Claim 1: Concepts and Procedures
Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Content Domain: **Ratios and Proportional Relationships**

Target A [m]: Understand ratio concepts and use ratio reasoning to solve problems. (DOK 1, 2)

Tasks for this target will require students to make sense of problems that use ratio and rate language and to find unit rates associated with given ratios. Students will be asked to display equivalent ratios in tables and as coordinate pairs, using information to compare ratios or find missing values.

Other tasks for this target ask students to find a percent as a rate per hundred. Problems involving rates, ratios, percents (finding the whole, given a part and the percent), and measurement conversions that use ratio reasoning will also be assessed in Claims 2–4.

Standards: 6.RP.A, 6.RP.A.1, 6.RP.A.2, 6.RP.A.3	**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 $b \neq 0$, 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 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.
Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 5.MD.A, 5.MD.A.1 7.RP.A, 7.RP.A.1, 7.RP.A.2, 7.RP.A.3	**Related Grade 5 Standards** **5.MD.A Convert like measurement units within a given measurement system.** **5.MD.A.1** Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.

	Related Grade 7 Standards **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* $^{1/2}/_{1/4}$ *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 multi-step ratio and percent problems. *Examples: simple interest, tax, markups and markdowns, gratuities and commissions, fees, percent increase and decrease, percent error.*
DOK Levels:	1, 2
Achievement Level Descriptors:	
RANGE Achievement Level Descriptor (Range ALD) Target A: Understand ratio concepts and use ratio reasoning to solve problems.	**Level 1** Students should be able to describe a ratio relationship between two whole number quantities, find missing values in tables that display a proportional relationship, and plot the pairs of values from a table on the coordinate plane. They should be able to find a percent as a rate per hundred and convert measurement units.
	Level 2 Students should be able to understand the concept of unit rate in straightforward, well-posed problems and solve straightforward, well-posed, one-step problems requiring ratio reasoning.
	Level 3 Students should be able to use ratio reasoning to solve and understand the concept of unit rates in unfamiliar or multi-step problems, including instances of unit pricing and constant speed, and solve percent problems by finding the whole, given a part and the percent. They should be able to describe a ratio relationship between any two number quantities (denominators less than or equal to 12).
	Level 4 Students should be able to solve unfamiliar or multi-step problems by finding the whole, given a part and the percent; explain ratio relationships between any two number quantities; and identify relationships between models or representations.

Evidence Required:	1. The student uses ratio language to describe a ratio relationship. 2. The student determines the unit rate associated with a real-world ratio. 3. The student finds missing values in tables of equivalent ratios. 4. The student plots coordinate pairs to represent equivalent ratios. 5. The student makes tables of equivalent ratios relating quantities with whole-number measurements. 6. The student solves real-world problems involving unit rate. 7. The student solves mathematical problems involving finding the whole, given a part and the percent. 8. The student solves real-world and mathematical problems involving finding a percent of a quantity as a rate per 100. 9. [Retired Evidence Required statement] 10. The student uses ratio reasoning to manipulate and transform units appropriately when multiplying or dividing quantities.
Allowable Response Types:	Multiple Choice, multiple correct response; Equation/Numeric; Fill-in Table; Graphing; Matching Tables
Allowable Stimulus Materials:	coordinate planes, tables, tape diagrams
Construct-Relevant Vocabulary:	ratio, unit rate, unit price, ordered pair
Allowable Tools:	Calculator (varies by task model)
Target-Specific Attributes:	Unit rates are limited to non-complex fractions.
Non-Targeted Constructs:	
Accessibility Guidance:	Item writers should consider the following Language and Visual Element/Design guidelines[1] 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

[1] 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

	• 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.[2]
Development Notes:	Real-world problems involving rates, ratios, percentages (finding the whole, given a part and the percent), and measurement conversions that use ratio reasoning will also be assessed in Claim 2, Claim 3, and Claim 4, as appropriate.

