi-stage problem solving and can also indicate unique and elegant strategies used by some students to solve a given problem, and can illuminate flaws in a student's approach to solving a problem. These tasks could:

- Present non-routine[5] problems where a substantial part of the challenge is in deciding what to do, and which mathematical tools to use; and
- Involve chains of autonomous[6] reasoning, in which some tasks may take a successful student 5 to 10 minutes, depending on the age of the student and the complexity of the task.

"A distinctive feature of both single-step and multi-step items and tasks for Claim 2 is that they are "well-posed." That is, whether the problem deals with pure or applied contexts, the problem itself is completely formulated; the challenge is in identifying or using an appropriate solution path."

[4] Text excerpted from the Smarter Balanced Mathematics Content Specifications (p. 56-57).
[5] As noted earlier, by "non-routine" we mean that the student will not have been taught a closely similar problem, so will not be expected to *remember* a solution path but will have to *adapt* or *extend* their earlier knowledge to find one.
[6] By "autonomous" we mean that the student responds to a single prompt, without further guidance within the task.

Grade 6 Content Combinations:	**The following standards can be effectively used in various combinations in Grade 6 Claim 2 items:** **Primary emphases for Claim 2 Items: Ratios and Proportional Relationships, The Number System, Expressions and Equations** **Ratios and Proportional Relationships (RP)** **6.RP.A: Understand ratio concepts and use ratio reasoning to solve problems.** **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."* **6.RP.A.2** Understand the concept of a unit rate *a/b* associated with a ratio *a:b* with *b* ≠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 3/4 cup of flour for each cup of sugar." "We paid $75 for 15 hamburgers, which is a rate of $5 per hamburger."* **6.RP.A.3** Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., 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.** Solve unit rate problems including those involving unit pricing and constant speed. *For example, "If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?"* **c.** Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); solve problems involving finding the whole, given a part and the percent. **d.** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. **The Number System (NS)** **6.NS.A: Apply and extend previous understanding of multiplication and division to divide fractions by fractions.** **6.NS.A.1** Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ac/bd.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of*

yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

6.NS.C: Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.C.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous 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, e.g., –(–3) = 3, and that 0 is its own opposite.
- **b.** Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; 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.

6.NS.C.7 Understand ordering and 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.** Understand 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.*

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.

Expressions and Equations (EE)

6.EE.A: Apply and extend previous understandings of arithmetic to algebraic expressions.

	6.EE.A.1 Write and evaluate numerical expressions involving whole-number exponents. **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* $A = 6\ s^2$ *to find the volume and surface area of a cube with sides of length s = 1/2.* **6.EE.A.3** Apply the properties of operations to generate equivalent expressions. *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.* **6.EE.A.4** Identify when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). *For example, the expressions y + y + y and 3y are equivalent because they name the same number regardless of which number y stands for.* **6.EE.B: Reason about and solve one-variable equations and inequalities.** **6.EE.B.5** Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. **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. **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. **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 inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams. **6.EE.C: Represent and analyze quantitative relationships between dependent and independent variables.** **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, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. 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.* **Standards to integrate with the emphases:** **Geometry (G)** **6.G.A: Solve real-world and mathematical problems involving area, surface area, and volume.** **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. **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 $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving real-world and mathematical problems. **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. **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.
Grade 7 Content Combinations:	**The following standards can be effectively used in various combinations in Grade 7 Claim 2 items:** **Primary emphases for Claim 2 Items at Grade 7: Ratios and Proportional Relationships, The Number System, Expressions and Equations** **Ratios and Proportional Relationships (RP)** **7.RP.A: Analyze proportional relationships and use them to solve real-world and mathematical problems.** **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 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction ½/¼ miles per hour, equivalently 2 miles per hour.* **7.RP.A.2** Recognize and represent proportional relationships between quantities. **a.** Decide whether two quantities are in a proportional relationship, e.g., 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 purchased 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.

7.RP.A.3 Use proportional relationships to solve multistep ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*

The Number System (NS)

7.NS.A: Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

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. Understand $p + q$ as the 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. Understand 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.

7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.

a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as $(-1)(-1) = 1$ and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with a non-zero divisor) is a rational number. If p and q are integers, then $-(p/q) = (-p)/q = p/(-q)$. Interpret quotients of rational numbers by describing real-world contexts.

	c. Apply properties of operations as strategies to multiply and divide rational numbers. **d.** Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats. **7.NS.A.3** Solve real-world and mathematical problems involving the four operations with rational numbers. **Expressions and Equations (EE)** **7.EE.A: Use properties of operations to generate equivalent expressions.** **7.EE.A.1** Apply properties of operations as strategies to add, subtract, factor, and expand linear expressions with rational coefficients. **7.EE.A.2** Understand that 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."* **7.EE.B: Solve real-life and mathematical problems using numerical and algebraic expressions and equations.** **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 a woman making $25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or $2.50, for a new salary of $27.50. If you want to place a towel bar 9 3/4 inches long in the center of a door that is 27 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.* **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. Give an inequality for the number of sales you need to make, and describe the solutions.*

	Standards to integrate with the emphases: **Geometry (G)** **7.G.A: Draw, construct, and describe geometrical figures and describe the relationships between them.** **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. **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. **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. **7.G.B Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.** **7.G.B.4** Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. **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. **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.
Grade 8 Content Combinations:	**The following standards can be effectively used in various combinations in Grade 8 Claim 2 items:** **Primary emphases for Grade 8 Claim 2 Items: Expressions and Equations, Functions, and Geometry** **Expressions and Equations (EE)** **8.EE.B: Understand the connections between proportional relationships, lines, and linear equations.** **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.* **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; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

8.EE.C: Analyze and solve linear equations and pairs of simultaneous linear equations.

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.

8.EE.C.8 Analyze and solve pairs of simultaneous linear equations.

- **a.** Understand that 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 cases by inspection. *For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.*
- **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 though the first pair of points intersects the line through and second pair.*

Functions (F)

8.F.A: Define, evaluate, and compare functions.

