

Grade 6 Target A

Domain, Target, Standards, DOK, Vertical Alignments, Achievement Levels, Evidence Required, Vocabulary, Response Types, Materials, Attributes, Question Types, and Question Banks (Examples)

[Content Domain: Ratios and Proportional Relationships](#)

[Target A \[m\]: 6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.](#)

[Standards included in Target A: 6.RP.A, 6.RP.A.1, 6.RP.A.2, 6.RP.A.3](#)

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Content Domain: Ratios and Proportional Relationships

Target A [m]: 6.RP.A Understand ratio concepts and use ratio reasoning to solve problems.

Standards included in Target A: 6.RP.A, 6.RP.A.1, 6.RP.A.2, 6.RP.A.3

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.

Vertical Alignment

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 $\frac{1}{2}$ mile in each $\frac{1}{4}$ hour, compute the unit rate as the complex fraction $\frac{\frac{1}{2}}{\frac{1}{4}}$ miles per hour, equivalently 2 miles per hour.

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.

Achievement Level Descriptors

These pages were adapted from open source documents available on the Smarter Balanced Website: <http://www.smarterbalanced.org/assessments/development/> August 2016

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. The student uses ratio reasoning to manipulate and transform units appropriately when multiplying or dividing quantities.

Vocabulary

Ratio, unit rate, unit price, ordered pair

Response Types

Multiple Choice, multiple correct response; Equation/Numeric; Fill-in Table; Graphing; Matching Tables

Materials

coordinate planes, tables, tape diagrams

Attributes

Unit rates are limited to non-complex fractions.

Claim 1: Concepts and Procedures (DOK 1, 2) Question Banks

Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Claim 1 6.RP.A.1 DOK Level 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

The student uses ratio language to describe a ratio relationship.

Question Type 1: The student is presented with a ratio relationship between two whole-number quantities.

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

Question Type 2: 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

Claim 1 6.RP.A.2 DOK Level 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."

Evidence Required

The student determines the unit rate associated with a real-world ratio.

Question Type 1: The student is presented with a real-world ratio problem.

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

Claim 1 6.RP.A.3a DOK Level 1

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

The student finds missing values in tables of equivalent ratios.

Question Type 1: The student is presented with a table that has an equivalent ratio and a single missing value.

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.

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

Question Type 2: The student is presented with a table that has an equivalent ratio and two missing values.

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

Claim 1 6.RP.A.3a DOK Level 1

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

The student plots coordinate pairs to represent equivalent ratios.

Question Type 1: The student is presented with a completed table that has an equivalent ratio.

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

Claim 1 6.RP.A.3a DOK Level 2

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

The student makes tables of equivalent ratios relating quantities with whole-number measurements.

Question Type 1: The student is presented with a partially completed table and information about a specific ratio.

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

Claim 1 6.RP.A.3b DOK Level 2

Solve unit rate problems including those involving unit pricing and constant speed.

Evidence Required

These pages were adapted from open source documents available on the Smarter Balanced Website: <http://www.smarterbalanced.org/assessments/development/> August 2016

The student solves real-world problems involving unit rate.

Question Type 1: The student is presented with a real-world problem involving unit rate.

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

Claim 1 6.RP.A.3c DOK Level 2

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

The student solves mathematical problems involving finding the whole, given a part and the percent.

Question Type 1: 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

Claim 1 6.RP.A.3c DOK Level 2

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

The student solves real-world and mathematical problems involving finding a percent of a quantity as a rate per 100.

Question Type 1: The student is presented with a part and a whole.

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.

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

Claim 1 6.RP.A.3c DOK Level 1

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

The student solves real-world and mathematical problems involving finding a percent of a quantity as a rate per 100.

Question Type 1: The student is presented with a real-world or mathematical percent problem.

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. $\frac{45}{10} \bullet 200$

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

Claim 1 6.RP.A.3d DOK Level 2

Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities.

Evidence Required

The student uses ratio reasoning to manipulate and transform units appropriately when multiplying or dividing quantities.

Question Type 1: The student is presented with a measurement and is asked to convert it to an equivalent measurement.

1. 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-world context)].

Response Type: Equation/Numeric

Claim 2 Problem Solving Question Banks

[Claim Descriptors and Targets](#)

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.

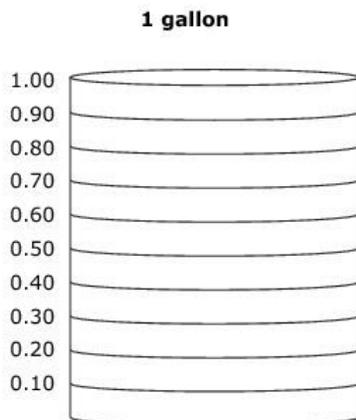
Example 1

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.

