

GO Math Unit 3

Ch. 6-8

Book Pages

Are YOU Ready?

Complete these exercises to review skills you will need for this module.

Simplify Fractions

EXAMPLE Simplify $\frac{15}{24}$.
 15: 1, 3, 5, 15
 24: 1, 2, 3, 4, 6, 8, 12, 24
 $\frac{15 \div 3}{24 \div 3} = \frac{5}{8}$

List all the factors of the numerator and denominator.
 Circle the greatest common factor (GCF).
 Divide the numerator and denominator by the GCF.



Write each fraction in simplest form.

1. $\frac{6}{9}$ _____
2. $\frac{4}{10}$ _____
3. $\frac{15}{20}$ _____
4. $\frac{20}{24}$ _____
5. $\frac{16}{56}$ _____
6. $\frac{45}{72}$ _____
7. $\frac{18}{60}$ _____
8. $\frac{32}{72}$ _____

Write Equivalent Fractions

EXAMPLE $\frac{6}{8} = \frac{6 \times 2}{8 \times 2} = \frac{12}{16}$ Multiply the numerator and denominator by the same number to find an equivalent fraction.
 $\frac{6}{8} = \frac{6 \div 2}{8 \div 2} = \frac{3}{4}$ Divide the numerator and denominator by the same number to find an equivalent fraction.



Write the equivalent fraction.

9. $\frac{12}{15} = \frac{\square}{5}$
10. $\frac{5}{6} = \frac{\square}{30}$
11. $\frac{16}{24} = \frac{4}{\square}$
12. $\frac{3}{9} = \frac{21}{\square}$
13. $\frac{15}{40} = \frac{\square}{8}$
14. $\frac{18}{30} = \frac{\square}{10}$
15. $\frac{48}{64} = \frac{12}{\square}$
16. $\frac{2}{7} = \frac{18}{\square}$

LESSON 6.1 Ratios

COMMON CORE 6.RP.1
 Understand the concept of a ratio and use ratio language to describe a relationship between two quantities. Also 6.RP.3, 6.RP.3a



ESSENTIAL QUESTION

How do you use ratios to compare two quantities?

EXPLORE ACTIVITY



COMMON CORE 6.RP.1



Representing Ratios with Models

A **ratio** is a comparison of two quantities. It shows how many times as great one quantity is than another.



For example, the ratio of star-shaped beads to moon-shaped beads in a bracelet is 3 to 1.

- A Write the ratio of moon beads to star beads. _____
- B Write the ratio of moon beads to all the beads. _____
- C If the bracelet has 2 moon beads, how many star beads does it have? _____
- D If the bracelet has 9 star beads, how many moon beads does it have? How do you know? _____

Reflect

1. **Make a Prediction** Write a rule that you can use to find the number of star beads in a bracelet when you know the number of moon beads. Then write a rule that you can use to find the number of moon beads when you know the number of star beads.

2. **Make a Prediction** Write a rule that you can use to find the total number of beads in a bracelet when you know the number of moon beads.

Writing Ratios

The numbers in a ratio are called **terms**. A ratio can be written in several different ways.

5 dogs to 3 cats 5 to 3 5 : 3 $\frac{5}{3}$

A ratio can compare a part to a part, a part to the whole, or the whole to a part.

EXAMPLE 1



COMMON CORE 6.RP.1

Math Talk

Mathematical Practices

What is the ratio of videos that are dramas to videos that are not dramas? Is this a part to part or part to whole ratio?

- A** Write the ratio of comedies to dramas in three different ways.

part to part

8 : 3 $\frac{8}{3}$ 8 comedies to 3 dramas

- B** Write the ratio of dramas to total videos in three different ways.

part to whole

3 : 14 $\frac{3}{14}$ 3 dramas to 14 total videos

The total number of videos is $8 + 3 + 2 + 1 = 14$.

Sam's Video Collection		
Comedies	8	
Dramas	3	
Cartoons	2	
Science Fiction	1	

Reflect

3. **Analyze Relationships** Describe the relationship between the drama videos and the science fiction videos.
4. **Analyze Relationships** The ratio of floor seats to balcony seats in a theater is 20 : 1. Does this theater have more floor seats or more balcony seats? How do you know?

YOUR TURN



Write each ratio in three different ways.

- bagel chips to peanuts _____
- total party mix to pretzels _____
- cheese crackers to peanuts _____

Party Mix Makes 8 cups
3 cups pretzels
3 cups bagel chips
1 cup cheese crackers
1 cup peanuts

Equivalent Ratios

Equivalent ratios are ratios that name the same comparison. You can find equivalent ratios by using a table or by multiplying or dividing both terms of a ratio by the same number. So, equivalent ratios have a multiplicative relationship.



A ratio with terms that have no common factors is said to be in simplest form.

EXAMPLE 2



COMMON CORE 6.RP.3, 6.RP.3a

You make 5 cups of punch by mixing 3 cups of cranberry juice with 2 cups of apple juice. How much cranberry juice and how much apple juice do you need to make four times the original recipe?

Method 1 Use a table.

STEP 1

Make a table comparing the number of cups of cranberry juice and apple juice needed to make two times, three times, and four times the original recipe.

Multiply both terms of the original ratio by the same number to find an equivalent ratio.

		3×2	3×3	3×4
Cranberry Juice	3	6	9	12
Apple Juice	2	4	6	8
		2×2	2×3	2×4

STEP 2

Write the original ratio and the ratio that shows the amount of cranberry juice and apple juice needed to make four times the original recipe.

$$\frac{3}{2} = \frac{12}{8}$$

You will need 12 cups of cranberry juice and 8 cups of apple juice.

Method 2 Multiply both terms of the ratio by the same number.

STEP 1

Write the original ratio in fraction form.

$$\frac{3}{2}$$

STEP 2

Multiply the numerator and denominator by the same number.

To make four times the original recipe, multiply by 4.



To make four times the original recipe, you will need 12 cups of cranberry juice and 8 cups of apple juice.

Math Talk

Mathematical Practices

The ratio of apple juice to grape juice in a recipe is 8 cups to 10 cups. What is this ratio in simplest form? Explain.



YOUR TURN

Q Write three ratios equivalent to the given ratio.

8. $\frac{8}{10}$ _____ 9. $\frac{1}{10}$ _____

Guided Practice

Q The number of dogs compared to the number of cats in an apartment complex is represented by the model shown. (Explore Activity)

1. Write a ratio that compares the number of dogs to the number of cats. _____

2. If there are 15 cats in the apartment complex, how many dogs are there?

$15 \div$ _____ = _____ dogs

3. How many cats are there if there are 5 dogs in the apartment complex?

$5 \times$ _____ = _____ cats

4. The only pets in the apartment complex are cats and dogs. If there are 10 dogs, how many pets are there? _____



Dana's Dozen Muffins

5 corn
4 bran
2 banana nut
1 blueberry

Q The contents of Dana's box of muffins are shown. Write each ratio in three different ways. (Example 1)

5. banana nut muffins to corn muffins _____

6. corn muffins to total muffins _____

Vocabulary Write three equivalent ratios for the given ratio. Circle the simplest form of the ratio. (Example 2)

7. $\frac{10}{12}$ _____ 8. $\frac{14}{2}$ _____ 9. $\frac{4}{7}$ _____

ESSENTIAL QUESTION CHECK-IN

Q 10. Use an example to describe the multiplicative relationship between two equivalent ratios.

Name _____ Class _____ Date _____

6.1 Independent Practice

6.RP.1, 6.RP.3, 6.RP.3a

Q Write three ratios equivalent to the ratio described in each situation.

11. The ratio of cups of water to cups of milk in a recipe is 1 to 3.

12. The ratio of boys to girls on the bus is $\frac{20}{13}$.

Q 13. In each bouquet of flowers, there are 4 roses and 6 white carnations. Complete the table to find how many roses and carnations there are in 4 bouquets of flowers.

Roses	4				
Carnations	6				

14. Ed is using the recipe shown to make fruit salad. He wants to use 30 diced strawberries in his fruit salad. How many bananas, apples, and pears should Ed use in his fruit salad?

Fruit Salad Recipe

4 bananas, diced
3 apples, diced
6 pears, diced
10 strawberries, diced

15. A collector has 120 movie posters and 100 band posters. She wants to sell 24 movie posters but still have her poster collection maintain the same ratio of 120 : 100. If she sells 24 movie posters, how many band posters should she sell? Explain.

16. Bob needs to mix 2 cups of orange juice concentrate with 3.5 cups of water to make orange juice. Bob has 6 cups of concentrate. How much orange juice can he make?

Q 17. **Multistep** The ratio of North American butterflies to South American butterflies at a butterfly park is 5 : 3. The ratio of South American butterflies to European butterflies is 3 : 2. There are 30 North American butterflies at the butterfly park.

- a. How many South American butterflies are there? _____
- b. How many European butterflies are there? _____

LESSON

6.2 Rates

COMMON CORE 6.RP.2
Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language. Also 6.RP.3, 6.RP.3b

ESSENTIAL QUESTION

How do you use rates to compare quantities?

EXPLORE ACTIVITY



COMMON CORE 6.RP.2, 6.RP.3b

Using Rates to Compare Prices

A **rate** is a comparison of two quantities that have different units.

Chris drove 107 miles in two hours. This can be expressed as the rate shown at the right. Notice that the units are different: **miles** and **hours**. The rate is $\frac{107 \text{ miles}}{2 \text{ hours}}$.

Shana is at the grocery store comparing two brands of juice. Brand A costs \$3.84 for a 16-ounce bottle. Brand B costs \$4.50 for a 25-ounce bottle.

To compare the costs, Shana must compare prices for equal amounts of juice. How can she do this?

A Complete the tables.

Brand A		Brand B	
Ounces	Price (\$)	Ounces	Price (\$)
16	3.84	25	4.50
8	1.92	5	
4		1	
2			
1			

B Brand A costs \$ _____ per ounce. Brand B costs \$ _____ per ounce.

C Which brand is the better buy? Why? _____

Reflect

1. **Analyze Relationships** Describe another method to compare the costs.



Calculating Unit Rates

A **unit rate** is a rate in which the second quantity is one unit. When the first quantity in a unit rate is an amount of money, the unit rate is sometimes called a **unit price** or **unit cost**.

EXAMPLE 1



COMMON CORE 6.RP.2

A Gerald pays \$90 for 6 yoga classes. What is the cost per class?

Use the information in the problem to write a rate: $\frac{\$90}{6 \text{ classes}}$

To find the unit rate, divide both quantities in the rate by the same number so that the second quantity is 1.

$$\frac{\$90}{6 \text{ classes}} = \frac{\$15}{1 \text{ class}}$$

Gerald's yoga classes cost \$15 per class.

B The cost of 2 cartons of milk is \$5.50. What is the unit price?

$$\frac{\$5.50}{2 \text{ cartons}} = \frac{\$2.75}{1 \text{ carton}}$$

The unit price is \$2.75 per carton of milk.

C A cruise ship travels 20 miles in 50 minutes. How far does the ship travel per minute?

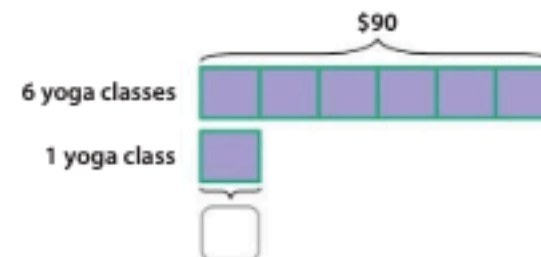
$$\frac{20 \text{ miles}}{50 \text{ minutes}} = \frac{0.4 \text{ mile}}{1 \text{ minute}}$$

The ship travels 0.4 mile per minute.

The first quantity in a unit rate can be less than 1.

Reflect

2. **Multiple Representations** Explain how you could use a diagram like the one shown below to find the unit rate in **A**. Then complete the diagram to find the unit rate.





YOUR TURN

3. There are 156 players on 13 teams. How many players are on each team? _____ players per team

Problem Solving with Unit Rates

You can solve rate problems by using a unit rate or by using equivalent rates.

EXAMPLE 2



6.RP.3, 6.RP.3b

At a summer camp, the campers are divided into groups. Each group has 16 campers and 2 cabins. How many cabins are needed for 112 campers?

Method 1 Find the unit rate. How many campers per cabin?

$$\frac{16 \text{ campers}}{2 \text{ cabins}} = \frac{8 \text{ campers}}{1 \text{ cabin}}$$

Divide to find the unit rate.

There are 8 campers per cabin.

$$\frac{112 \text{ campers}}{8 \text{ campers per cabin}} = 14 \text{ cabins}$$

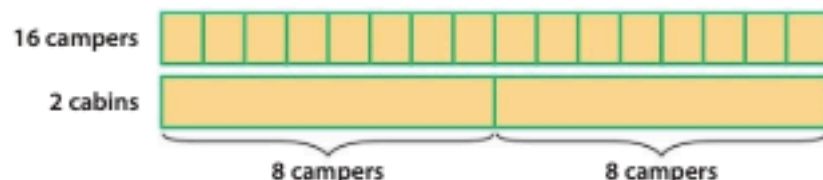
Divide to find the number of cabins.

Method 2 Use equivalent rates.

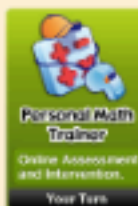
$$\frac{16 \text{ campers}}{2 \text{ cabins}} = \frac{112 \text{ campers}}{14 \text{ cabins}}$$

The camp needs 14 cabins.