8.F.A.1 Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

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.*

8.F.A.3 Interpret the equation $y = mx + b$ as defining 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.*

Geometry (G)

8.G.A: Understand congruence and similarity using physical models, transparencies, or

	geometry software. **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. **8.G.A.2** Understand 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 that exhibits the congruence between them. **8.G.A.3** Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates. **8.G.A.4** Understand 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 exhibits the similarity between them. **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 explain, in terms of transversals why this is so.* **8.G.B: Understand and apply the Pythagorean Theorem.** **8.G.B.6** Explain a proof of the Pythagorean Theorem and its converse. **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. **8.G.B.8** Apply the Pythagorean Theorem to find the distance between two points in a coordinate system. **Standards to integrate with the primary emphases** **Functions (F)** **8.F.B: Use functions to model relationships between quantities.** **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. **8.F.B.5** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

	Geometry (G) **8.G.C: Solve real-world and mathematical problems involving volume of cylinders, cones, and spheres.** **8.G.C.9** Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

Range ALDs – Claim 2 Grades 6 - 8	**Level 1** Students should be able to identify important quantities in the context of a familiar situation and translate words to equations or other mathematical formulation. When given the correct math tool(s), students should be able to apply the tool(s) to problems with a high degree of scaffolding.
	Level 2 Students should be able to identify important quantities in the context of an unfamiliar situation and to select tools to solve a familiar and moderately scaffolded problem or to solve a less familiar or a nonscaffolded problem with partial accuracy. Students should be able to provide solutions to familiar problems using an appropriate format (e.g., correct units, etc.). They should be able to interpret information and results in the context of a familiar situation.
	Level 3 Students should be able to map, display, and identify relationships, use appropriate tools strategically, and apply mathematics accurately in everyday life, society, and the workplace. They should be able to interpret information and results in the context of an unfamiliar situation.
	Level 4 Students should be able to analyze and interpret the context of an unfamiliar situation for problems of increasing complexity and solve problems with optimal solutions.

Target 2A: Apply mathematics to solve well-posed problems in pure mathematics and arising in everyday life, society, and the workplace.

General Task Model Expectations for Target 2A:

- The student is asked to solve a well-posed problem arising in a mathematical context or a context from everyday life, society, or the workplace.
- Mathematical information from the context is presented in a table, graph, or diagram, or is extracted from a verbal description or pictorial representation of the context.
- Solving the problem requires, in Grades 6–7, understanding of and proficiency with ratios, rates and proportional relationships, the number system, or expressions and equations; in Grade 8, understanding of and proficiency with expressions and equations, functions, and geometry and geometric measurement.
- Understandings from statistics, probability, and geometry may be needed to set up the problem, but are not the primary focus of the problem (except that geometry is a legitimate primary focus in Grade 8). Claim 4 is the proper place for problems whose primary focus is statistics or probability.
- The task does not indicate by key words or other scaffolding which arithmetic and algebraic operations, and which geometry constructions or transformations, are to be performed or in what order.
- Difficulty of the task may be varied by varying (a) the difficulty of extracting information from the context (b) the number of steps or (c) the complexity of the expressions, equations, functions, or geometric figures or measurements used.
- Tasks have DOK Level 1, 2, or 3.

Task Model 2A.1

Expectations:

- Students use ratios, rates or proportional relationships to solve a problem arising in a real-world context.
- Dimensions along which to vary the task include
  a) Using ratios of whole numbers (Grade 6, Example Item a) versus fractions (Grade 7, Example Item c). The associated unit rate can be a fraction in Grade 6 (Example Item b).
  b) Working with single ratios or expecting students to find equivalent ratios, including making tables of equivalent ratios (Grade 6) versus expecting an understanding of proportional relationships (Grade 7, Example Item d) versus comparing proportional relationships (Grade 8, Example Item e).
  c) Complexity of percent problems, e.g., calculating the whole from a part or the part from a whole (Grade 6, Example Item f), versus calculating the total amount given a part and the change between the part and the whole (Grade 7, Example Item g).

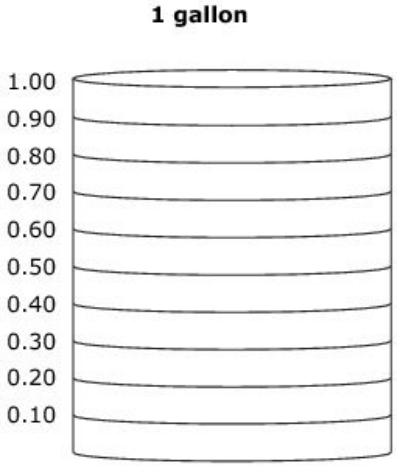
Example Item 2A.1a (Grade 6):
Primary Target 2A (Content Domain RP), Secondary Target 1A (CCSS 6.RP.A), Tertiary Target 2D

Tim made 80 gallons of paint by mixing 48 gallons of green paint with 32 gallons of blue paint.

What part of every gallon is from green paint?

The picture represents 1 gallon of mixed paint.

Click on the picture to show how much of the gallon is from green paint.



Rubric: (1 point) The student clicks on the picture so that 0.6 gallon is shaded.

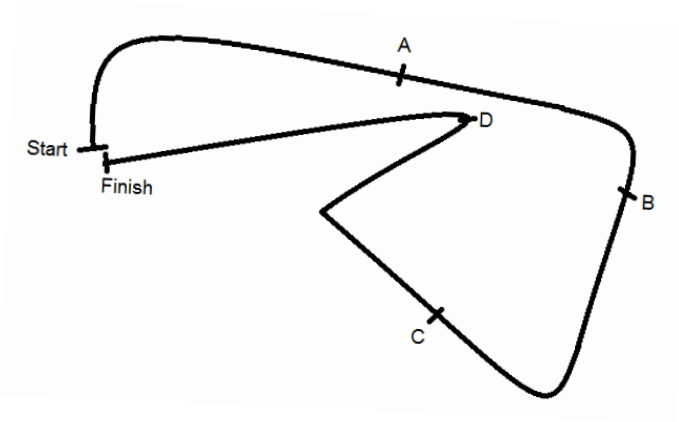
Response Type: Hot Spot

Example Item 2A.1b (Grade 6):
Primary Target 2A (Content Domain RP), Secondary Target 1A (CCSS 6.RP.A), Tertiary Target 2D

It takes Shaun 90 minutes to complete a 15 mile race. The route, with four checkpoints (labeled A, B, C, and D), is shown.