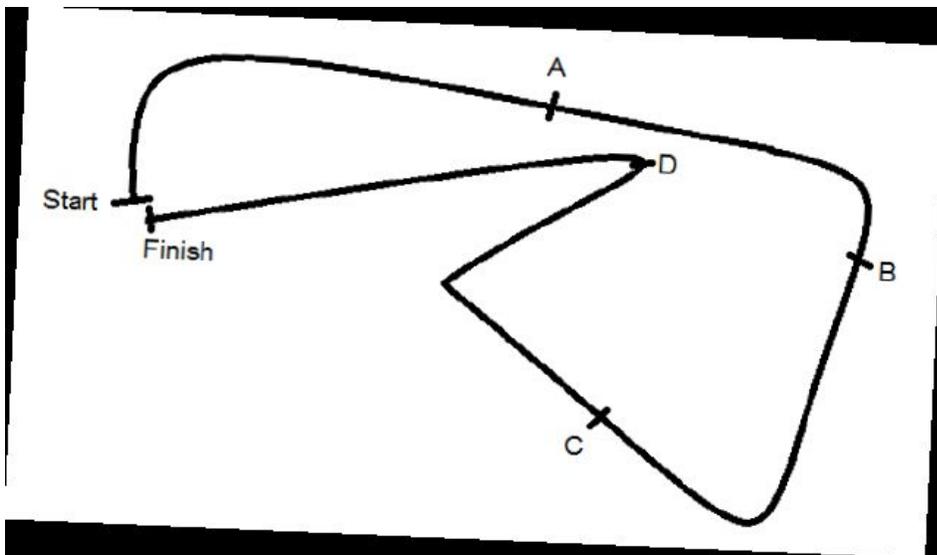
Response Type: Hot Spot

Example 2

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

Example 3

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

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- 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 $\frac{1}{2}$).

Response Type: Equation/Numeric

Example 4

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

Claim 3 Communicating Reasoning Question Banks

[Claim Descriptors and Targets](#)

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

Example 1

Lyla flew her radio-controlled airplane 500 feet in 20 seconds. She claims that the speed of her airplane was 25 feet per second during the flight. What assumption must Lyla make for her claim to be true?

- A. The airplane flew in a circle.
- B. The airplane flew in a straight line.
- C. The airplane flew at a constant speed.
- D. The airplane flew faster at the end of the flight than at the beginning.

Rubric: (1 point) The student selects the correct statement (C).

Response Type: Multiple Choice, single correct response

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Example 2

Clark biked 4 miles in 20 minutes. How far can he go in 2 hours if he bikes at this rate?

Enter your answer in the first response box.

Show how you would solve this problem with a table or an equation (choose one option).

Option 1: Table

Enter values in the table so that it shows the number of miles, m , Clark can bike in 2 hours at this rate.

Miles (m)							
Minutes							
Hours							

Option 2: Equation

Enter an equation that can be solved to find the number of miles, m , Clark can bike in 2 hours at this rate in the second response box.

Rubric: (2 points) The student enters the correct number of miles (24) and fills in the table with at least two columns, one of which contains the correct answer, or enters an equation that can be solved to find the answer (see examples below of each).

(1 point) The student does one of these parts correctly.

Example for Option 1

Miles	4	8	12	16	20	24	
Minutes	20	40	60	80	100	120	
Hours	1/3	2/3	1	4/3	5/3	2	

Example for Option 2

$2 \cdot 3 \cdot 4 = m$ or $4/20 = m/120$ or equivalent equation.

Response Type: Equation/Numeric and Fill-in Table

Claim 4 Modeling and Data Analysis Question Banks

[Claim Descriptors and Targets](#)

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Example 1

Hummingbirds drink nectar from flowers and sugar water from bird feeders.

- Sugar water is made by mixing 50 grams of sugar with 200 grams of water.
- A hummingbird's favorite flower nectar is 21% sugar by mass.

The amount of food a hummingbird eats at one time is always the same whether it eats sugar water or flower nectar.

Part A

Will the hummingbird get more sugar from a meal of sugar water made according to the recipe, or from an equal-sized meal of flower nectar? [Drop down choices: sugar water, flower nectar]

Part B

How much more sugar, in grams, would a hummingbird get from 4 grams of the [fills in with student's choice for the more sugary food type from part A] than from 4 grams of the [fills in with student's choice for the less sugary food type from part A]?

Interaction: Once the student selects the more sugary food type in part A, part B populates with the student's choice. The student can go back and change the choice in part A, in which case the statement of part B changes as well. Title the response box in Part B "Grams of sugar."

Rubric: (2 points) The student selects the more sugary food item (flower nectar) and identifies the additional amount of sugar correctly (0.04). (1 point) The student identifies the food made by the recipe and enters the difference as 0.16, which corresponds to assuming the recipe is 25% sugar by weight (a likely mistake) but then correctly computing the difference.

Response Type: Drop Down Menu⁵ and Equation/Numeric