Check Use a diagram to check the unit rate if there are 16 campers in 2 cabins. Then, use the unit rate to check if 14 cabins is a reasonable number for 112 campers.



The unit rate of 8 campers per cabin is reasonable. You can multiply 14 cabins by 8 campers per cabin to find that there would be enough room for 112 campers.



YOUR TURN

4. Petra jogs 3 miles in 27 minutes. At this rate, how long would it take her to jog 5 miles? Show your work.

Guided Practice

Mason's favorite brand of peanut butter is available in two sizes. Each size and its price are shown in the table. Use the table for 1 and 2. (Explore Activity)

1. What is the unit rate for each size of peanut butter?

Regular: \$ _____ per ounce

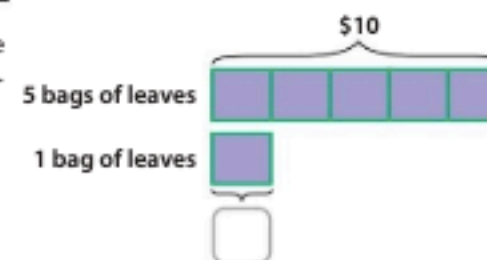
Family size: \$ _____ per ounce

	Size (oz)	Price (\$)
Regular	16	3.36
Family Size	40	7.60

2. Which size is the better buy? _____

3. Martin charges \$10 for every 5 bags of leaves he rakes. Last weekend, he raked 24 bags of leaves. How much money did he earn? (Example 1)

_____ for 24 bags of leaves



Find the unit rate. (Example 1)

4. Lisa walked 48 blocks in 3 hours.
_____ blocks per hour
5. Gordon types 1,800 words in 25 minutes.
_____ words per minute
6. A particular frozen yogurt has 75 calories in 2 ounces. How many calories are in 8 ounces of the yogurt? (Example 2)
7. The cost of 10 oranges is \$1. What is the cost of 5 dozen oranges? (Example 2)



ESSENTIAL QUESTION CHECK-IN

8. How can you use a rate to compare the costs of two boxes of cereal that are different sizes?



Name _____ Class _____ Date _____

6.2 Independent Practice

COMMON CORE 6.RP.2, 6.RP.3, 6.RP.3b

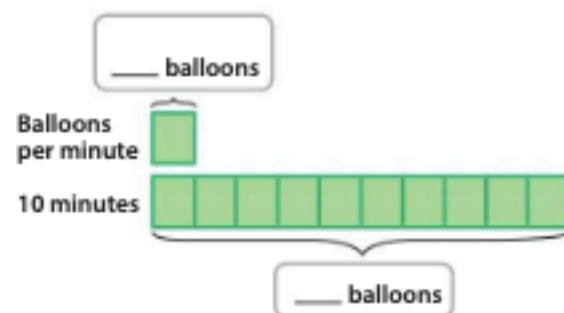
- Q** Taryn and Alastair both mow lawns. Each charges a flat fee to mow a lawn. The table shows the number of lawns mowed in the past week, the time spent mowing lawns, and the money earned.

	Number of Lawns Mowed	Time Spent Mowing Lawns (in hours)	Money Earned
Taryn	9	7.5	\$112.50
Alastair	7	5	\$122.50

9. How much does Taryn charge to mow a lawn? _____
10. How much does Alastair charge to mow a lawn? _____
11. Who earns more per hour, Taryn or Alastair? _____
12. **What If?** If Taryn and Alastair want to earn an additional \$735 each, how many additional hours will each spend mowing lawns? Assume each mows at the rate shown in the table and charges by the hour. Explain.

- Q** 13. **Multistep** Tomas makes balloon sculptures at a circus. In 180 minutes, he uses 252 balloons to make 36 identical balloon sculptures.

- a. How many minutes does it take to make one balloon sculpture? How many balloons are used in one sculpture? _____
- b. What is Tomas's unit rate for balloons used per minute? _____
- c. Complete the diagram to find out how many balloons he will use in 10 minutes. _____



LESSON 6.3 Using Ratios and Rates to Solve Problems

COMMON CORE 6.RP.3
 Use ratio and rate reasoning to solve... problems, e.g., by reasoning about tables... double number line diagrams... Also 6.RP.3a


ESSENTIAL QUESTION

How can you use ratios and rates to make comparisons and predictions?

EXPLORE ACTIVITY 1


COMMON CORE 6.RP.3a


Using Tables to Compare Ratios

Anna's recipe for lemonade calls for 2 cups of lemonade concentrate and 3 cups of water. Bailey's recipe calls for 3 cups of lemonade concentrate and 5 cups of water.

- A** In Anna's recipe, the ratio of concentrate to water is _____. Use equivalent ratios to complete the table.

	2×2	$2 \times \square$	$2 \times \square$
Concentrate (c)	2	4	
Water (c)	3		9
	3×2	3×3	3×5

- B** In Bailey's recipe, the ratio of concentrate to water is _____. Use equivalent ratios to complete the table.

	3×3	3×4	$3 \times \square$
Concentrate (c)	3	9	12
Water (c)	5		25
	5×3	$5 \times \square$	$5 \times \square$

- C** Find two columns, one in each table, in which the amount of water is the same. Circle these two columns.
- D** Whose recipe makes stronger lemonade? How do you know?

- E** Compare the ratios: $\frac{10}{15} \bigcirc \frac{9}{15}$ $\frac{2}{3} \bigcirc \frac{3}{5}$

EXPLORE ACTIVITY 1 (cont'd)

Reflect

1. **Analyze Relationships** Suppose each person pours herself one cup of the lemonade she made. How much concentrate is in each person's cup? How do you know?

Comparing Ratios

You can use equivalent ratios to solve real-world problems.

EXAMPLE 1



6.RP.3

A fruit and nut bar recipe calls for 4 cups of chopped nuts and 6 cups of dried fruit. When Tonya made a batch of these bars, she used 6 cups of chopped nuts and 9 cups of dried fruit. Did Tonya use the correct ratio of nuts to fruit?

STEP 1 Find the ratio of nuts to fruit in the recipe.

$\frac{4}{6}$ 4 cups of nuts to 6 cups of fruit

STEP 2 Find the ratio of nuts to fruit that Tonya used.

$\frac{6}{9}$ 6 cups of nuts to 9 cups of fruit

STEP 3 Find equivalent ratios that have the same second term.

$$\frac{4}{6} = \frac{12}{18} \quad \frac{6}{9} = \frac{12}{18}$$

18 is a multiple of 6 and 9, so find equivalent ratios with 18 in the second term.

The ratios $\frac{4}{6}$ and $\frac{6}{9}$ are equivalent. So, Tonya used the same ratio of nuts to fruit that was given in the recipe.

Math Talk

Mathematical Practices

Explain how you compare two ratios to check if they are equivalent.

YOUR TURN

2. In the science club, there are 2 sixth-graders for every 3 seventh-graders. At this year's science fair, there were 7 projects by sixth-graders for every 12 projects by seventh-graders. Is the ratio of sixth-graders to seventh-graders in the science club equivalent to the ratio of science fair projects by sixth-graders to projects by seventh-graders? Explain.

EXPLORE ACTIVITY 2



6.RP.3

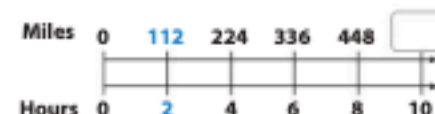
Using Rates to Make Predictions

You can represent rates on a double number line to make predictions.

Janet drives from Clarkson to Humbolt in 2 hours. Suppose Janet drives for 10 hours. If she maintains the same driving rate, can she drive more than 600 miles? Justify your answer.



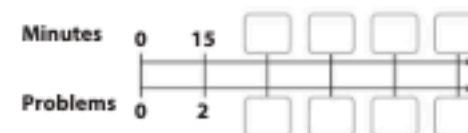
The double number line shows the number of miles Janet drives in various amounts of time.



- A Explain how Janet's rate for two hours is represented on the double number line.
- B Describe the relationship between Janet's rate for two hours and the other rates shown on the double number line.
- C Complete the number line.
- D At this rate, can Janet drive more than 600 miles in 10 hours? Explain.

Reflect

3. In fifteen minutes, Lena can finish 2 math homework problems. How many math problems can she finish in 75 minutes? Use a double number line to find the answer.



4. How is using a double number line similar to finding equivalent ratios?

Guided Practice

1. Celeste is making fruit baskets for her service club to take to a local hospital. The directions say to fill the boxes using 5 apples for every 6 oranges. Celeste is filling her baskets with 2 apples for every 3 oranges. (Explore Activity 1)

- a. Complete the tables to find equivalent ratios.

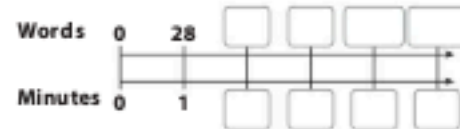
Apples	5			
Oranges	6			

Apples	2			
Oranges	3			

- b. Compare the ratios. Is Celeste using the correct ratio of apples to oranges?

2. Neha used 4 bananas and 5 oranges in her fruit salad. Daniel used 7 bananas and 9 oranges. Did Neha and Daniel use the same ratio of bananas to oranges? If not, who used the greater ratio of bananas to oranges? (Example 1)

3. Tim is a first grader and reads 28 words per minute. Assuming he maintains the same rate, use the double number line to find how many words he can read in 5 minutes. (Explore Activity 2)



4. A cafeteria sells 30 drinks every 15 minutes. Predict how many drinks the cafeteria sells every hour. (Explore Activity 2)

ESSENTIAL QUESTION CHECK-IN

5. Explain how to compare two ratios.

Name _____

Class _____

Date _____

6.3 Independent Practice

6.RP.3, 6.RP.3a

6. Gina's art teacher mixes 9 pints of yellow paint with 6 pints of blue paint to create green paint. Gina mixes 4 pints of yellow paint with 3 pints of blue paint. Did Gina use the same ratio of yellow paint to blue paint instructed by her teacher? Explain.

7. The Suarez family paid \$15.75 for 3 movie tickets. How much would they have paid for 12 tickets?

8. A grocery store sells snacks by weight. A six-ounce bag of mixed nuts costs \$3.60. Predict the cost of a two-ounce bag.

9. The Martin family's truck gets an average of 25 miles per gallon. Predict how many miles they can drive using 7 gallons of gas.

10. **Multistep** The table shows two cell phone plans that offer free minutes for each given number of paid minutes used. Pablo has Plan A and Sam has Plan B.

- a. What is Pablo's ratio of free to paid minutes?

- b. What is Sam's ratio of free to paid minutes?

- c. Does Pablo's cell phone plan offer the same ratio of free to paid minutes as Sam's? Explain.

	Cell Phone Plans	
	Plan A	Plan B
Free minutes	2	8
Paid minutes	10	25

11. **Consumer Math** A store has apples on sale for \$3.00 for 2 pounds. How many pounds of apples can you buy for \$9? If an apple is approximately 5 ounces, how many apples can you buy for \$9? Explain your reasoning.

Ready to Go On?



6.1 Ratios

Use the table to find each ratio.

- white socks to brown socks _____
- blue socks to nonblue socks _____
- black socks to all of the socks _____
- Find two ratios equivalent to the ratio in Exercise 1.

Color of socks	white	black	blue	brown
Number of socks	8	6	4	5

6.2 Rates

Find each rate.

- Earl runs 75 meters in 30 seconds. How many meters does Earl run per second? _____
- The cost of 3 scarves is \$26.25. What is the unit price? _____

6.3 Using Ratios and Rates to Solve Problems

- Danny charges \$35 for 3 hours of swimming lessons. Martin charges \$24 for 2 hours of swimming lessons. Who offers a better deal? _____
- There are 32 female performers in a dance recital. The ratio of men to women is 3:8. How many men are in the dance recital? _____

ESSENTIAL QUESTION

- How can you use ratios and rates to solve problems?



Assessment Readiness



Selected Response

- Which ratio is **not** equivalent to the other three?
(A) $\frac{2}{3}$ (B) $\frac{6}{9}$ (C) $\frac{12}{15}$ (D) $\frac{18}{27}$
- A lifeguard received 15 hours of first aid training and 10 hours of cardiopulmonary resuscitation (CPR) training. What is the ratio of hours of CPR training to hours of first aid training?
(A) 15:10 (B) 15:25 (C) 10:15 (D) 25:15
- Jerry bought 4 DVDs for \$25.20. What was the unit rate?
(A) \$3.15 (B) \$4.20 (C) \$6.30 (D) \$8.40
- There are 1,920 fence posts used in a 12-kilometer stretch of fence. How many fence posts are used in 1 kilometer of fence?
(A) 150 (B) 160 (C) 155 (D) 180
- Sheila can ride her bicycle 6,000 meters in 15 minutes. How far can she ride her bicycle in 2 minutes?
(A) 400 meters (B) 600 meters (C) 800 meters (D) 1,000 meters
- Lennon has a checking account. He withdrew \$130.47 from an ATM Tuesday. Wednesday he deposited \$240.93. Friday he wrote a check for \$56.02. What was the total change in Lennon's account?
(A) \$-73.21 (B) \$54.44 (C) \$166.48 (D) \$315.38

- Cheyenne is making a recipe that uses 5 cups of beans and 2 cups of carrots. Which combination below uses the same ratio of beans to carrots?
(A) 10 cups of beans and 3 cups of carrots
(B) 10 cups of beans and 4 cups of carrots
(C) 12 cups of beans and 4 cups of carrots
(D) 12 cups of beans and 5 cups of carrots
- $\frac{5}{8}$ of the 64 musicians in a music contest are guitarists. Some of the guitarists play jazz solos, and the rest play classical solos. The ratio of the number of guitarists playing jazz solos to the total number of guitarists in the contest is 1:4. How many guitarists play classical solos in the contest?
(A) 10 (B) 30 (C) 16 (D) 48

Mini-Task

- Mikaela is competing in a race in which she both runs and rides a bicycle. She runs 5 kilometers in 0.5 hour and rides her bicycle 20 kilometers in 0.8 hour.
a. At the rate given, how many kilometers can Mikaela run in 1 hour?

b. At the rate given, how many kilometers can Mikaela bike in 1 hour?