Assume Shaun runs at a constant rate during the race.

Complete the table to show Shaun's time, in minutes, and distance, in miles, at each checkpoint.



Checkpoint	A	B	C	D	Finish
Number of minutes		30		75	90
Number of miles	3		8.5		15

Rubric: (2 points) The student correctly enters all four missing values in the table.
(1 point) The student correctly determines both minutes (e.g., 18, 51) or both miles (e.g., 5, 12.5) or three out of four values correct.

Response Type: Fill-in Table

Commentary: Filling out the different cells in the table requires increasingly sophisticated skills moving from left to right. For students using a unit rate, they must first multiply one-digit whole numbers, then divide a two-digit by a one-digit number resulting in a whole number, then multiply a decimal and a whole number, then divide a two-digit whole number by a one-digit whole number resulting in a decimal. The item could be made easier by changing all entries to require whole-number arithmetic or harder by changing all entries to require decimal number arithmetic. Alternatively, students might notice that the entries in columns A and B are obvious factors of the entries of the columns labeled "Finish" and could easily find their corresponding entries; changing those numbers to less obvious factors would increase the difficulty for students as well.

Example Item 2A.1c (Grade 6):
Primary Target 2A (Content Domain RP), Secondary Target 1A (6.RP.A), Tertiary Standard 2D

Katie and Becca each bought a new book for $50.

- Katie sold her book to the used bookstore for 25% less than the original price.
- Becca sold her book to the used bookstore for 40% less than the original price.

Enter how much more money, in dollars, Katie received for her book than Becca received for her book.

Rubric: (1 point) The student enters the correct difference in the response box (e.g., 7.50 or 7 ½).

Response Type: Equation/Numeric

Example Item 2A.1d (Grade 7):
Primary Target 2A (Content Domain RP), Secondary Target 1A (CCSS 7.RP.A), Tertiary Target 2D

Luke buys a television that is on sale for 25% off the original price. The original price is $120 more than the sale price.

What is the original price of the television?

Rubric: (1 point) The student enters the correct original price in the response box (e.g., 480).

Response Type: Equation/Numeric

Example Item 2A.1e (Grade 7):
Primary Target 2A (Content Domain RP), Secondary Target 1A (CCSS 7.RP.A), Tertiary Target 2D

Elly poured $\frac{1}{10}$ gallon of water into an empty bottle. Now it is $\frac{1}{2}$ full. How many **cups** of water does a full bottle hold?

- There are 16 cups in one gallon.

Enter the total number of **cups** that are in the bottle when it is full.

Rubric: (1 point) The student enters the correct number of cups in the response box (e.g., $3\frac{1}{5}$ or 3.2).

Response Type: Equation/Numeric

Example Item 2A.1.f (Grade 7):
Primary Target 2A (Content Domain EE), Secondary Target 1C (CCSS 7.RP.A), Tertiary Target 2D

Justin's car can travel 77.5 miles using 3.1 gallons of gas.

At this rate, how far, in miles, can Justin travel using 8.2 gallons of gas?

Enter the distance in the response box.

Rubric: (1 point) The student enters the correct distances in the response boxes (e.g., 205).

Response Type: Equation/Numeric

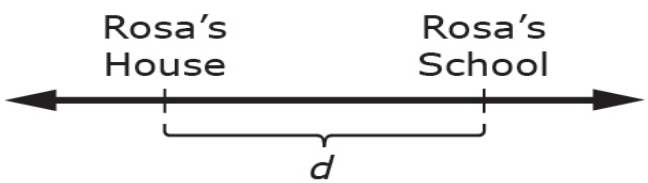
Task Model 2A.2

Expectations:

- Students solve real-world and mathematical problems involving understanding rational numbers and their operations.
- Items in this task model have a fairly straightforward connection between the context and the computation to be performed to solve the problem. They can be single step or multi-step. However, the item should not directly indicate the calculation to be performed.
- Items involving division of fractions can involve (a) division of fractions with like denominators (Example Item a) (b) division of a fraction by a whole number or a whole number by a fraction (Example Item b) (c) division of a fraction by a fraction (harder, Example Item c).
- Items involving operations with rational numbers can involve (a) operations with of integers (easier Grade 7) (b) operations with rational numbers that are not integers (harder Grade 7).

Example Item 2A.2a (Grade 6):
Primary Target 2A (Content Domain NS), Secondary Target 1B (CCSS 6.NS.A), Tertiary Target 2C
(Adapted from Illustrative Mathematics, Running to School, Variation 1)

The distance between Rosa's house and her school is $\frac{3}{4}$ mile. She ran $\frac{1}{2}$ mile.



What fraction of the distance, *d*, between her house and her school, did Rosa run?

Enter your answer in the response box.

Rubric: (1 point). The student enters the correct fraction in the response box (e.g., $\frac{2}{3}$).

Response Type: Equation/Numeric

Example Item 2A.2b (Grade 6):
Primary Target 2A (Content Domain NS), Secondary Target 1B (CCSS 6.NS.A), Tertiary Target 2C
(Adapted from Illustrative Mathematics, Making Hot Cocoa, Variation 1)

A serving of hot chocolate requires $\frac{3}{4}$ cup of milk.

How many servings can Nina make with $7\frac{1}{2}$ cups of milk?

Enter your answer in the response box.

Rubric: (1 point). The student enters the correct number of servings in the response box (e.g., 10).

Response Type: (Equation/Numeric)

Example Item 2A.2c (Grade 6):
Primary Target 2A (Content Domain NS), Secondary Target 1B (CCSS 6.NS.A), Tertiary Target 2C
(Adapted from Illustrative Mathematics, 6.NS How Many Containers in One Cup/Cups in One Container?)