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

Task Model 1 **Response Type: Multiple Choice, multiple correct response** **DOK Level 1** **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."* **Evidence Required:** 1. The student uses ratio language to describe a ratio relationship. **Tools:** None **Version 3 Update:** Added new example stem 2.	**Prompt Features:** The student is prompted to identify statements that use ratio language to describe a ratio relationship. **Stimulus Guidelines:** Context should be familiar to students 11 to 13 years old. **TM1** **Stimulus:** The student is presented with a ratio relationship between two whole-number quantities. **Example Stem:** A game has green and blue pieces. The ratio of green game pieces to total pieces is 5:12. Select **all** the statements about the game pieces that are correct. A. The ratio of green pieces to blue pieces is 7:5. B. The ratio of total pieces to blue pieces is 12:7. C. There must be 7 more blue pieces than green pieces. D. The ratio of total pieces to green pieces is 12:5. **Answer Choices:** Answer choices will be four statements describing the ratio relationship. At least two statements must be correct. **Rubric:** (1 point) Student selects all the correct statements (e.g., B and D). **Response Type:** Multiple Choice, multiple correct response **Example Stem 2:** A punch recipe calls for 3 cups of orange juice for every 2 cups of cranberry juice. Select **all** of the statements about the recipe that are correct. A. There are 3 cups of orange juice for every 5 cups of punch. B. The ratio of cranberry juice to orange juice is 2 to 3. C. The ratio of orange juice to cranberry juice is 2:1. D. The ratio of cranberry juice to punch is 2:5. **Answer Choices:** Answer choices will be four statements describing the ratio relationship. At least two statements must be correct. **Rubric:** (1 point) Student selects all the correct statements (e.g., A, B and D). **Response Type:** Multiple Choice, multiple correct response

Task Model 2 **Response Type: Equation / Numeric** **DOK Level 2** **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."* **Evidence Required:** 2. The student determines the unit rate associated with a real-world ratio. **Tools:** Calculator	**Prompt Features:** The student is prompted to identify the unit rate that corresponds to a ratio of real-world quantities. **Stimulus Guidelines:** • Context should be familiar to students 11 to 13 years old. • Item difficulty can be adjusted via these example methods: o Both numbers and unit rate are whole numbers. o Both numbers are whole numbers and unit rate is a fraction. **TM2** **Stimulus:** The student is presented with a real-world ratio problem. **Example Stem:** Carl can type 180 words in 2 minutes. How many words per minute can Carl type? **Rubric:** (1 point) Student enters correct value (e.g., 90). Units should be assumed from the problem. **Response Type:** Equation/Numeric

Task Model 3

Response Type: Fill-in Table

DOK Level 1

6.RP.A.3a
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.

Evidence Required:
3. The student finds missing values in tables of equivalent ratios.

Tools: Calculator

Prompt Features: The student is prompted to find missing values in tables of equivalent ratios.

Stimulus Guidelines:

- If used, context should be familiar to students 11 to 13 years old.
- The values for the table should be whole numbers.
- Tables should be labeled and have two columns and 3–5 rows of data.
- Either one *x*- or *y*-value should be missing from the table.
- All table formats in an item should be the same.
- Unit rate should be a whole number or non-complex fraction.
- Item difficulty can be adjusted via these example methods:
  - All numbers and unit rates are whole numbers. Unit rate is given in the table (i.e., 1:3).
  - All numbers and unit rates are whole numbers. Unit rate is not given in the table.
  - All numbers are whole numbers and unit rate is a non-complex fraction.

TM3a
Stimulus: The student is presented with a table that has an equivalent ratio and a single missing value.

Example Stem 1: The table shows the number of tennis balls that fit into a given number of cans. Each can holds the same number of balls.

Cans	Balls
2	6
	15
7	21
9	27

Fill in the missing value in the table.

Example Stem 2: This table contains equivalent ratios between *x* and *y*.

x	***y***
2	6
5	
7	21
9	27

Fill in the missing value in the table.

Rubric: (1 point) Student enters correct missing value (e.g., 5; 15).

Response Type: Fill-in Table

Task Model 3 **Response Type: Fill-in Table** **DOK Level 2** **6.RP.A.3a** 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. **Evidence Required:** 3. The student finds missing values in tables of equivalent ratios. **Tools:** Calculator	**TM3b** **Stimulus:** The student is presented with a table that has an equivalent ratio and two missing values. **Example Stem:** The table shows the number of tennis balls that fit into a given number of cans. Each can holds the same number of balls. **Cans** | **Balls** 1 | 4 | 12 13 | 15 | 45 Fill in the missing values to complete the table. **Rubric:** (1 point) Student enters the two correct values into the table (e.g., 3 and 39). **Response Type:** Fill-in Table

Task Model 4

Response Type: Graphing

DOK Level 1

6.RP.A.3a
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.