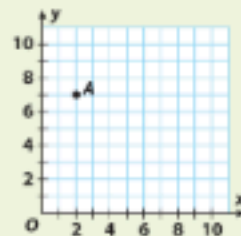
c. If Mikaela runs for 1 hour and bikes for 1 hour at the rates given, how far will she travel?

Are YOU Ready?

Complete these exercises to review skills you will need for this module.

Graph Ordered Pairs (First Quadrant)

EXAMPLE



To graph $A(2, 7)$, start at the origin. Move 2 units right. Then move 7 units up. Graph point $A(2, 7)$.

Graph each ordered pair on the coordinate plane above.

1. $B(9, 6)$
2. $C(0, 2)$
3. $D(6, 10)$
4. $E(3, 4)$

Write Equivalent Fractions

EXAMPLE

$$\frac{14}{21} = \frac{14 \times 2}{21 \times 2} = \frac{28}{42}$$

$$\frac{14}{21} = \frac{14 \div 7}{21 \div 7} = \frac{2}{3}$$

Multiply the numerator and denominator by the same number to find an equivalent fraction.
Divide the numerator and denominator by the same number to find an equivalent fraction.

Write the equivalent fraction.

5. $\frac{6}{8} = \frac{\square}{32}$
6. $\frac{4}{6} = \frac{\square}{12}$
7. $\frac{1}{8} = \frac{\square}{56}$
8. $\frac{9}{12} = \frac{\square}{4}$
9. $\frac{5}{9} = \frac{25}{\square}$
10. $\frac{5}{6} = \frac{20}{\square}$
11. $\frac{36}{45} = \frac{12}{\square}$
12. $\frac{20}{36} = \frac{10}{\square}$

Multiples

EXAMPLE

List the first five multiples of 4.

$$4 \times 1 = 4$$

$$4 \times 2 = 8$$

$$4 \times 3 = 12$$

$$4 \times 4 = 16$$

$$4 \times 5 = 20$$

Multiply 4 by the numbers 1, 2, 3, 4, and 5.

List the next four multiples of each number.

13. 3 _____
14. 7 _____
15. 8 _____



LESSON 7.1 Ratios, Rates, Tables, and Graphs

COMMON CORE 6.RP.3a
Make tables of equivalent ratios ..., find missing values in the tables, and plot the pairs of values on the coordinate plane. ... Also 6.RP.3, 6.RP.3b



ESSENTIAL QUESTION

How can you represent real-world problems involving ratios and rates with tables and graphs?

EXPLORE ACTIVITY 1



COMMON CORE 6.RP.3, 6.RP.3a

Finding Ratios from Tables

Students in Mr. Webster's science classes are doing an experiment that requires 250 milliliters of distilled water for every 5 milliliters of ammonia. The table shows the amount of distilled water needed for various amounts of ammonia.

Ammonia (mL)	2	3	3.5		5
Distilled water (mL)	100			200	250

- A** Use the numbers in the first column of the table to write a ratio of distilled water to ammonia. _____
- B** How much distilled water is used for 1 milliliter of ammonia? _____
Use your answer to write another ratio of distilled water to ammonia. _____
- C** The ratios in **A** and **B** are **equivalent/not equivalent**.
- D** How can you use your answer to **B** to find the amount of distilled water to add to a given amount of ammonia?

- E** Complete the table. What are the equivalent ratios shown in the table?

$$\frac{100}{2} = \frac{\square}{3} = \frac{\square}{3.5} = \frac{200}{\square} = \frac{250}{5}$$

Reflect

1. **Look for a Pattern** When the amount of ammonia increases by 1 milliliter, the amount of distilled water increases by _____ milliliters. So 6 milliliters of ammonia requires _____ milliliters of distilled water.



Math Talk

Mathematical Practices
Is the relationship between the amount of ammonia and the amount of distilled water additive or multiplicative? Explain.

EXPLORE ACTIVITY 2



COMMON CORE 6.RP.3a

Graphing with Ratios

- Q** **A** Copy the table from Explore Activity 1 that shows the amounts of ammonia and distilled water.

Ammonia (mL)	2	3	3.5		5
Distilled water (mL)	100			200	250

- B** Write the information in the table as ordered pairs. Use the amount of ammonia as the x -coordinates and the amount of distilled water as the y -coordinates.

(2, _____) (3, _____), (3.5, _____), (_____, 200), (5, 250)

Graph the ordered pairs. Because fractions and decimals can represent amounts of chemicals, connect the points.

Describe your graph. _____

- C** For each ordered pair that you graphed, write the ratio of the y -coordinate to the x -coordinate. _____

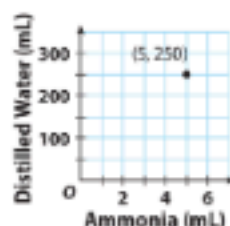
- D** The ratio of distilled water to ammonia is $\frac{\square}{1}$. How are the ratios in

C related to this ratio? _____

- E** The point (2.5, 125) is on the graph but not in the table. The ratio of the y -coordinate to the x -coordinate is _____. How is this ratio related to the ratios in **C** and **D**? _____

2.5 milliliters of ammonia requires _____ milliliters of distilled water.

- F** **Conjecture** What do you think is true for every point on the graph?



Reflect

- 2. Communicate Mathematical Ideas** How can you use the graph to find the amount of distilled water to use for 4.5 milliliters of ammonia?

Representing Rates with Tables and Graphs

You can use tables and graphs to represent real-world problems involving equivalent rates.

EXAMPLE 1



COMMON CORE 6.RP.3a, 6.RP.3b

The Webster family is taking an express train to Washington, D.C. The train travels at a constant speed and makes the trip in 2 hours.



- A** Make a table to show the distance the train travels in various amounts of time.

STEP 1 Write a ratio of distance to time to find the rate.

$$\frac{\text{distance}}{\text{time}} = \frac{120 \text{ miles}}{2 \text{ hours}} = \frac{60 \text{ miles}}{1 \text{ hour}} = 60 \text{ miles per hour}$$

STEP 2 Use the unit rate to make a table.

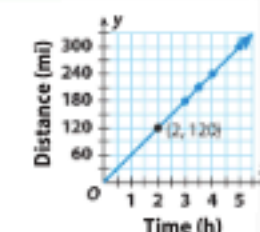
Time (h)	2	3	3.5	4	5
Distance (mi)	120	180	210	240	300

- B** Graph the information from the table.

STEP 1 Write ordered pairs. Use Time as the x -coordinates and Distance as the y -coordinates.

(2, 120), (3, 180), (3.5, 210), (4, 240), (5, 300)

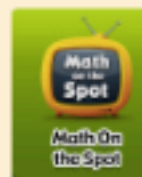
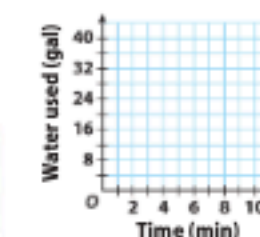
STEP 2 Graph the ordered pairs and connect the points.



YOUR TURN

- Q** **3.** A shower uses 12 gallons of water in 3 minutes. Complete the table and graph.

Time (min)	2	3	3.5		6.5
Water used (gal)				20	



Guided Practice



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and Intervention



Selected
Answers
See all the
selected answers.

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1. The ratio of oxygen atoms to sulfur atoms in sulfur dioxide is always the same. The table shows the numbers of atoms in different quantities of sulfur dioxide. Complete the table. (*Explore Activity 1*)

Sulfur atoms	6	9	21	
Oxygen atoms	12			54

What are the equivalent ratios shown in the table?

3. Stickers are made with the same ratio of width to length. A sticker 2 inches wide has a length of 4 inches. Complete the table. (*Explore Activity 1*)

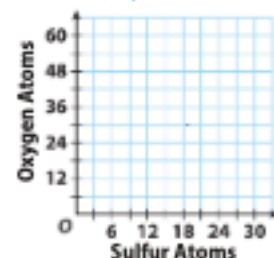
Width (in.)	2	4	7	
Length (in.)				16

What are the equivalent ratios shown in the table?

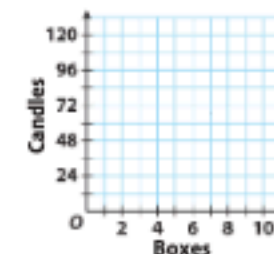
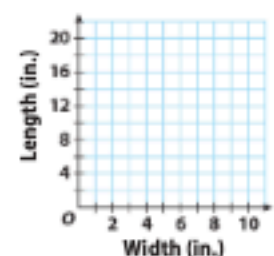
5. Five boxes of candles contain a total of 60 candles. Each box holds the same number of candles. Complete the table and graph the relationship. (*Example 1*)

Boxes	5	8	
Candles			120

2. Use the table in Exercise 1 to graph the relationship between sulfur atoms and oxygen atoms. (*Explore Activity 2*)



4. Graph the relationship between the width and the length of the stickers from Exercise 3. (*Explore Activity 2*)



ESSENTIAL QUESTION CHECK-IN



6. How do you represent real-world problems involving ratios and rates with tables and graphs?

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Name _____

Class _____

Date _____

7.1 Independent Practice

COMMON CORE 6.RP.3, 6.RP.3a, 6.RP.3b



The table shows information about the number of sweatshirts sold and the money collected at a fundraiser for school athletic programs. For Exercises 7–12, use the table.

Sweatshirts sold	3	5	8		12
Money collected (\$)	60			180	

7. Find the rate of money collected per sweatshirt sold. Show your work.

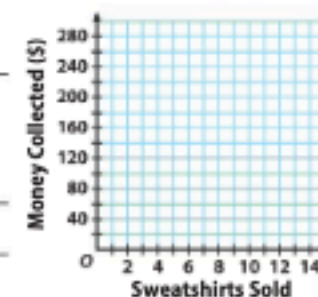
8. Use the unit rate to complete the table.

9. Explain how to graph information from the table.

10. Write the information in the table as ordered pairs. Graph the relationship from the table.

11. **What if?** How much money would be collected if 24 sweatshirts were sold? Show your work.

12. **Analyze Relationships** Does the point (5.5, 110) make sense in this context? Explain.



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Selected
Answers
See all the
selected answers.

LESSON 7.2 Solving Problems with Proportions

COMMON CORE 6.RP.3
Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about... equations. Also 6.RP.3b

ESSENTIAL QUESTION

How can you solve problems with proportions?

EXPLORE ACTIVITY **Real World** **COMMON CORE 6.RP.3**

Using Equivalent Ratios to Solve Proportions

A **proportion** is a statement that two ratios or rates are equivalent.

$\frac{1}{3}$ and $\frac{2}{6}$ are equivalent ratios. $\frac{1}{3} = \frac{2}{6}$ is a proportion.

EXAMPLE 1 Sheldon and Leonard are partners in a business. Sheldon makes \$2 in profits for every \$5 that Leonard makes. If Leonard makes \$20 profit on the first item they sell, how much profit does Sheldon make?

Sheldon's profit is unknown.

STEP 1 Write a proportion.

Sheldon's profit \rightarrow \$ = Sheldon's profit
Leonard's profit \rightarrow \$5 = \$20 Leonard's profit

STEP 2 Use common denominators to write equivalent ratios.

The common denominator is _____.
Multiply the numerator and denominator by 4 to create an equivalent ratio.

Equivalent ratios with the same denominators have the same numerators.

$$\begin{array}{l} \$2 \times \frac{4}{4} = \$8 \\ \$5 \times \frac{4}{4} = \$20 \\ \$ \times \frac{4}{4} = \$ \\ \$ \times \frac{4}{4} = \$20 \\ \square = \$8 \end{array}$$

If Leonard makes \$20 profit, Sheldon makes _____ profit.

YOUR TURN

- The members of the PTA are ordering pizza for a meeting. They plan to order 2 cheese pizzas for every 3 pepperoni pizzas they order. How many cheese pizzas will they order if they order 15 pepperoni pizzas?



Lesson 7.2 179

Using Unit Rates to Solve Proportions

You can also use equivalent rates to solve proportions. Finding a unit rate may help you write equivalent rates.

EXAMPLE 2 **Real World** **COMMON CORE 6.RP.3b**

The distance Ali runs in 36 minutes is shown on the pedometer. At this rate, how far could he run in 60 minutes?



STEP 1 Write a proportion.

$$\frac{\text{time}}{\text{distance}} = \frac{36 \text{ minutes}}{3 \text{ miles}} = \frac{60 \text{ minutes}}{\square \text{ miles}} = \frac{\text{time}}{\text{distance}}$$

60 is not a multiple of 36. So, there is no whole number by which you can multiply 3 miles to find \square .

STEP 2 Find the unit rate of the rate you know.

$$\frac{36 \div 3}{3 \div 3} = \frac{12}{1}$$

The unit rate is 12 minutes per 1 mile.

STEP 3 Use the unit rate to write an equivalent rate that compares 60 miles to an unknown number of minutes.