It takes $\frac{1}{2}$ cup of water to fill $\frac{2}{3}$ of a plastic container.

How much water, in cups, will the full container hold?

Enter your answer in the response box.

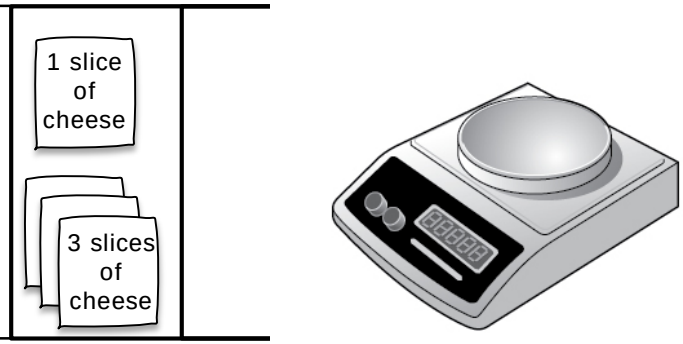
Rubric: (1 point). The student enters the correct number of cups in the response box (e.g., $\frac{3}{4}$).

Response Type: (Equation/Numeric)

Example Item 2A.2d (Grade 6)
Primary Target 2A (Content Domain NS), Secondary Target 1B (CCSS 6.NS.A), Tertiary Target 2C

Ellie ordered $\frac{3}{4}$ of a pound of cheese from the deli.

Drag the slices of cheese onto the scale so that together they weigh at least ¾ of a pound.

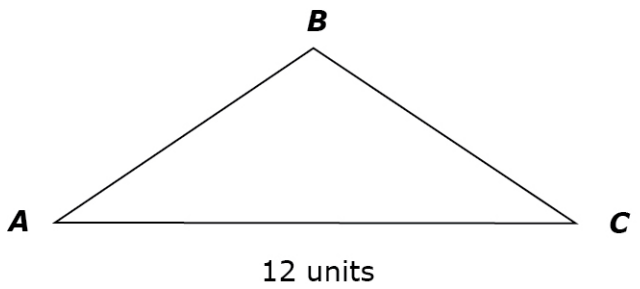


Interaction: The student drags pieces of cheese singly or in groups of three onto the scale. The weight of the cheese, to the nearest hundredth of a pound, is shown on the scale as the slices are added. Each slice is approximately 0.05 pounds, although they are not all equal.

Rubric: (1 point) The student drags the correct number of slices onto the scale (e.g., 8).

Response Type: Drag and drop

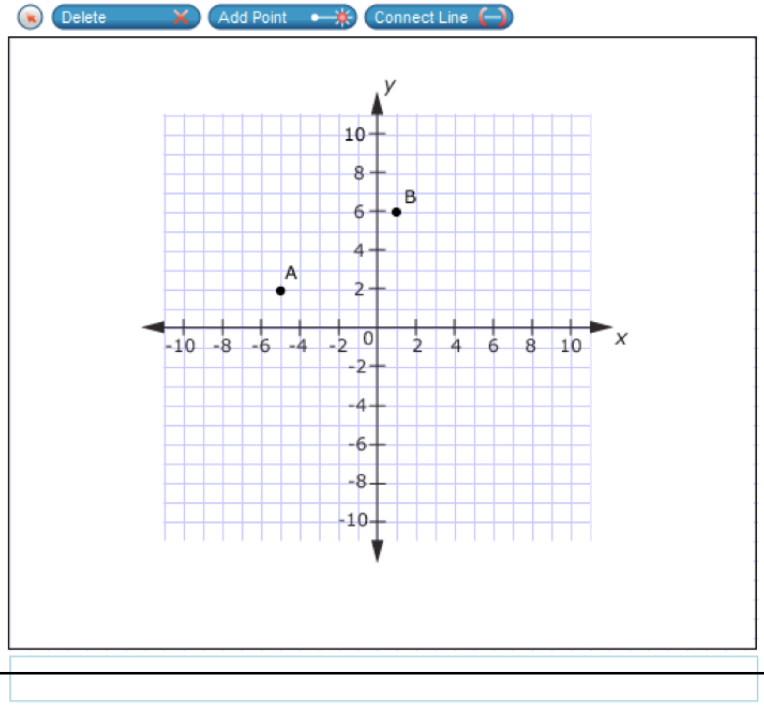
Example Item 2A.2e (Grade 7)
Primary Target 2A (Content Domain NS), Secondary Target 1D (CCSS 6.NS.C)



Complete the sketch of triangle ABC in the coordinate plane.

- Point A is plotted at (-5, 2)
- Point B is plotted at (1, 6)
- Side AC is parallel to the *x*-axis and is 12 units long

Use the Add Point and Connect Line Tool to plot C in the coordinate plane and connect the three points.



Rubric: (1 point). The student plots point C in the coordinate plane and draws the three line segments. (C is plotted at (7, 2); segments AB, AC, and BC are created)

Response Type: Graphing

Example Item 2A.2f (Grade 7):
Primary Target 2A (Content Domain NS), Secondary Target 1B (CCSS 7.NS.A), Tertiary Target 2C

The weather report predicted that the low temperature would be -8 degrees Fahrenheit. The radio announcer said,

"The low temperature was 5 degrees colder than predicted!"

What was the low temperature, in degrees Fahrenheit?

Enter your answer in the response box.

Rubric: (1 point). The student enters the correct temperature in the response box (e.g., -13).

Response Type: Equation/Numeric

Task Model 2A.3

Expectations:

- The student solves a real world and mathematical problems using expressions, equations, and functions (functions limited to Grade 8 problems).
- For problems involving equations in one variable, grade level may be varied by choosing equations of the form $px = q$ or $x+p = q$ (Grade 6) or equations of the form $px + q = r$ or $p(x+q) = r$ (Grade 7). (Note that there is no restriction on equation structure in Grade 8.)
- The equation should not be extractable by key words or other scaffolding.
- Items can simply ask for the equation and not its solution (Example Item 2A.3c), or they can ask for the solution as well.