Evidence Required:
4. The student plots coordinate pairs to represent equivalent ratios.

Tools: Calculator

Accessibility Note: Graphing items are not currently able to be Brailled. Minimize the number of items developed to this TM.

Prompt Features: The student is prompted to plot ordered pairs in the coordinate plane that correspond to ratios in a table.

Stimulus Guidelines:

- Table should have two columns and 3–5 rows of data.
- All table formats in an item should be the same.
- The *x*- and *y*-values for the table should be whole numbers.
- Unit rates should be a whole number or non-complex fraction.
- If used, context should be familiar to students 11 to 13 years old.
- Graph should have a title and have both axes labeled.
- Item difficulty can be adjusted via these example methods:
  - All numbers are whole numbers. The independent values are all consecutive numbers.
  - All numbers are whole numbers. Some independent values are consecutive numbers.
  - All numbers are whole numbers. All independent values are non-consecutive numbers.

TM4
Stimulus: The student is presented with a completed table that has an equivalent ratio.

Example Stem: The table shows the number of tennis balls that fit into a given number of cans.

Cans	Balls
2	6
5	15
7	21
8	24

Use the Add Point tool to plot the ordered pairs in the coordinate plane.

Interaction: Students will be given a graph with axes numbered and labeled appropriately. Students will need the Add Point and Delete tools.

Rubric: (1 point) Student correctly plots all coordinate pairs on the graph.

Response Type: Graphing

Task Model 5

Response Type: Fill-in Table

DOK Level 2

6.RP.A.3a
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.

Evidence Required:
5. The student makes tables of equivalent ratios relating quantities with whole-number measurements.

Tools: Calculator

Version 3 Update:
Revised TM5 including prompt features, stimulus guidelines, and example stem.

Prompt Features: The student is prompted to create a table given a ratio.

Stimulus Guidelines:

- Ratios use whole numbers
- Tables should have 3 rows of values

TM5
Stimulus: The student is presented with a partially completed table and information about a specific ratio.

Example Stem: To make popcorn, a movie theater uses 9 tablespoons of oil for each cup of popcorn kernels.

Using this information, complete the table for the missing amounts of oil and popcorn kernels.

Tablespoons of Oil	Cups of Popcorn Kernels
18	
	4
	9

Rubric: (1 point) Student enters the correct missing values in the table (e.g., 2, 36, 81).

Response Type: Fill-in Table

Task Model 6 **Response Type: Equation / Numeric** **DOK Level 2** **6.RP.A.3b** Solve unit rate problems including those involving unit pricing and constant speed. **Evidence Required:** 6. The student solves real-world problems involving unit rate. **Tools:** Calculator	**Prompt Features:** The student is prompted to identify the solution to problems involving a unit rate. **Stimulus Guidelines:** • Context should be familiar to students 11 to 13 years old. • Unit rate should be a whole number or non-complex fraction. • Unit of measurement values should be whole numbers appropriate for the given situation. **TM6** **Stimulus:** The student is presented with a real-world problem involving unit rate. **Example Stem:** Carl types 180 words in 2 minutes. Enter the number of words Carl types in 5 minutes at this rate. **Rubric:** (1 point) Student enters correct numeric value (e.g., 450). **Response Type:** Equation/Numeric

Task Model 7 **Response Type: Equation / Numeric** **DOK Level 2** **6.RP.A.3c** 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. **Evidence Required:** 7. The student solves mathematical problems involving finding the whole, given a part and the percent. **Tools:** Calculator	**Prompt Features:** The student is prompted to solve a mathematical problem involving finding the whole, given a part and the percent. **Stimulus Guidelines:** • If used, context should be familiar to students 11 to 13 years old. • Percent and total quantities should be whole numbers. • Item difficulty can be adjusted via these example methods: o Benchmark percentages (such as 100% and 50%) are used. o Benchmark percentages (such as 75%, 25%, and 10%) are used. o Non-benchmark percentages are used. **TM7** **Stimulus:** The student is presented with a part and a percent. Enter the unknown value that makes this statement true: 30% of ☐ is 60. **Rubric:** (1 point) Student enters the correct numeric value representing the total amount (e.g., 200). **Response Type:** Equation/Numeric