Think: You can multiply $12 \times 5 = 60$. So multiply the denominator by the same number.

$$\frac{12 \times 5}{1 \times 5} = \frac{60}{\square}$$

$$\frac{60}{5} = \frac{60}{\square}$$

$$\square = 5 \text{ miles}$$

At this rate, Ali can run 5 miles in 60 minutes.

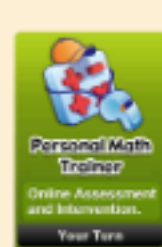
Math Talk

Mathematical Practices

Compare the fractions $\frac{36}{3}$ and $\frac{60}{5}$ using $<$, $>$ or $=$. Explain.

YOUR TURN

- Ms. Reynold's sprinkler system has 9 stations that water all the parts of her front and back lawn. Each station runs for an equal amount of time. If it takes 48 minutes for the first 4 stations to water, how long does it take to water all parts of her lawn? _____



180 Unit 3

Using Proportional Relationships to Find Distance on a Map

A **scale drawing** is a drawing of a real object that is proportionally smaller or larger than the real object. A **scale** describes how the dimensions in the objects compare.

A map is a scale drawing. The measurements on a map are in proportion to the actual distances. If 1 inch on a map equals an actual distance of 2 miles, the scale is 1 inch = 2 miles. You can write a scale as a rate to solve problems.

EXAMPLE 3



COMMON CORE 6.RP.3b

The distance between two schools on Lehigh Avenue is shown on the map. What is the actual distance between the schools?

STEP 1 Write a proportion.

$$\frac{2 \text{ miles}}{1 \text{ inch}} = \frac{\square \text{ miles}}{3 \text{ inches}} \quad \text{Write the scale as a unit rate.}$$

STEP 2 Write an equivalent rate to find the missing number.

$$\frac{2 \text{ miles} \times 3}{1 \text{ inch} \times 3} = \frac{6 \text{ miles}}{3 \text{ inches}}$$

So, in Step 1, the missing number is 6.

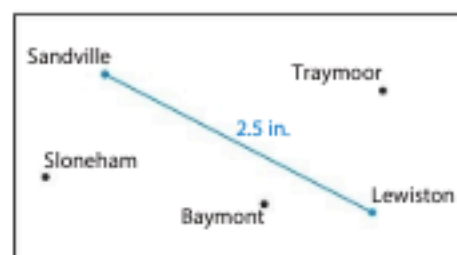
The actual distance between the two schools is 6 miles.



Scale: 1 inch = 2 miles

YOUR TURN

3. The distance between Sandville and Lewiston is shown on the map. What is the actual distance between the towns?



Scale: 1 inch = 20 miles



Guided Practice

Find the unknown value in each proportion. (Explore Activity Example 1)

$$1. \frac{3}{5} = \frac{\square}{30}$$

$$\frac{3 \times \square}{5 \times \square} = \frac{\square}{30}$$

$$2. \frac{4}{10} = \frac{\square}{5}$$

$$\frac{4 \div \square}{10 \div \square} = \frac{\square}{5}$$

Solve using equivalent ratios. (Explore Activity Example 1)

3. Leila and Jo are two of the partners in a business. Leila makes \$3 in profits for every \$4 that Jo makes. If Jo makes \$60 profit on the first item they sell, how

much profit does Leila make? _____

4. Hendrick wants to enlarge a photo that is 4 inches wide and 6 inches tall. The enlarged photo keeps the same ratio. How tall is the enlarged photo if it is

12 inches wide? _____

Solve using unit rates. (Example 2)

5. A person on a moving sidewalk travels 21 feet in 7 seconds. The moving sidewalk has a length of 180 feet. How long will it take to move from one end of the sidewalk to the other?

7. Contestants in a dance-a-thon rest for the same amount of time every hour. A couple rests for 25 minutes in 5 hours. How long did they rest in 8 hours?

9. What is the actual distance between Gendet and Montrose? (Example 3)

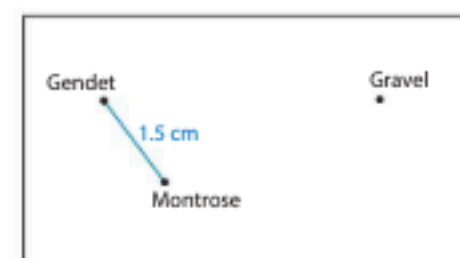
6. In a repeating musical pattern, there are 56 beats in 7 measures. How many measures are there in 104 beats?

8. Frances gets 6 paychecks in 12 weeks. How many paychecks does she get in 52 weeks?



ESSENTIAL QUESTION CHECK-IN

10. How do you solve problems with proportions?



Scale: 1 centimeter = 16 kilometers

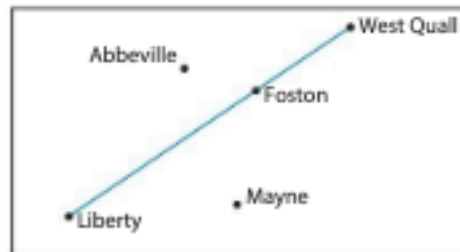


7.2 Independent Practice

COMMON CORE 6.RP.3, 6.RP.3b



- Q** 11. The scale of the map is missing. The actual distance from Liberty to West Quall is 72 miles, and it is 6 inches on the map.



- What is the scale of the map?
- Foston is between Liberty and West Quall and is 4 inches from Liberty on the map. How far is Foston from West Quall?

- Q** 12. A punch recipe says to mix 4 cups pineapple juice, 8 cups orange juice, and 12 cups seltzer in order to make 18 servings of punch.

- How many cups of each ingredient do you need to make 108 cups of punch?
_____ cups pineapple juice
_____ cups orange juice
_____ cups seltzer
- How many servings can be made from 108 cups of punch?
- For every cup of seltzer you use, how much orange juice do you use?

- Q** 13. On an airplane, there are two seats on the left side in each row and three seats on the right side. There are 90 seats on the right side of the plane.

- How many seats are on the left side of the plane?
- How many seats are there altogether?

- Q** 14. Carrie and Krystal are taking a road trip from Greenville to North Valley. Each person has her own map, and the scales on the maps are different.

- On Carrie's map, Greenville and North Valley are 4.5 inches apart. The scale on her map is 1 inch = 20 miles. How far is Greenville from North Valley?
- The scale on Krystal's map is 1 inch = 18 miles. How far apart are Greenville and North Valley on Krystal's map?

- Q** 15. **Multistep** A machine can produce 27 inches of ribbon every 3 minutes. How many feet of ribbon can the machine make in one hour? Explain.

LESSON 7.3 Converting Within Measurement Systems

COMMON CORE 6.RP.3d

Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. Also 6.RP.3

ESSENTIAL QUESTION

How do you convert units within a measurement system?

EXPLORE ACTIVITY



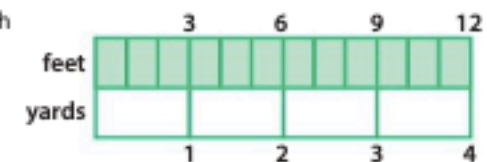
COMMON CORE 6.RP.3d

Using a Model to Convert Units

The two most common systems of measurement are the customary system and the metric system. You can use a model to convert from one unit to another within the same measurement system.

- STEP 1** Use the model to complete each statement below.

- 1 yard = 3 feet
2 yards = _____ feet
3 yards = _____ feet
4 yards = _____ feet



- STEP 2** Rewrite your answers as ratios.

$$\frac{\square \text{ feet}}{2 \text{ yards}} = \frac{3 \text{ feet}}{1 \text{ yard}} \quad \frac{\square \text{ feet}}{3 \text{ yards}} = \frac{3 \text{ feet}}{1 \text{ yard}} \quad \frac{\square \text{ feet}}{4 \text{ yards}} = \frac{3 \text{ feet}}{1 \text{ yard}}$$

Since 1 yard = 3 feet, the ratio of feet to yards in any measurement is always $\frac{3}{1}$. This means any ratio forming a proportion with $\frac{3}{1}$ can represent a ratio of feet to yards.

$$\frac{3}{1} = \frac{12}{4} \text{ so } 12 \text{ feet} = \underline{\hspace{1cm}} \text{ yards.} \quad \frac{3}{1} = \frac{54}{18} \text{ so } \underline{\hspace{1cm}} \text{ feet} = 18 \text{ yards.}$$

Reflect

- Communicate Mathematical Ideas** How could you draw a model to show the relationship between feet and inches?



Converting Units Using Proportions and Unit Rates

You can use ratios and proportions to convert both customary and metric units. Use the table below to convert from one unit to another within the same measurement system.

Customary Measurements		
Length	Weight	Capacity
1 ft = 12 in.		1 c = 8 fl oz
1 yd = 36 in.	1 lb = 16 oz	1 pt = 2 c
1 yd = 3 ft	1 T = 2,000 lb	1 qt = 2 pt
1 mi = 5,280 ft		1 qt = 4 c
1 mi = 1,760 yd		1 gal = 4 qt
Metric Measurements		
Length	Mass	Capacity
1 km = 1,000 m	1 kg = 1,000 g	
1 m = 100 cm	1 g = 1,000 mg	1 L = 1,000 mL
1 cm = 10 mm		

EXAMPLE 1



COMMON CORE 6.RP.3d

- A** What is the weight of a 3-pound human brain in ounces?

Use a proportion to convert 3 pounds to ounces.

Use $\frac{16 \text{ ounces}}{1 \text{ pound}}$ to convert pounds to ounces.

- STEP 1** Write a proportion.

$$\frac{16 \text{ ounces}}{1 \text{ pound}} = \frac{\square \text{ ounces}}{3 \text{ pounds}}$$

- STEP 2** Use common denominators to write equivalent ratios.

$$\frac{16 \times 3}{1 \times 3} = \frac{\square}{3} \quad 3 \text{ is a common denominator.}$$

$$\frac{48}{3} = \frac{\square}{3} \quad \text{Equivalent rates with the same denominators have the same numerators.}$$

$$\square = 48 \text{ ounces}$$

The weight is 48 ounces.

- B** A moderate amount of daily sodium consumption is 2,000 milligrams. What is this mass in grams?

Use a proportion to convert 2,000 milligrams to grams.

Use $\frac{1,000 \text{ mg}}{1 \text{ g}}$ to convert milligrams to grams.



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My Notes



- STEP 1** Write a proportion.

$$\frac{1,000 \text{ mg}}{1 \text{ g}} = \frac{2,000 \text{ mg}}{\square \text{ g}}$$

- STEP 2** Write equivalent ratios.

Think: You can multiply $1,000 \times 2 = 2,000$. So multiply the denominator by the same number.

$$\frac{1,000 \times 2}{1 \times 2} = \frac{2,000}{\square}$$

$$\frac{2,000}{2} = \frac{2,000}{\square}$$

Equivalent ratios with the same numerators have the same denominators.

$$\square = 2 \text{ grams}$$

The mass is 2 grams.

Math Talk

Mathematical Practices

How would you convert 3 liters to milliliters?

YOUR TURN

- Q 2.** The height of a doorway is 2 yards. What is the height of the doorway in inches? _____

Converting Units by Using Conversion Factors

Another way to convert measurements is by using a conversion factor.

A **conversion factor** is a ratio comparing two equivalent measurements.

EXAMPLE 2



COMMON CORE 6.RP.3d

Elena wants to buy 2 gallons of milk but can only find quart containers for sale. How many quarts does she need?

You are converting to quarts from gallons.

- STEP 1** Find the conversion factor.

Write 4 quarts = 1 gallon as a ratio: $\frac{4 \text{ quarts}}{1 \text{ gallon}}$

- STEP 2** Multiply the given measurement by the conversion factor.

$$2 \text{ gallons} \cdot \frac{4 \text{ quarts}}{1 \text{ gallon}} = \square \text{ quarts}$$

$$2 \text{ gallons} \cdot \frac{4 \text{ quarts}}{1 \text{ gallon}} = 8 \text{ quarts} \quad \text{Cancel the common unit.}$$

Elena needs 8 quarts of milk.



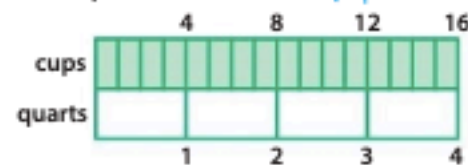


YOUR TURN

- Q** 3. An oak tree is planted when it is 250 centimeters tall. What is this height in meters? _____

Guided Practice

- Q** Use the model below to complete each statement. (Explore Activity 1)



1. $\frac{4}{1} = \frac{12}{3}$, so 12 cups = _____ quarts
2. $\frac{4}{1} = \frac{48}{12}$, so _____ cups = 12 quarts

- Q** Use ratios and proportions to solve. (Example 1)

3. Mary Catherine makes 2 gallons of punch for her party. How many cups of punch did she make?

4. An African elephant weighs 6 tons. What is the weight of the elephant in pounds?

5. The distance from Jason's house to school is 0.5 kilometer. What is this distance in meters?

6. The mass of a moon rock is 3.5 kilograms. What is the mass of the moon rock in grams?

- Q** Use a conversion factor to solve. (Example 2)

7. $1.75 \text{ grams} \cdot \frac{1,000 \text{ mg}}{1 \text{ g}} =$ _____
8. $27 \text{ millimeters} \cdot \frac{1 \text{ cm}}{10 \text{ mm}} =$ _____
9. A package weighs 96 ounces. What is the weight of the package in pounds?