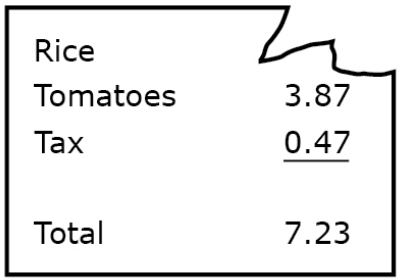
Example Item 2A.3a (Grade 6)

Primary Target 2A (Content Domain EE), Secondary Target 1F (CCSS 6.EE.B), Tertiary Target 2D

Sierra's bought a bag of rice and some tomatoes. The corner of her of her receipt got torn. The torn receipt is shown.

Write an equation that can be solved to determine the cost, x, of the bag of rice.

Enter your equation in the response box.



Rice	
Tomatoes	3.87
Tax	0.47
Total	7.23

Rubric: (1 point) The student enters a correct equation in the response box (e.g., $x+3.87+0.47=7.23$).

Response Type: Equation/Numeric

Example Item 2A.3b (Grade 7):
Primary Target 2A (Content Domain EE), Secondary Target 1D (CCSS 7.EE.B), Tertiary Target 2D

The marching band has 85 members. There are 15 more girls than boys in the band.
How many boys are in the marching band?

Enter your answer in the response box.

Rubric: (1 point) The student enters the correct number of boys in the response box (e.g., 35).

Response Type: Equation/Numeric

Item Commentary: Notice that although the equation is simple, the item is a disguised 2-step problem, which prevents extracting the equation through simple keyword analysis. Indeed, keyword analysis might lead to the wrong equation.

Example Item 2A.3c (Grade 7):
Primary Target 2A (Content Domain RP), Secondary Target 1A (CCSS 7.RP.A), Tertiary Target 2D

The school bus driver follows the same route to pick students up in the morning and to drop them off in the afternoon. Because of traffic, the afternoon drive takes 1.5 times as long as the morning drive.

Enter an equation that represents the relationship between the number of minutes x, of the morning drive, to the **total** number of minutes, y, that the bus driver spends picking up and dropping off students each day.

Rubric: (1 point) The student enters a correct equation in the response box (e.g., $y=2.5x$).

Response Type: Equation/Numeric

Item Commentary: Notice that although the equation is simple, finding the constant of proportionality is not as straightforward as it would appear to be, which prevents extracting the equation through simple keyword analysis. Indeed, keyword analysis might lead to the wrong equation ($y=1.5x$).

Example Item 2A.3d (Grade 8):
Primary Target 2A (Content Domain F), Secondary Target 1E (CCSS 8.F.A), Tertiary Target 2D

Helga wants to have a lot of helium-filled balloons at her party.

- The helium tank costs $58 to rent.
- Balloons cost $0.29 each.
- She wants to have 5 helium-filled balloons for each party guest.

Enter an equation that represents the total cost, C, in dollars of the helium-filled balloons for n party guests.

Rubric: (1 point) The student enters a correct equation in the response box (e.g., $C=58+1.45n$).

Response Type: Equation/Numeric

Task Model 2A.4

Expectations:

- The student solves a problem related to the Pythagorean Theorem or volumes of cylinders, cones, and spheres.
- The task should require more than a routine application of the Pythagorean Theorem or a volume formula.

Example Item 2A.4a (Grade 8):
Primary Target 2A (Content Domain G), Secondary Target 1H (CCSS 8.G.B), Tertiary Target 2D

Two sides of a right triangle have lengths $\sqrt{10}$ centimeters and $\sqrt{6}$ centimeters. There are two possible lengths for the third side.

Enter the **longest** possible side length, in centimeters, for the third side of this triangle.

Rubric: (1 point) The student enters the correct length in the response box (e.g., 4).

Response Type: Equation/Numeric

Example Item 2A.4b (Grade 8):
Primary Target 2A (Content Domain G), Secondary Target 1I (CCSS 8.G.C), Tertiary Target 2D

A sphere and the base of a cone have a radius of 3 inches. The volume of the sphere equals the volume of the cone. What is the height of the cone, in inches?

Enter the height, in inches.

Rubric: (1 point) The student enters the correct radius in the response box (e.g., 12).

Response Type: Equation/Numeric

Example Item 2A.4c (Grade 8):
Primary Target 2B (Content Domain G), Secondary Target 1F (CCSS 8.G.C), Tertiary Target 2D

A right cylindrical tank has a height of 10 feet and a radius of 4 feet. Jane fills this tank with water at a rate of 8 cubic feet per minute. Using this rate, determine the number of minutes it will take Jane to completely fill the tank.

Enter your answer, rounded to the nearest minute, in the response box.

Rubric: (1 point) The student enters the correct number of minutes in the response box (e.g., 63).

Response Type: Equation/Numeric

Target 2B: Select and use appropriate tools strategically.

General Task Model Expectations for Target 2B:

- Mathematical information from the context is presented in a table, graph, or diagram, or is extracted from a verbal description or pictorial representation of the context.
- Tasks aligned to this task model focus on using tools to solve problems or making strategic choices about which tool to use or whether to use a tool to solve a problem.
- Difficulty of the task may be varied by varying (a) the difficulty of extracting information from the context, (b) the number of steps, (c) the complexity of the numbers used, or (d) the complexity of the interpretation required.
- Tasks have DOK Level 2 or 3.