Task Model 8 **Response Type: Equation / Numeric** **DOK Level 2** **6.RP.A.3c** 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. **Evidence Required:** 8. The student solves real-world and mathematical problems involving finding a percent of a quantity as a rate per 100. **Tools:** Calculator	**Prompt Features:** The student is prompted to solve a real-world or mathematical problem involving finding a percent of a quantity as a rate per 100. **Stimulus Guidelines:** • If used, context should be familiar to students 11 to 13 years old. • Generally percentages and quantities should be whole numbers unless appropriate for the situation. • Item difficulty can be adjusted via these example methods: o Benchmark percentages (such as 100% and 50%) are used. o Benchmark percentages (such as 75%, 25%, and 10%) are used. o Non-benchmark percentages are used. **TM8a** **Stimulus:** The student is presented with a part and a whole. **Example Stem 1:** Janet correctly answers 45 questions on her science test. There are 50 questions on the test. Enter the percent of the questions Janet did **not** answer correctly. **Example Stem 2:** Enter the unknown value that makes this statement true: 45 is ☐ % of 50. **Rubric:** (1 point) Student enters the correct numeric value representing the percent (e.g., 10; 90) and 0.90 is not an acceptable answer. Percent symbol (%) is not required for a correct response. **Response Type:** Equation/Numeric

Task Model 8 **Response Type: Multiple Choice, multiple correct response** **DOK Level 1** **6.RP.A.3c** 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. **Evidence Required:** 8. The student solves real-world and mathematical problems involving finding a percent of a quantity as a rate per 100. **Tools:** Calculator **Version 3 Update:** Evidence required statement 9 and TM9 have been retired.	**Prompt Features:** The student is prompted to identify solution methods for problems involving finding a percent of a quantity as a rate per 100. **Stimulus Guidelines:** • If used, context should be familiar to students 11 to 13 years old. • Percentages and quantities should be whole numbers. **TM8b** **Stimulus:** The student is presented with a real-world or mathematical percent problem. **Example Stem 1:** In a school with 200 students, 45% are males. Select **all** expressions that can be used to find the total number of male students**.** A. $\frac{45}{100} \bullet 200$ B. $\frac{0.45}{100} \bullet 200$ C. $0.45 \bullet 200$ D. $\frac{45}{10} \bullet 200$ **Example Stem 2:** Select **all** expressions that can be used to find 45% of 200. A. $\frac{45}{100} \bullet 200$ B. $\frac{0.45}{100} \bullet 200$ C. $0.45 \bullet 200$ D. $\frac{45}{10} \bullet 200$ **Answer Choices:** At least two expressions must be correct. **Rubric:** (1 point) Student selects all the correct mathematical expressions (e.g., A and C; A and C). **Response Type:** Multiple Choice, multiple correct response

Task Model 10 **Response Type: Equation / Numeric** **DOK Level 2** **6.RP.A.3d** Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. **Evidence Required:** 10. The student uses ratio reasoning to manipulate and transform units appropriately when multiplying or dividing quantities. **Tools:** Calculator **Version 3 Update:** Revised stimulus guidelines and example stem to eliminate multi-unit conversions.	**Prompt Features:** The student is prompted to use ratio reasoning to convert measurement units. **Stimulus Guidelines:** • If used, context should be familiar to students 11 to 13 years old. • Units of measurement should be rational numbers appropriate for the given situation. • Specify measurement relationship when needed (e.g., 1 inch = 2.54 cm). • Item difficulty can be adjusted via these example methods: o All numbers used in conversion are whole numbers. o Some numbers used in conversion are decimals. **TM10** **Stimulus:** The student is presented with a measurement and is asked to convert it to an equivalent measurement. **Example Stem:** Aaron needs 24 inches of copper wire for an experiment. The wire is sold by the centimeter. Given that 1 inch = 2.54 centimeters, how many **centimeters** of wire does Aaron need? **Rubric:** (1 point) Student enters the correct numeric value for the converted unit of measurement [e.g., 60.96 (accept 61 because of the real-word context)]. **Response Type:** Equation/Numeric