10. A jet flies at an altitude of 52,800 feet. What is the height of the jet in miles?



ESSENTIAL QUESTION CHECK-IN

- Q** 11. How do you convert units within a measurement system?



Name _____ Class _____ Date _____

7.3 Independent Practice

COMMON CORE 6.RP.3d

- Q** 12. What is a conversion factor that you can use to convert gallons to pints? How did you find it?

13. Three friends each have some ribbon. Carol has 42 inches of ribbon, Tino has 2.5 feet of ribbon, and Baxter has 1.5 yards of ribbon. Express the total length of ribbon the three friends have in inches, feet and yards.

_____ inches = _____ feet = _____ yards

- Q** 14. Suzanna wants to measure a board, but she doesn't have a ruler to measure with. However, she does have several copies of a book that she knows is 17 centimeters tall.

- a. Suzanna lays the books end to end and finds that the board is the same length as 21 books. How many centimeters long is the board?

- b. Suzanna needs a board that is at least 3.5 meters long. Is the board long enough? Explain.

- Q** Sheldon needs to buy 8 gallons of ice cream for a family reunion. The table shows the prices for different sizes of two brands of ice cream.

	Price of small size	Price of large size
Cold Farms	\$2.50 for 1 pint	\$4.50 for 1 quart
Cone Dreams	\$4.25 for 1 quart	\$9.50 for 1 gallon

15. Which size container of Cold Farm ice cream is the better deal for Sheldon? Explain.

16. **Multistep** Which size and brand of ice cream is the best deal?



LESSON 7.4 Converting Between Measurement Systems

COMMON CORE 6.RP.3d

Use ratio reasoning to convert measurement units; manipulate and transform units appropriately when multiplying or dividing quantities. Also 6.RP.3, 6.RP.3b

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ESSENTIAL QUESTION

How can you use ratios and proportions to convert measurements?

EXPLORE ACTIVITY



COMMON CORE 6.RP.3d

Converting Inches to Centimeters

Measurements are used when determining the length, weight, or capacity of an object. The two most common systems of measurement are the *customary system* and the *metric system*.

The table shows equivalencies between the customary and metric systems. You can use these equivalencies to convert a measurement in one system to a measurement in the other system.

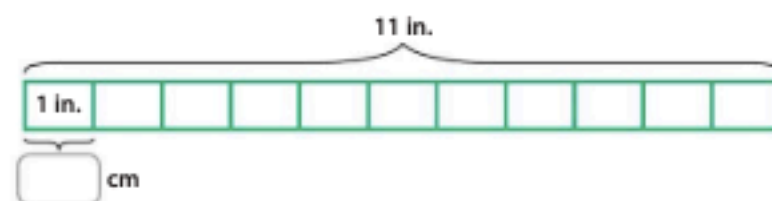
Length	Weight/Mass	Capacity
1 inch \approx 2.54 centimeters	1 ounce \approx 28.4 grams	1 fluid ounce \approx 29.6 milliliters
1 foot \approx 0.305 meter	1 pound \approx 0.454 kilogram	1 quart \approx 0.946 liter
1 yard \approx 0.914 meter		1 gallon \approx 3.79 liters
1 mile \approx 1.61 kilometers		

Most conversions are approximate, as indicated by the symbol \approx .

The length of a sheet of paper is 11 inches. What is this length in centimeters?

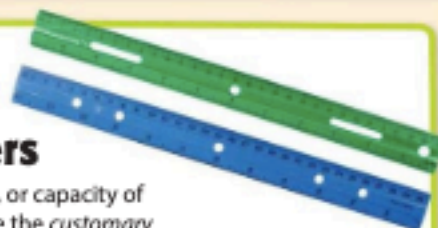
- A** You can use a bar diagram to solve this problem. Each part represents 1 inch.

1 inch = _____ centimeter(s)



- B** How does the diagram help you solve the problem?

- C** 11 inches = _____ centimeters



EXPLORE ACTIVITY (cont'd)

Reflect

1. **Communicate Mathematical Ideas** Suppose you wanted to use a diagram to convert ounces to grams. Which unit would the parts in your diagram represent?

Math On the Spot

Math On the Spot

Using Conversion Factors

Another way to convert measurements is by using a ratio called a *conversion factor*. A **conversion factor** is a ratio of two equivalent measurements. Since the two measurements in a conversion factor are equivalent, a conversion factor is equal to 1.

EXAMPLE 1



COMMON CORE 6.RP.3d

While lifting weights, John adds 11.35 kilograms to his bar. About how many pounds does he add to his bar?

- STEP 1** Find the conversion factor.

1 pound \approx 0.454 kilogram

Write the conversion factor as

a ratio: $\frac{1 \text{ pound}}{0.454 \text{ kilogram}}$



- STEP 2** Convert the given measurement.

kilograms \times $\frac{\text{conversion factor}}{\text{conversion factor}}$ = pounds

11.35 kilograms \times $\frac{1 \text{ pound}}{0.454 \text{ kilogram}}$ \approx 25 pounds

John adds about 25 pounds to his bar.



Online Assessment and Intervention

Interactive Example



Online Assessment and Intervention

Your Turn

YOUR TURN

2. 6 quarts \approx _____ liters 3. 14 feet \approx _____ meters
4. 255.6 grams \approx _____ ounces 5. 7 liters \approx _____ quarts

Using Proportions to Convert Measurements

You can also convert a measurement from one unit to another by using a proportion. First write the conversion factor as a ratio, then multiply by a form of 1 to generate an equivalent ratio. Recall that two equal ratios form a proportion.

Proportions: $\frac{3 \text{ inches}}{2 \text{ feet}} = \frac{6 \text{ inches}}{4 \text{ feet}} \quad \frac{5}{10} = \frac{1}{2}$

EXAMPLE 2



COMMON CORE 6.RP.3, 6.RP.3b, 6.RP.3d

Bob's driveway is 45 feet long by 18 feet wide. He plans to pave the entire driveway. The asphalt paving costs \$24 per square meter. What will be the total cost of the paving?



STEP 1 First find the dimensions of the driveway in meters. Convert each measurement to meters. Use 1 foot \approx 0.305 meter.

$$\begin{aligned} \frac{1 \text{ foot}}{0.305 \text{ meter}} &= \frac{45 \text{ feet}}{13.725 \text{ meters}} \\ \frac{1 \text{ foot}}{0.305 \text{ meter}} &= \frac{18 \text{ feet}}{5.49 \text{ meters}} \end{aligned}$$

Length \approx 13.725 meters

Width \approx 5.49 meters

The length and width are approximate because the conversion between feet and meters is approximate.

STEP 2 Find the area in square meters.

$$\begin{aligned} \text{Area} &= \text{length} \times \text{width} \\ &= 13.725 \times 5.49 \\ &= 75.35 \text{ square meters} \end{aligned}$$

STEP 3 Now find the total cost of the paving.

$$\begin{array}{rcl} \text{square meters} & \times & \text{cost per square meter} = \text{total cost} \\ 75.35 & \times & \$24 = \$1,808.40 \end{array}$$

Reflect

6. **Error Analysis** Yolanda found the area of Bob's driveway in square meters as shown. Explain why Yolanda's answer is incorrect.

$$\begin{aligned} \text{Area} &= 45 \times 18 = 810 \text{ square feet} \\ 810 \text{ square feet} &\times \frac{0.305 \text{ meter}}{1 \text{ foot}} \approx 247.1 \text{ square meters} \end{aligned}$$

My Notes



Math Talk

Mathematical Practices

How much does the paving cost per square foot? Explain.

YOUR TURN

7. A flower bed is 2 meters wide and 3 meters long. What is the area of the flower bed in square feet? Round your converted dimensions and your final answer to the nearest hundredth.

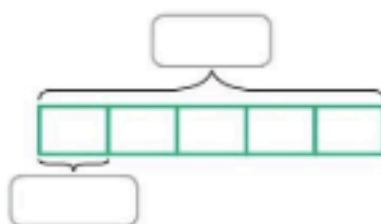
_____ square feet

Guided Practice

Q Complete each diagram to solve the problem. (Explore Activity)

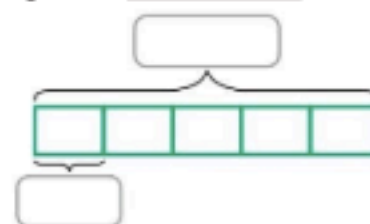
1. Kate ran 5 miles. How far did she run in kilometers?

5 miles = _____ kilometers



2. Alex filled a 5-gallon jug with water. How many liters of water are in the container?

5 gallons \approx _____ liters



Q Use a conversion factor to convert each measurement. (Example 1 and 2)

3. A ruler is 12 inches long. What is the length of this ruler in centimeters?
_____ centimeters
4. A kitten weighs 4 pounds. What is the approximate mass of the kitten in kilograms?
_____ kilograms

Q Use a proportion to convert each measurement. (Example 2)

5. 20 yards \approx _____ meters
7. 5 quarts \approx _____ liters
9. 10 liters \approx _____ gallons
11. 165 centimeters \approx _____ inches
6. 12 ounces \approx _____ grams
8. 400 meters \approx _____ yards
10. 137.25 meters \approx _____ feet
12. 10,000 kilometers \approx _____ miles



ESSENTIAL QUESTION CHECK-IN

- Q** 13. Write a proportion that you can use to convert 60 inches to centimeters.

7.4 Independent Practice

LEARN CORE 6.RP.3, 6.RP.3b, 6.RP.3d



Q Tell which measure is greater.

14. Six feet or two meters _____
15. One inch or one centimeter _____
16. One yard or one meter _____
17. One mile or one kilometer _____
18. One ounce or one gram _____
19. One quart or one liter _____
20. 10 pounds or 10 kilograms _____
21. Four liters or one gallon _____
22. Two miles or three kilometers _____
23. What is the limit in kilograms?



24. What is the speed limit in miles per hour?

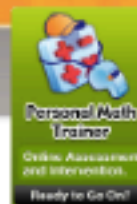


25. Which container holds more, a half-gallon milk jug or a 2-liter juice bottle? _____
26. The label on a can of lemonade gives the volume as 12 fl oz, or 355 mL. Verify that these two measurements are nearly equivalent. _____
27. The mass of a textbook is about 1.25 kilograms. About how many pounds is this? _____
28. **Critique Reasoning** Michael estimated his mass as 8 kilograms. Is his estimate reasonable? Justify your answer. _____
29. Your mother bought a three-liter bottle of water. When she got home, she discovered a small leak in the bottom and asked you to find a container to transfer the water into. All you could find were two half-gallon jugs.
 - a. Will your containers hold all of the water? _____

- b. **What if?** Suppose an entire liter of water leaked out in the car. In that case, would you be able to fit all of the remaining water into one of the half-gallon jugs? _____

MODULE QUIZ

Ready to Go On?



7.1 Ratios, Rates, Tables, and Graphs

1. Charlie runs laps around a track. The table shows how long it takes him to run different numbers of laps. How long would it take Charlie to run 5 laps?

Number of Laps	2	4	6	8	10
Time (min)	10	20	30	40	50

7.2 Solving Proportionality Problems

2. Emily is entering a bicycle race for charity. Her mother pledges \$0.40 for every 0.25 mile she bikes. If Emily bikes 15 miles, how much will her mother donate? _____
3. Rob is saving to buy a new MP3 player. For every \$15 he earns babysitting, he saves \$6. On Saturday, Rob earned \$75 babysitting. How much money did he save? _____

7.3 Within Measurement Systems

Convert each measurement.

4. 18 meters = _____ centimeters
5. 5 pounds = _____ ounces
6. 6 quarts = _____ fluid ounces
7. 9 liters = _____ milliliters

7.4 Converting Between Measurement Systems

Convert each measurement.

8. 5 inches = _____ centimeters
9. 198.9 grams \approx _____ ounces
10. 8 gallons \approx _____ liters
11. 12 feet \approx _____ meters



ESSENTIAL QUESTION

12. Write a real-world problem that could be solved using a proportion.



MODULE 7 MIXED REVIEW

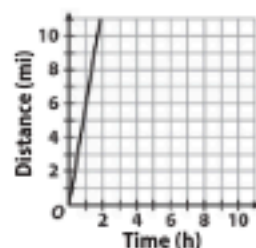
Assessment Readiness



Selected Response



1. The graph below represents the distance Manuel walks over several hours.



Which is an ordered pair on the line?

- (A) (2.5, 14) (C) (2.25, 12)
(B) (1.25, 5) (D) (1.5, 9)
2. Jonah's house and his grandparents' house are 8,046.72 meters apart. What is this distance in miles?
- (A) 4 miles (C) 7 miles
(B) 5 miles (D) 8 miles
3. Megan is making bracelets to sell to earn money for the local animal shelter. It takes her $\frac{1}{4}$ hour to pick out all the beads and $\frac{1}{10}$ hour to string them. This week, she only has $\frac{1}{2}$ hours to make bracelets. How many bracelets will Megan be able to make?
- (A) 10 bracelets (C) 15 bracelets
(B) 12 bracelets (D) 21 bracelets
4. Rosa can run 4 miles in 56 minutes. How many miles does Rosa run if she runs for 42 minutes?
- (A) 2 miles (C) 3.5 miles
(B) 3 miles (D) 5 miles

5. The table below shows the number of petals and leaves for different numbers of flowers.

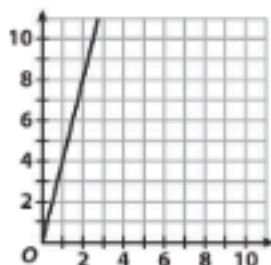
Petals	5	10	15	20
Leaves	2	4	6	8

How many petals are present when there are 12 leaves?