Task Model 2B.1

Expectations:

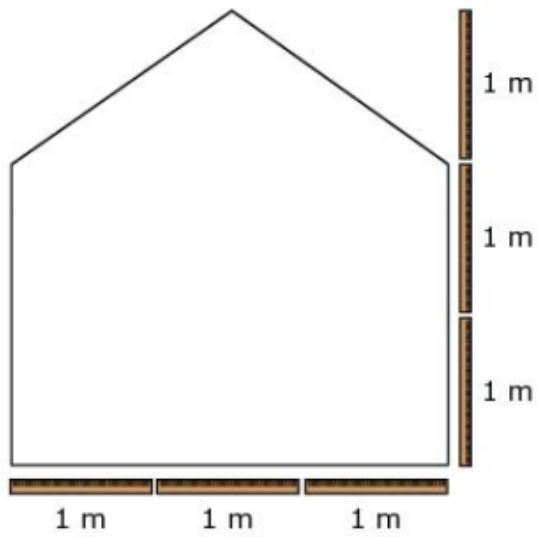
- The student uses a tool to solve a problem.
- The tool should have a mathematical purpose relevant to the solution of the problem. For example, in Example Item 2B.1a, the tool is needed to make measurements, and in Example Item 2B.1b, the tool helps the student think through the conditions.

Example Item 2B.1a (Grade 7):
Primary Target 2B (Content Domain RP), Secondary Target 1A (CCSS 7.RP.A), Tertiary Target 2D

John needs to paint one wall in his school. He knows that one can of paint covers an area of 24 square feet. John uses a meter stick to measure the dimensions of the wall, as shown.

- 1 meter is approximately 39 inches

What is the **fewest** number of cans of paint John can use to paint the wall?



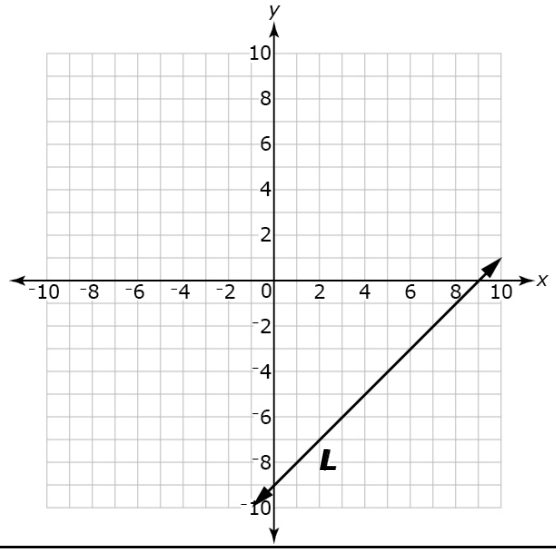
Rubric: (1 point) The student enters the correct number of cans of paint in the response box (e.g., 4).

Response Type: Equation/Numeric

Example Item 2B.1b (Grade 8):
Primary Target 2B (Content Domain EE), Secondary Target 1D (CCSS 8.EE.C)

Line ***L*** is shown on the coordinate plane. Use the Add Arrow tool to draw line ***M*** so that:

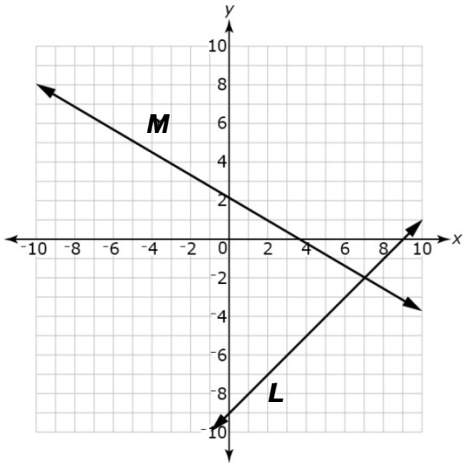
- Lines ***L*** and line ***M*** are graphs of a system of linear equations with a solution of (7, –2).
- The slope of line ***M*** is greater than –1 and less than 0.
- The *y*-intercept of line ***M*** is positive.



Interaction: The double arrow Add Arrow tool is available, as well as the Add Point tool.

Rubric: (1 point) The student draws a line that meets the requirements (e.g., see below).

Response Type: Graphing



Grades 6-8, Claim 2

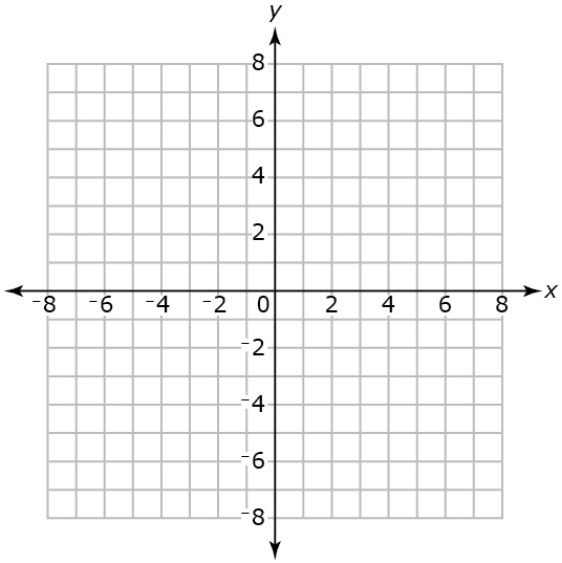
Example Item 2B.1c (Grade 8):

Primary Target 2B (Content Domain F), Secondary Target 1E (CCSS 8.F.A)

This table shows some values of a linear function.

x	***y***
–1	–5
1	–1
3	3

Use the Add Arrow tool to draw the graph of a **different** function that has the **same** rate of change as the one shown in the table of values.



Rubric: (1 point) The student draws a line with the correct slope and does not pass through the points shown in the function table (e.g., slope of 2, passes through any *y*-intercept **except** (0, –3))

Response Type: Graphing

Task Model 2B.2

Expectations:

- The student makes strategic choices about using tools.
- The student has access to a tool that is more appropriate for some problems than others. Students may choose to use the tool or not.
- Mathematical contexts involving computations that benefit from seeing structure or understanding numbers may be used in addition to real world contexts.
- Computations with numbers may draw on operations learned in earlier grades if the computations are particularly complex and lend themselves to making strategic choices whether or not to use a calculator.
- Dimensions along which to vary the item include (a) varying the context (b) varying the tool to be used (c) varying the complexity of the numbers to be used.

Example Item 2B.2a (Grade 6):
Primary Target 2B (Content Domain NS), Secondary Target 1C (CCSS 6.NS.B)

Perform the following calculations. You may use a calculator, but in some cases mental calculations might be faster and more reliable.