- (A) 25 petals (C) 35 petals
(B) 30 petals (D) 36 petals
6. A recipe calls for 3 cups of sugar and 9 cups of water. How many cups of water should be used with 2 cups of sugar?
- (A) 3 cups (C) 6 cups
(B) 4 cups (D) 8 cups

Mini-Task

7. The unlabeled graph shows the relationship between two customary units of measure. Only two pairs of units can be represented by the graph.



- a. Determine the possible pairs of units.
- _____
- _____
- b. Describe the relationship for each pair.
- _____
- _____

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Percents



ESSENTIAL QUESTION

How can you use percents to solve real-world problems?



Real-World Video

When you eat at a restaurant, your bill will include sales tax for most items. It is customary to add a tip for your server in many restaurants. Both taxes and tips are calculated as a percent of the bill.

MODULE

8

LESSON 8.1 Understanding Percent

COMMON CORE 6.RP.3c

LESSON 8.2 Percents, Fractions, and Decimals

COMMON CORE 6.RP.3

LESSON 8.3 Solving Percent Problems

COMMON CORE 6.RP.3, 6.RP.3c



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Are YOU Ready?

Complete these exercises to review skills you will need for this module.

Write Equivalent Fractions

EXAMPLE

$$\frac{9}{12} = \frac{9 \div 3}{12 \div 3} = \frac{3}{4}$$

Multiply the numerator and denominator by the same number to find an equivalent fraction.

Divide the numerator and denominator by the same number to find an equivalent fraction.



Personal Math Trainer
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Write the equivalent fraction.

1. $\frac{9}{18} = \frac{\square}{6}$

2. $\frac{4}{6} = \frac{\square}{18}$

3. $\frac{25}{30} = \frac{5}{\square}$

4. $\frac{12}{15} = \frac{36}{\square}$

5. $\frac{15}{24} = \frac{\square}{8}$

6. $\frac{24}{32} = \frac{\square}{8}$

7. $\frac{50}{60} = \frac{10}{\square}$

8. $\frac{5}{9} = \frac{20}{\square}$

Multiply Fractions

EXAMPLE

$$\frac{5}{12} \times \frac{3}{10} = \frac{\cancel{5}^1}{\cancel{12}_4} \times \frac{\cancel{3}_3}{\cancel{10}_2} = \frac{1}{8}$$

Divide by the common factors.

Simplify.

Multiply. Write each product in simplest form.

9. $\frac{3}{8} \times \frac{4}{11} =$

10. $\frac{8}{15} \times \frac{5}{6} =$

11. $\frac{7}{12} \times \frac{3}{14} =$

12. $\frac{9}{20} \times \frac{4}{5} =$

13. $\frac{7}{10} \times \frac{20}{21} =$

14. $\frac{8}{18} \times \frac{9}{20} =$

Decimal Operations (Multiplication)

EXAMPLE

$$\begin{array}{r} 1.6 \\ \times 0.3 \\ \hline 0.48 \end{array}$$

Multiply as you would with whole numbers.

Count the total number of decimal places in the factors.

Place the decimal point that number of places in the product.

Multiply.

15. 20×0.25

16. 0.3×16.99

17. 0.2×75

18. 5.5×1.1

19. 11.99×0.8

20. 7.25×0.5

21. 4×0.75

22. 0.15×12.50

23. 6.5×0.7

LESSON

8.1 Understanding Percent

COMMON CORE 6.RP.3c

Find a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means 30/100 times the quantity); ...



ESSENTIAL QUESTION

How can you write a ratio as a percent?

EXPLORE ACTIVITY 1



COMMON CORE 6.RP.3c

Using a Grid to Model Percents

A **percent** is a ratio that compares a number to 100. The symbol % is used to show a percent.

17% is equivalent to

$$\bullet \frac{17}{100}$$

$$\bullet 17 \text{ to } 100$$

$$\bullet 17:100$$



The free-throw ratios for three basketball players are shown.

Player 1: $\frac{17}{25}$

Player 2: $\frac{33}{50}$

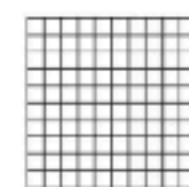
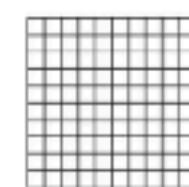
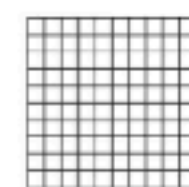
Player 3: $\frac{14}{20}$

A Rewrite each ratio as a number compared to 100. Then shade the grid to represent the free-throw ratio.

Player 1: $\frac{17}{25} = \frac{\square}{100}$

Player 2: $\frac{33}{50} = \frac{\square}{100}$

Player 3: $\frac{14}{20} = \frac{\square}{100}$



B Which player has the greatest free-throw ratio? _____

How is this shown on the grids? _____

C Use a percent to describe each player's free-throw ratio. Write the percents in order from least to greatest.

D How did you determine how many squares to shade on each grid?

EXPLORE ACTIVITY 2

COMMON CORE 6.RP.3c

Connecting Fractions and Percents

You can use a percent bar model to model a ratio expressed as a fraction and to find an equivalent percent.

- A** Use a percent bar model to find an equivalent percent for $\frac{1}{4}$.



Draw a model to represent 100 and divide it into fourths. Shade $\frac{1}{4}$.



$\frac{1}{4}$ of 100 = 25, so $\frac{1}{4}$ of 100% = _____

Tell which operation you can use to find $\frac{1}{4}$ of 100.

Then find $\frac{1}{4}$ of 100%. _____

- B** Use a percent bar model to find an equivalent percent for $\frac{1}{3}$.

Draw a model and divide it into thirds. Shade $\frac{1}{3}$.



$\frac{1}{3}$ of 100 = $33\frac{1}{3}$, so $\frac{1}{3}$ of 100% = _____ %

Tell which operation you can use to find $\frac{1}{3}$ of 100.

Then find $\frac{1}{3}$ of 100%. _____

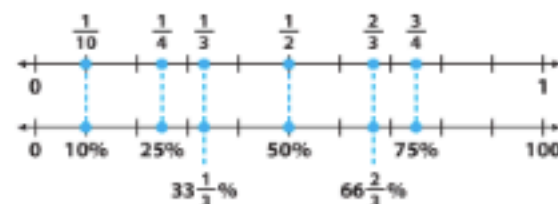
Reflect

1. **Critique Reasoning** Jo says she can find the percent equivalent of $\frac{2}{4}$ by multiplying the percent equivalent of $\frac{1}{4}$ by 3. How can you use a percent bar model to support this claim?

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Using Benchmarks and Proportional Reasoning

You can use certain *benchmark* percents to write other percents and to estimate fractions.



EXAMPLE 1



COMMON CORE 6.RP.3c

- A** Find an equivalent percent for $\frac{3}{10}$.

STEP 1 Write $\frac{3}{10}$ as a multiple of a benchmark fraction.

$$\frac{3}{10} = 3 \cdot \frac{1}{10} \quad \text{Think: } \frac{3}{10} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10}$$

STEP 2 Find an equivalent percent for $\frac{1}{10}$.

$$\frac{1}{10} = 10\% \quad \text{Use the number lines to find the equivalent percent for } \frac{1}{10}.$$

STEP 3 Multiply.

$$\frac{3}{10} = 3 \cdot \frac{1}{10} = 3 \cdot 10\% = 30\%$$

- B** 76% of the students at a middle school bring their own lunch. About what fraction of the students bring their own lunch?

STEP 1 Note that 76% is close to the benchmark 75%.

STEP 2 Find a fraction equivalent for 75%:

$$75\% = \frac{3}{4}$$

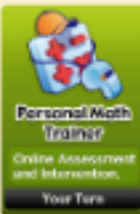
About $\frac{3}{4}$ of the students bring their own lunch.



Math Talk

Mathematical Practices

Explain how you could use equivalent ratios to write $\frac{3}{10}$ as a percent.



YOUR TURN

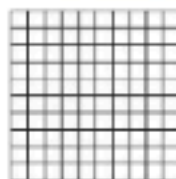
Q Use a benchmark to find an equivalent percent for each fraction.

2. $\frac{9}{10}$ _____ 3. $\frac{2}{5}$ _____
4. 64% of the animals at an animal shelter are dogs. About what fraction of the animals at the shelter are dogs?
- _____

Guided Practice

1. Shade the grid to represent the ratio $\frac{9}{25}$. Then find a percent equivalent to the given ratio. (Explore Activity 1)

$$\frac{9}{25} \times \frac{\square}{\square} = \frac{\square}{100} = \frac{\square}{\square}\%$$



2. Use the percent bar model to find the missing percent. (Explore Activity 2)



Q Identify a benchmark you can use to find an equivalent percent for each ratio. Then find the equivalent percent. (Example 1)

3. $\frac{6}{10}$ Benchmark: $\frac{1}{\square}$ 4. $\frac{2}{4}$ Benchmark: $\frac{\square}{4}$ 5. $\frac{4}{5}$ Benchmark: $\frac{\square}{5}$

6. 41% of the students at an art college want to be graphic designers. About what fraction of the students want to be graphic designers? (Example 1)
- _____

ESSENTIAL QUESTION CHECK-IN

7. How do you write a ratio as a percent?
- _____
- _____

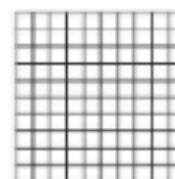
Name _____ Class _____ Date _____

8.1 Independent Practice

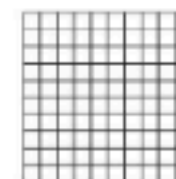
COMMON CORE 6.RP.3c

Q Shade the grid to represent the ratio. Then find the missing number.

8. $\frac{23}{50} = \frac{\square}{100}$



9. $\frac{11}{20} = \frac{\square}{100}$



10. Mark wants to use a grid like the ones in Exercises 1 and 2 to model the percent equivalent of the fraction $\frac{2}{3}$. How many grid squares should he shade? What percent would his model show?
- _____

11. The ratios of saves for a baseball pitcher to the number of save opportunities are given for three relief pitchers: $\frac{9}{10}$, $\frac{4}{5}$, $\frac{17}{20}$. Write each ratio as a percent. Order the percents from least to greatest.
- _____

Q Circle the greater quantity.

12. $\frac{1}{3}$ of a box of Corn Krinkles

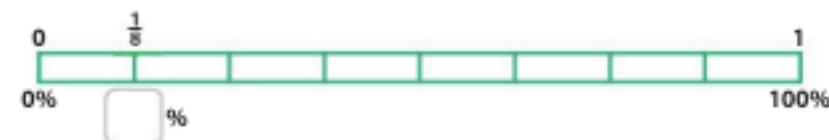
50% of a box of Corn Krinkles

13. 30% of your minutes are used up

$\frac{1}{4}$ of your minutes are used up

14. **Multiple Representations** Explain how you could write 35% as the sum of two benchmark percents or as a multiple of a percent.
- _____

15. Use the percent bar model to find the missing percent.



LESSON 8.2 Percents, Fractions, and Decimals

COMMON CORE 6.RP.3
Use ratio and rate reasoning to solve real-world and mathematical problems,...

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ESSENTIAL QUESTION

How can you write equivalent percents, fractions, and decimals?

EXPLORE ACTIVITY



COMMON CORE 6.RP.3

Writing Percents as Decimals and Fractions

You can write a percent as an equivalent fraction or as an equivalent decimal. Equivalent percents, decimals, and fractions all represent equal parts of the same whole.

EXAMPLE 1 Lorenzo spends 35% of his budget on rent for his apartment. Write this percent as a fraction and as a decimal.

STEP 1

Write the percent as a fraction in simplest form.

Percent means _____.

$$35\% = \frac{\boxed{}}{100}$$

Simplify the fraction.

$$\frac{35}{100} = \frac{7}{\boxed{}}$$

STEP 2

Write the percent as a decimal.

Write the decimal equivalent of $\frac{35}{100}$. $\frac{35}{100} = \underline{\hspace{2cm}}$

So, 35% written as a fraction in simplest form is $\frac{\boxed{}}{\boxed{}}$ and written as a decimal is _____.

YOUR TURN

Write each percent as a fraction and as a decimal.

- 15% _____
- 48% _____
- 80% _____
- 75% _____
- 36% _____
- 40% _____



EXPLORE ACTIVITY 2

COMMON CORE 6.RP.3

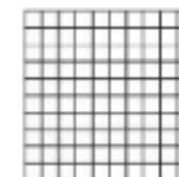
Modeling Decimal, Fraction, and Percent Equivalencies

Using models can help you understand how decimals, fractions, and percents are related.

A Model 0.78 by shading a 10-by-10 grid.

$$0.78 = \frac{\boxed{}}{100}$$

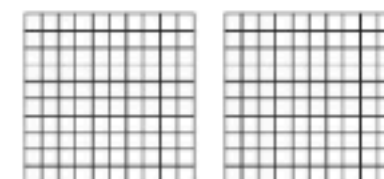
_____ out of a hundred, or _____ %.



B Model 1.42 by shading 10-by-10 grids.

$$1.42 = \frac{\boxed{}}{100} + \frac{\boxed{}}{100} = \frac{\boxed{}}{100} = 1 \frac{\boxed{}}{100}$$

$$1.42 = 100\% + \underline{\hspace{2cm}}\% = \underline{\hspace{2cm}}\%$$

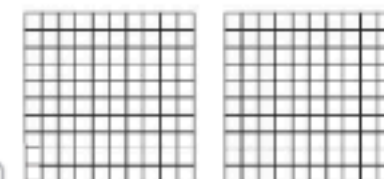


C Model 125% by shading 10-by-10 grids.

The model shows $100\% + \underline{\hspace{2cm}}\% = 125\%$.

$$125\% = \text{the decimal } \underline{\hspace{2cm}}$$

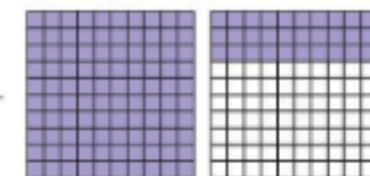
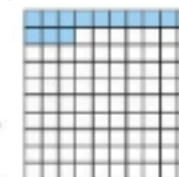
$$125\% = \frac{\boxed{}}{100} + \frac{\boxed{}}{100} = \frac{\boxed{}}{100} = 1 \frac{\boxed{}}{100} = 1 \frac{\boxed{}}{\boxed{}}$$



Reflect

7. Multiple Representations What decimal, fraction, and percent equivalencies are shown in each model? Explain.

- _____
- _____



Writing Fractions as Decimals and Percents

You can write some fractions as percents by writing an equivalent fraction with a denominator of 100. This method is useful when the fraction has a denominator that is a factor or a multiple of 100. If a fraction does not have a denominator that is a factor or multiple of 100, you can use long division.

EXAMPLE 2

COMMON CORE 6.RP.3

- A** 96 out of 200 animals treated by a veterinarian are horses. Write $\frac{96}{200}$ as a decimal and as a percent.

STEP 1 Write an equivalent fraction with a denominator of 100.

$$\frac{96}{200} = \frac{48}{100} \quad \text{Divide both the numerator and denominator by 2.}$$

STEP 2 Write the decimal equivalent.

$$\frac{48}{100} = 0.48$$

STEP 3 Write the percent equivalent.

$$\frac{48}{100} = 48\% \quad \text{Percent means per 100.}$$

Notice that the denominator is not a factor or multiple of 100.

- B** $\frac{1}{8}$ of the animals treated by the veterinarian are dogs. Write $\frac{1}{8}$ as a decimal and as a percent.

STEP 1 Use long division to divide the numerator by the denominator.

$$\begin{array}{r} 0.125 \\ 8 \overline{)1.000} \\ \underline{-8} \\ 20 \\ \underline{-16} \\ 40 \\ \underline{-40} \\ 0 \end{array} \quad \text{Add a decimal point and zeros to the right of the numerator as needed.}$$

The decimal equivalent of $\frac{1}{8}$ is 0.125.

STEP 2 Write the decimal as a percent.

$$0.125 = \frac{125}{1,000} \quad \text{Write the fraction equivalent of the decimal.}$$

$$\frac{125}{1,000} = \frac{12.5}{100} \quad \text{Write an equivalent fraction with a denominator of 100.}$$

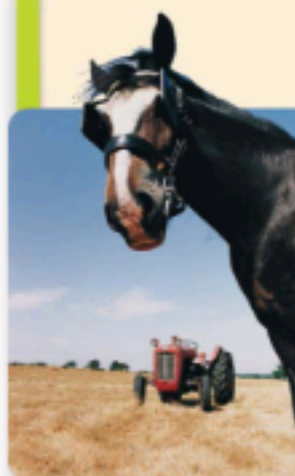
$$\frac{12.5}{100} = 12.5\% \quad \text{Write as a percent.}$$

The percent equivalent of $\frac{1}{8}$ is 12.5%.

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Notice that the denominator is a multiple of 100.



Lesson 8.2 211

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YOUR TURN

Q Write each fraction as a decimal and as a percent.

8. $\frac{9}{25}$ _____ 9. $\frac{7}{8}$ _____

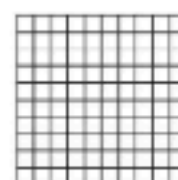
Guided Practice

1. Helene spends 12% of her budget on transportation expenses. Write this percent as a fraction and as a decimal. (Explore Activity Example 1)

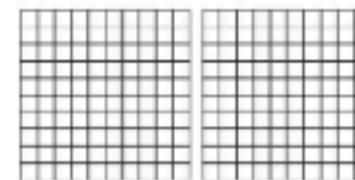
Q

Q Model the decimal. Then write percent and fraction equivalents. (Explore Activity 2)

2. 0.53



3. 1.07



Q Write each fraction as a decimal and as a percent. (Example 2)

4. $\frac{7}{20}$ of the packages _____ 5. $\frac{3}{8}$ of a pie _____



ESSENTIAL QUESTION CHECK-IN

6. How does the definition of *percent* help you write fraction and decimal equivalents?

Q

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Name _____ Class _____ Date _____

8.2 Independent Practice

COMMON CORE 6.RP.3



Write each percent as a fraction and as a decimal.

7. 72% full 8. 25% successes 9. 500% increase

10. 5% tax 11. 37% profit 12. 165% improvement



Write each fraction as a decimal and as a percent.

13. $\frac{5}{8}$ of an inch 14. $\frac{258}{300}$ of the contestants 15. $\frac{350}{100}$ of the revenue



16. The poster shows how many of its games the football team has won so far. Express this information as a fraction, a percent, and as a decimal.
17. Justine answered 68 questions correctly on an 80-question test. Express this amount as a fraction, percent, and decimal.

GO TEAM!
12 out of 15 wins!



Each diagram is made of smaller, identical pieces. Tell how many pieces you would shade to model the given percent.

18. 75% _____ 19. 25% _____



LESSON 8.3 Solving Percent Problems

COMMON CORE 6.RP.3c
Find a percent of a quantity ...; solve problems involving finding the whole, given a part and the percent. Also 6.RP.3



ESSENTIAL QUESTION

How do you use percents to solve problems?

EXPLORE ACTIVITY



COMMON CORE 6.RP.3

Modeling a Percent Problem

You can use a model to solve a percent problem.

A sports store received a shipment of 400 baseball gloves. 30% were left-handed. How many left-handed gloves were in the shipment?



- A** Use the diagram to solve this problem.

30% means 30 out of _____.

There were _____ left-handed gloves for every 100 baseball gloves.



Complete the diagram to model this situation.

- B** Describe how the diagram models the shipment of gloves.

- C** Explain how you can use the diagram to find the total number of left-handed gloves in the shipment.

D Use a bar model to solve this problem. The bar represents 100%, or the entire shipment of 400 gloves. The bar is divided into 10 equal parts. Complete the labels along the bottom of the bar.





EXPLORE ACTIVITY (cont'd)

Reflect

1. **Justify Reasoning** How did you determine the labels along the bottom of the bar model in Step D?

2. **Communicate Mathematical Ideas** How can you use the bar model to find the number of left-handed gloves?



Finding a Percent of a Number

A percent is equivalent to the ratio of a part to a whole. To find a percent of a number, you can write a ratio to represent the percent, and find an equivalent ratio that compares the part to the whole.

To find 30% of 400, you can use:

Proportional Reasoning

$$\frac{30}{100} = \frac{?}{400} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array}$$

$$= \frac{120}{400}$$

Multiplication

$$30\% \text{ of } 400 = \frac{30}{100} \text{ of } 400$$

$$= \frac{30}{100} \times 400$$

$$= 120$$

The word *of* indicates multiplication.



EXAMPLE 1

COMMON CORE 6.RP.3c

- A Use proportional reasoning to find 28% of 25.

STEP 1 Write a proportion comparing the percent to the ratio of part to whole.

$$\frac{?}{25} = \frac{28}{100} \quad \text{Notice that 25 is a factor of 100.}$$

STEP 2 Find the multiplication factor.

$$\begin{array}{l} \text{part} \rightarrow ? \\ \text{whole} \rightarrow 25 \end{array} = \frac{28}{100} \quad \text{Since } 25 \cdot 4 = 100, \text{ find what number times 4 equals 28.}$$

STEP 3 Find the numerator.

$$\frac{7}{25} = \frac{28}{100} \quad \text{Since } 4 \cdot 7 = 28, 28\% \text{ of } 25 = 7.$$

28% of 25 is 7.

Math Talk

Mathematical Practices

Could you also use the proportion $\frac{28}{100} = \frac{?}{25}$ to find 28% of 25? Explain.

- B Multiply by a fraction to find 35% of 60.

STEP 1 Write the percent as a fraction.

$$35\% \text{ of } 60 = \frac{35}{100} \text{ of } 60$$

STEP 2 Multiply.

$$\frac{35}{100} \text{ of } 60 = \frac{35}{100} \times 60$$

$$= \frac{2,100}{100}$$

$$= 21 \quad \text{Simplify.}$$

35% of 60 is 21.

- C Multiply by a decimal to find 5% of 180.

STEP 1 Write the percent as a decimal.

$$5\% = \frac{5}{100} = 0.05$$

STEP 2 Multiply.

$$180 \times 0.05 = 9$$

5% of 180 is 9.



Reflect

3. **Analyze Relationships** In **B**, the percent is 35%. What is the part and what is the whole?

4. **Communicate Mathematical Ideas** Explain how to use proportional reasoning to find 35% of 600.

YOUR TURN

Find the percent of each number.

5. 38% of 50 _____
6. 27% of 300 _____
7. 60% of 75 _____



Find a Percent Given a Part and a Whole

You can use proportional reasoning to solve problems in which you need to find a percent.

EXAMPLE 2



COMMON CORE 6.RP.3

The school principal spent \$2,000 to buy some new computer equipment. Of this money, \$120 was used to buy some new keyboards. What percent of the money was spent on keyboards?

STEP 1 Since you want to know the part of the money spent on keyboards, compare the part to the whole.

$$\begin{array}{l} \text{part} \rightarrow \$120 \\ \text{whole} \rightarrow \$2,000 \end{array}$$

STEP 2 Write a proportion comparing the percent to the ratio of part to whole.

$$\begin{array}{l} \text{part} \rightarrow ? \\ \text{whole} \rightarrow 100 \end{array} = \begin{array}{l} 120 \\ 2,000 \end{array} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array}$$

STEP 3 Find the multiplication factor.

$$\begin{array}{c} \times 20 \\ 100 = 2,000 \\ \times 20 \end{array} \quad \begin{array}{l} \text{Since } 100 \times 20 = 2,000, \text{ find what} \\ \text{number times } 20 \text{ equals } 120. \end{array}$$

STEP 4 Find the numerator.

$$\frac{6}{100} = \frac{120}{2,000} \quad \text{Since } 20 \times 6 = 120, \text{ the percent is } 6\%.$$

The principal spent 6% of the money on keyboards.

Reflect

- Q 8. Communicate Mathematical Ideas** Write 57% as a ratio. Which part of the ratio represents the part and which part represents the whole? Explain.

YOUR TURN

- Q 9.** Out of the 25 students in Mrs. Green's class, 19 have a pet. What percent of the students in Mrs. Green's class have a pet? _____

Finding a Whole Given a Part and a Percent

You can use proportional reasoning to solve problems in which you know a part and a percent and need to find the whole.

EXAMPLE 3



COMMON CORE 6.RP.3c

Twelve of the students in the school choir like to sing solos. These 12 students make up 24% of the choir. How many students are in the choir?

STEP 1 Since you want to know the total number of students in the choir, compare the part to the whole.

$$\begin{array}{l} \text{part} \rightarrow 12 \\ \text{whole} \rightarrow ? \end{array}$$

STEP 2 Write a proportion comparing the percent to the ratio of part to whole.

$$\begin{array}{l} \text{part} \rightarrow 12 \\ \text{whole} \rightarrow ? \end{array} = \frac{24}{100} \quad \begin{array}{l} \leftarrow \text{part} \\ \leftarrow \text{whole} \end{array} \quad \text{You know that 12 students represent 24\%.$$

STEP 3 Find the multiplication factor.

$$\frac{12}{?} = \frac{24}{100} \quad \text{Since } 12 \times 2 = 24, \text{ find what number times 2 equals } 100.$$

STEP 4 Find the denominator.

$$\frac{12}{50} = \frac{24}{100} \quad \text{Since } 50 \times 2 = 100, \text{ the denominator is } 50.$$

There are 50 students in the choir.

Reflect

- 10. Check for Reasonableness** In Example 3, 24% is close to 25%. How could you use this fact to check that 50 is a reasonable number for the total number of students in the choir?

YOUR TURN

- 11.** 6 is 30% of _____. **12.** 15% of ____ is 75.



Math Talk

Mathematical Practices

Suppose 10 more students join the choir. None of them are soloists. What percent are soloists now?



Guided Practice



1. A store has 300 televisions on order, and 80% are high definition. How many televisions on order are high definition? Use the bar model and complete the bottom of the bar. (Explore Activity)



2. Use proportional reasoning to find 65% of 200. (Example 1)

$$\begin{array}{l} \text{part} \rightarrow \frac{\boxed{}}{100} = \frac{?}{\boxed{}} \leftarrow \text{part} \\ \text{whole} \rightarrow \frac{\boxed{}}{100} = \frac{\boxed{}}{\boxed{}} \leftarrow \text{whole} \end{array}$$

65% of 200 is _____.

4. Alana spent \$21 of her \$300 paycheck on a gift. What percent of her paycheck was spent on the gift? (Example 2)

$$\begin{array}{l} \text{part} \rightarrow \frac{?}{\boxed{}} = \frac{\$ \boxed{}}{\$ \boxed{}} \leftarrow \text{part} \\ \text{whole} \rightarrow \frac{\boxed{}}{\boxed{}} = \frac{\$ \boxed{}}{\$ \boxed{}} \leftarrow \text{whole} \end{array}$$

Alana spent _____ of her paycheck on the gift.