Part A:
(1 – 1) + (2 – 2) + (3 – 3) + (4 – 4) + (5 – 5) + (6 – 6) + (7 – 7) + (8 – 8) + (9 – 9) + 10 = ?
Enter your answer in the first response box.

Part B: 987 × 654 = ?
Enter your answer in the second response box.

Rubric: (1 point) The student correctly enters the correct values for both parts in the response boxes (e.g., 10; 645,498).

Response Type: Equation/Numeric (2 response boxes)

Commentary: It is more strategic to do the first problem without a calculator. Other examples of calculations that would be better done without a calculator include (100 + 200 + 300 + 400 + 500) ÷ (500 + 400 + 300 + 200 + 100) and (941,704,813 – 237,498) × (1,234 – 1,000 – 200 – 30 – 4).

Example Item 2B.2b (Grade 7)

Primary Target 2B (Content Domain NS), Secondary Target 1B (CCSS 7.NS.A)

Determine whether each expression has a value that is positive, negative, or zero.

Select the correct comparison for each expression.

Expression	Positive	Zero	Negative
$\left(1\frac{2}{3}\right)+\left(-\frac{4}{3}\right)$			
$\frac{23}{56}-0.42$			
$(-0.025)\cdot\left(\frac{9}{16}\right)$			
$\left(-\frac{21}{5}\right)\div\left(-\frac{21}{5}\right)$			

Rubric: (1 point) The student selects the correct sign for each expression, as shown below.

Expression	Positive	Zero	Negative
$\left(1\frac{2}{3}\right)+\left(-\frac{4}{3}\right)$	✓		
$\frac{23}{56}-0.42$			✓
$(-0.025)\cdot\left(\frac{9}{16}\right)$			✓
$\left(-\frac{21}{5}\right)\div\left(-\frac{21}{5}\right)$	✓		

Response Type: Matching Tables

Commentary: It is more strategic to do all but the second problem without a calculator.

Example Item 2B.2.c

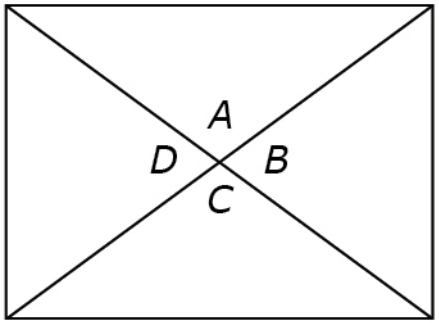
Primary Target 2B (Content Domain G), Secondary Target 1F (CCSS 7.G.B), Tertiary Target 2D

The figure shows a scale drawing of a window.

Find the measures of angles A, B, C, and D to the nearest degree.

Enter the measures in the table shown.

Angle	Measure, in degrees
A	
B	
C	
D	



Rubric: (1 point) The student enters correct angle measures in the response box within a tolerance of +/-3 degrees (e.g., 72, 108, 72, 108). Note that vertical angles should be equal and supplementary angles should sum to 180 degrees.

Response Type: Fill in Table

Commentary: The student has the choice of using a protractor and a ruler. Students will need to measure at least one angle with the protractor, but do not need the ruler at all. They could just measure one of the angles using the protractor and deduce the rest, which is more strategic, or they could measure all four angles, which is less strategic.

Target 2C: Interpret results in the context of a situation.

General Task Model Expectations for Target 2C

- The student is asked to interpret the solution of a well-posed problem arising in a context from everyday life, society, or the workplace, and then to interpret the solution in terms of the context.
- Possible interpretations include: giving the units of an answer and explaining their meaning, interpreting parts of an expression, and interpreting the solution to an equation. Problems involving interpreting data are more likely to fit into Claim 4C than Claim 2C.
- Because the focus is on interpreting the solution, items in this task model will generally have lower cognitive demand in the problem solving aspects than items in task models for 2A and 2B.
- Mathematical information from the context is presented in a table, graph, or diagram, or is extracted from a verbal description or pictorial representation of the context.
- Solving the problem requires either using units, writing an expression in an equivalent form, setting up and solving an equation or system of equations, or calculating geometric measures.
- Difficulty of the task may be varied by varying (a) the difficulty of extracting information from the context (b) the number of steps (c) the complexity of the numbers used or (d) the complexity of the interpretation required.
- Tasks have DOK Level 1 or 2.

Task Model 2C.1

Expectations:

- The student performs a calculation arising from a context and reports a number other than the direct result of the calculation because the context provides additional constraints on the allowable answers, for example.
  - choosing a value that falls into a range of acceptable values limited by information given in the context,
  - rounding up or down based on the constraints of the context.
- The student may be asked to interpret the meaning of points on the number line or in the coordinate plane in a real-world context.

Example Item 2C.1a (Grade 6):
Primary Target 2C (Content Domain RP), Secondary Target 1A (CCSS 6.RP.A), Tertiary Target 2D

A factory makes 12 bottles every 2 minutes. The factory makes bottles for 8 hours each work day. Enter a whole number to represent the **fewest** number of work days the factory will need to make 28,000 bottles.

Rubric: (1 point) The student enters the correct least number of days in the response box (e.g., 10).

Response Type: Equation/Numeric

Example Item 2C.1b (Grade 7)
Primary Target 2C (Content Domain NS), Secondary Target 1B (CCSS 7.NS.A)

This table shows the monthly change in Sara's bank account balance for each month listed. For example, the account balance change of -30 means that Sara's balance decreased by $30 from the beginning to the end of the month of February.

Month	Account Balance Change (Dollars)
January	+38
February	–30
March	–19
April	+49

Determine whether each statement about Sara's bank account balance is true or false, based on the information in the table. Select True or False for each statement.

Statement	True	False
Sara has less money in her account at the end of February than at the end of any other month.		
Sara's account balance is the same at the end of April as it is at the end of January.		
Sara has more money in her account at the end of April than she had at the **beginning** of January.		

Rubric: (1 point) The student correctly selects true or false for all three statements (e.g., FTT).

Response Type: Matching Tables

Task Model 2C.2

- The student interprets expression, equations, or graphs that represent a real-world context.
- Tasks involving expressions can involve interpreting the expression as representing a meaningful calculation arising from the context, or comparing two expressions, either equivalent or not, in terms of the calculation they represent. They can also involve interpreting constants, terms, or factors in terms of the context.
- Tasks involving solving equations in one variable can involve interpreting the solution in terms of the context.
- Tasks involving functions (Grade 8), either defined by an expression in one variable or an equation in two variables, can involve interpreting a parameter in the expression or equation; they can also involve interpreting graphical or tabular representations of the function, or making a connection between different representations.
- The wording of the problem should not reveal the answer to the interpretation step.
- Dimensions along which to vary the item include (a) varying the context (b) varying the type of expression or the type of equation to be solved (one- or two-step) (c) varying the complexity of the interpretation asked.

Example Item 2C.2a (Grade 7):
Primary Target 2C (Content Domain EE), Secondary Target 1D (CCSS 7.EE.B), Tertiary Target 2D
(Source: Adapted from *Illustrative Mathematics*, Grade 7.EE)

The students in Mr. Sanchez's class are converting distances measured in miles (m) to kilometers (km).

Abby and Renato use the following methods to convert miles to kilometers.

- Abby takes the number of miles, doubles it, and then subtracts 20% of the result.
- Renato first divides the number of miles by 5, then multiplies the result by 8.

Which equation correctly shows why both their methods produce the same result?

A. $2m - 0.20 = \frac{m}{5} \cdot 8$
B. $2m - 0.20(2m) = \frac{m}{5} \cdot 8$
C. $2m - 2.20m = \frac{m}{5} + 8\left(\frac{m}{5}\right)$
D. $0.20(2m) - 2m = \frac{m}{5} + 8\left(\frac{m}{5}\right)$

Rubric: (1 point) The student selects the correct equation (e.g., B).

Response Type: Multiple Choice, single correct response

Example Item 2C.2b (Grade 7):

Primary Target 2C (Content Domain EE), Secondary Target 1C (CCSS 7.EE.B), Tertiary Target 2D

A mail-order company sells jars of spices.

- An empty jar has a mass of 200 grams.
- A full jar contains 110 grams of a spice.
- The company sells *n* jars filled with spices.

Select the best interpretation of the expression $(200 + 110)n$.

A. The cost to ship 1 full jar
B. The cost to ship *n* full jars
C. The mass of 1 full jar
D. The mass of *n* full jars

Rubric: (1 point) The student selects the correct interpretation (e.g., D).

Response Type: Multiple Choice, single correct response

Example Item 2C.2c (Grade 8):

Primary Target 2C (Content Domain EE), Secondary Target 1C (CCSS 8.EE.B), Tertiary Target 2D

A comet is orbiting the sun.

The equation $d = 130{,}000t$ represents the relationship between d, the distance traveled by the comet in kilometers and t, the time, in hours, since astronomers first spotted the comet

What does the 130,000 in the equation tell us about the comet?

A. The comet will travel 130,000 kilometers in a year.
B. The comet is traveling at 130,000 kilometers per hour.
C. The comet has traveled 130,000 kilometers since astronomers spotted it.
D. The comet has been traveling for 130,000 hours since astronomers spotted it.

Rubric: (1 point) The student selects the correct interpretation (e.g., B).

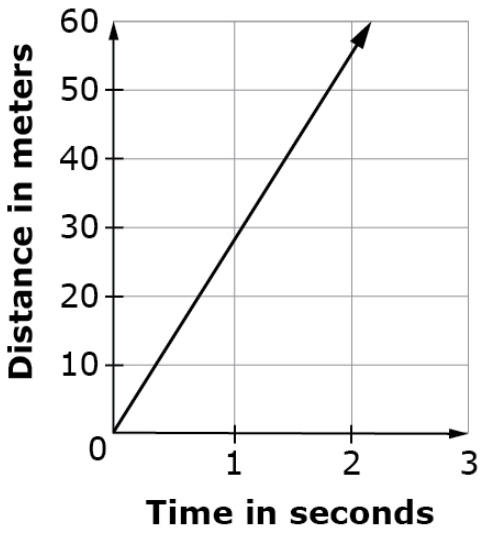
Response Type: Multiple Choice, single correct response

Commentary: In Grade 8, students should also be interpreting the x- and y-intercepts as well as the slope of linear relationships.

Example Item 2C.2d (Grade 7):
Primary Target 2A (Content Domain RP), Secondary Target 1A (CCSS 7.RP.A), Tertiary Target 2C, Quaternary Target 2D

A car is traveling on the highway. The distance, in meters, it has traveled over a two-second interval is shown in the graph. A crow can fly up to 32 meters per second. Would it be possible for a crow to pass the car?

A. Yes, it is possible for a crow to pass the car.
B. No, it is not possible for a crow to pass the car.
C. The speed of the car and the maximum speed of the crow are too close to tell.
D. There is not enough information to answer the question.



Rubric: (1 point) The student selects the correct answer choice (e.g., A).

Response Type: Multiple choice, single correct response

Target 2D: Identify important quantities in a practical situation and map their relationships (e.g., using diagrams, two-way tables, graphs, flowcharts, or formulas).

Target 2D identifies a key step in the modeling cycle, and is thus frequently present in problems with real-world contexts. Note that Target 2D is never the primary target for an item, but is frequently a Tertiary or Quaternary Target for an item with primary alignment to 2A, 2B, or 2C; see, for example, items in Task Models 2A.1, 2A.3, and 2C.2 and Example Items 2B.1a, 2B.2c, and 2C.1a.

General Task Model Expectations for Target 2D

- Students are presented with a mathematical problem in a real-world context where the quantities of interest are not named explicitly, are named but represented in different ways, or the relationship between the quantities is not immediately clear.
- The student is asked to solve a problem that may require the integration of concepts and skills from multiple domains.