3. Use multiplication to find 5% of 180. (Example 1)

$$\begin{array}{l} \frac{5}{100} \text{ of } 180 = \frac{5}{100} \boxed{} 180 \\ = \frac{\boxed{}}{100} = \boxed{} \end{array}$$

5% of 180 is _____.

5. At Pizza Pi, 9% of the pizzas made last week had extra cheese. If 27 pizzas had extra cheese, how many pizzas in all were made last week? (Example 3)

$$\begin{array}{l} \text{part} \rightarrow \frac{\boxed{}}{100} = \frac{27}{?} \leftarrow \text{part} \\ \text{whole} \rightarrow \frac{\boxed{}}{100} = \frac{?}{?} \leftarrow \text{whole} \end{array}$$

There were _____ pizzas made last week.



ESSENTIAL QUESTION CHECK-IN



6. How can you use proportional reasoning to solve problems involving percent?

Name _____ Class _____ Date _____

8.3 Independent Practice

COMMON CORE 6.RP.3, 6.RP.3c



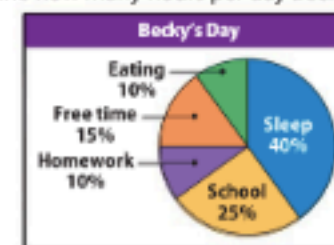
Find the percent of each number.

- | | | |
|-----------------------|------------------------|---------------------|
| 7. 64% of 75 tiles | 8. 20% of 70 plants | 9. 32% of 25 pages |
| _____ | _____ | _____ |
| 10. 85% of 40 e-mails | 11. 72% of 350 friends | 12. 5% of 220 files |
| _____ | _____ | _____ |



Complete each sentence.

- | | |
|---|--|
| 13. 4 students is _____ % of 20 students. | 14. 2 doctors is _____ % of 25 doctors. |
| 15. _____ % of 50 shirts is 35 shirts. | 16. _____ % of 200 miles is 150 miles. |
| 17. 4% of _____ days is 56 days. | 18. 60 minutes is 20% of _____ minutes. |
| 19. 80% of _____ games is 32 games. | 20. 360 kilometers is 24% of _____ kilometers. |
| 21. 75% of _____ peaches is 15 peaches. | 22. 9 stores is 3% of _____ stores. |
23. At a shelter, 15% of the dogs are puppies. There are 60 dogs at the shelter.
How many are puppies? _____ puppies
24. Carl has 200 songs on his MP3 player. Of these songs, 24 are country songs. What percent of Carl's songs are country songs?
25. **Consumer Math** The sales tax in the town where Amanda lives is 7%. Amanda paid \$35 in sales tax on a new stereo. What was the price of the stereo? _____
26. **Financial Literacy** Ashton is saving money to buy a new bike. He needs \$120 but has only saved 60% so far. How much more money does Ashton need to buy the scooter? _____
27. **Consumer Math** Monica paid sales tax of \$1.50 when she bought a new bike helmet. If the sales tax rate was 5%, how much did the store charge for the helmet before tax? _____
28. Use the circle graph to determine how many hours per day Becky spends on each activity.



School: _____ hours
 Eating: _____ hours
 Sleep: _____ hours
 Homework: _____ hours
 Free time: _____ hours

MODULE QUIZ

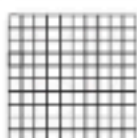
Ready to Go On?

8.1 Understanding Percent

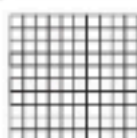
Shade the grid and write the equivalent percent for each fraction.



1. $\frac{19}{50}$ _____



2. $\frac{13}{20}$ _____



8.2 Percents, Fractions, and Decimals

Write each number in two equivalent forms.



3. $\frac{3}{4}$ _____

4. 62.5% _____



5. 0.24 _____

6. $\frac{31}{50}$ _____

7. Selma spent $\frac{7}{10}$ of her allowance on a new backpack. What percent of her allowance did she spend? _____

8.3 Solving Percent Problems

Complete each sentence.



8. 12 is 30% of _____.

9. 45% of 20 is _____.

10. 18 is _____ % of 30.

11. 56 is 80% of _____.



12. A pack of cinnamon-scented pencils sells for \$4.00. What is the sales tax rate if the total cost of the pencils is \$4.32? _____



ESSENTIAL QUESTION



13. How can you solve problems involving percents?



MODULE 8 MIXED REVIEW

Assessment Readiness

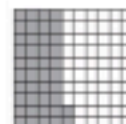


Personal Math Trainer
Online Assessment and Intervention
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Selected Response

1. What percent does this shaded grid represent?



- (A) 42%
- (B) 48%
- (C) 52%
- (D) 58%

2. Which expression is **not** equal to one fourth of 52?

- (A) $0.25 \cdot 52$
- (B) 4% of 52
- (C) $52 \div 4$
- (D) $\frac{52}{4}$

3. Approximately $\frac{4}{5}$ of U.S. homeowners have a cell phone. What percent of homeowners do **not** have a cell phone?

- (A) 20%
- (B) 45%
- (C) 55%
- (D) 80%

4. The ratio of rock music to total CDs that Ella owns is $\frac{25}{40}$. Paolo has 50 rock music CDs. The ratio of rock music to total CDs in his collection is equivalent to the ratio of rock music to total CDs in Ella's collection. How many CDs do they own?

- (A) 65
- (B) 80
- (C) 120
- (D) 130

5. Gabriel saves 40% of his monthly paycheck for college. He earned \$270 last month. How much money did Gabriel save for college?

- (A) \$96
- (B) \$108
- (C) \$162
- (D) \$180

6. Forty children from an after-school club went to the matinee. This is 25% of the children in the club. How many children are in the club?

- (A) 10
- (B) 160
- (C) 200
- (D) 900

7. Dominic answered 43 of the 50 questions on his spelling test correctly. Which decimal represents the fraction of problems he answered incorrectly?

- (A) 0.07
- (B) 0.14
- (C) 0.86
- (D) 0.93

Mini-Task



8. Jen bought some sesame bagels and some plain bagels. The ratio of the number of sesame bagels to the number of plain bagels is 1 : 3.

a. What fraction of the bagels are plain?

b. What percent of the bagels are plain?

c. If Jill bought 2 dozen bagels, how many of each type of bagel did she buy?

Study Guide Review

MODULE 6

Representing Ratios and Rates



ESSENTIAL QUESTION

How can you use ratios and rates to solve real-world problems?

EXAMPLE 1

Tina pays \$45.50 for 13 boxes of wheat crackers. What is the unit price?

$$\frac{\$45.50}{13 \text{ boxes}} = \frac{\$3.50}{1 \text{ box}}$$

The unit price is \$3.50 per box of crackers.

EXAMPLE 2

A trail mix recipe calls for 3 cups of raisins and 4 cups of peanuts. Mitt made trail mix for a party and used 5 cups of raisins and 6 cups of peanuts. Did Mitt use the correct ratio of raisins to peanuts?

$$\frac{3 \text{ cups of raisins}}{4 \text{ cups of peanuts}}$$

The ratio of raisins to peanuts in the recipe is $\frac{3}{4}$.

$$\frac{5 \text{ cups of raisins}}{6 \text{ cups of peanuts}}$$

Mitt used a ratio of $\frac{5}{6}$.

$$\frac{3}{4} \times \frac{3}{3} = \frac{9}{12} \quad \frac{5}{6} \times \frac{2}{2} = \frac{10}{12} \quad \frac{9}{12} < \frac{10}{12}$$

Mitt used a higher ratio of raisins to peanuts in his trail mix.

EXERCISES

Write three equivalent ratios for each ratio. (Lesson 7.1)

1. $\frac{18}{6}$ _____ 2. $\frac{5}{45}$ _____ 3. $\frac{1}{1000}$ _____

4. To make a dark orange color, Ron mixes 3 ounces of red paint with 2 ounces of yellow paint. Write the ratio of red paint to yellow paint three ways. (Lesson 7.1) _____

5. A box of a dozen fruit tarts costs \$15.00. What is the cost of one fruit tart? (Lesson 7.2) _____

Compare the ratios. (Lesson 7.3)

6. $\frac{2}{5}$ ○ $\frac{3}{4}$ 7. $\frac{9}{2}$ ○ $\frac{10}{7}$ 8. $\frac{2}{11}$ ○ $\frac{3}{12}$ 9. $\frac{6}{7}$ ○ $\frac{8}{9}$

Key Vocabulary

equivalent ratios (*razones equivalentes*)

rate (*tasa*)

ratio (*razón*)

unit rate (*tasa unitaria*)

MODULE 7

Applying Ratios and Rates



ESSENTIAL QUESTION

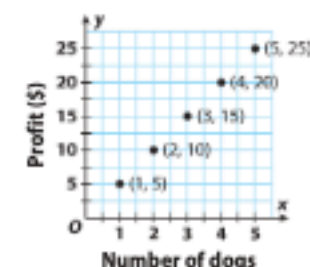
How can you use ratios and rates to solve real-world problems?

EXAMPLE 1

A. Jessica earns \$5 for each dog she walks. Complete the table, describe the rule, and tell whether the relationship is additive or multiplicative. Then graph the ordered pairs on a coordinate plane.

Number of dogs	1	2	3	4	5
Profit (\$)	5	10	15	20	25

Jessica's profit is the number of dogs walked multiplied by \$5. The relationship is multiplicative.



B. A veterinarian tells Lee that his dog should have a 35 centimeter collar. What is this measurement in inches?

Use the conversion factor 1 inch = 2.54 centimeters, written as the rate $\frac{1 \text{ in.}}{2.54 \text{ cm}}$.

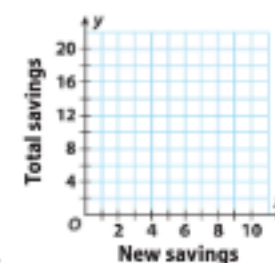
$$35 \text{ cm} \cdot \frac{1 \text{ in.}}{2.54 \text{ cm}} \approx 13.78$$

The collar should be about 14 inches.

EXERCISES

1. Thaddeus already has \$5 saved. He wants to save more to buy a book. Complete the table, and graph the ordered pairs on the coordinate graph. (Lessons 8.1, 8.2)

New savings	4	6	8	10
Total savings	9			



2. There are 2 hydrogen atoms and 1 oxygen atom in a water molecule. Complete the table, and list the equivalent ratios shown on the table. (Lessons 8.1, 8.2)

Hydrogen atoms	8		16	20
Oxygen atoms		6		

3. Sam can solve 30 multiplication problems in 2 minutes. How many can he solve in 20 minutes? (Lesson 8.3)

4. A male Chihuahua weighs 5 pounds. How many ounces does he weigh? (Lesson 8.4)

MODULE 8 Percents

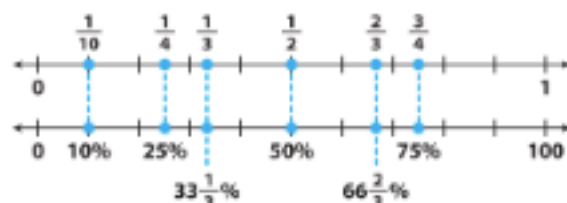


ESSENTIAL QUESTION

How can you use percents to solve real-world problems?

EXAMPLE 1

Find an equivalent percent for $\frac{7}{10}$.



$$\frac{7}{10} = 7 \cdot \frac{1}{10}$$

$$\frac{7}{10} = 7 \cdot 10\%$$

$$\frac{7}{10} = 70\%$$

Find an equivalent percent for $\frac{1}{5}$.



$$\frac{1}{5} \text{ of } 100 = 20, \text{ so } \frac{1}{5} \text{ of } 100\% = 20\%$$

$$\frac{1}{5} = 20\%$$

EXAMPLE 2

Thirteen of the 50 states in the United States do not touch the

ite $\frac{13}{50}$ as a decimal and a percent.

$$\frac{13}{50} = \frac{26}{100} = 0.26 \quad 0.26 = 26\% \quad \frac{13}{50} = 0.26 = 26\%$$

EXAMPLE 3

Buckner put \$60 of his \$400 paycheck into his savings account. Find the percent of his paycheck that Buckner saved.

$$\frac{60}{400} = \frac{?}{100} \quad \frac{60 \div 4}{400 \div 4} = \frac{15}{100} \quad \text{Buckner saved 15\% of his paycheck.}$$

EXERCISES

Write each fraction as a decimal and a percent. (Lessons 9.1, 9.2)

1. $\frac{3}{4}$ _____ 2. $\frac{7}{20}$ _____ 3. $\frac{8}{5}$ _____

Complete each statement. (Lessons 9.1, 9.2)

4. 25% of 200 is _____. 5. 16 is _____ of 20. 6. 21 is 70% of _____.

7. 42 of the 150 employees at Carlo's Car Repair wear contact lenses. What percent of the employees wear

contact lenses? (Lesson 9.3) _____

8. Last week at Best Bargain, 75% of the computers sold were laptops. If 340 computers were sold last week,

how many were laptops? (Lesson 9.3) _____

Unit 3 Performance Tasks

1. **CAREERS IN MATH** **Residential Builder** Kaylee, a residential builder, is working on a paint budget for a custom-designed home she is building. A gallon of paint costs \$38.50, and its label says it covers about 350 square feet.

- a. Explain how to calculate the cost of paint per square foot. Find this value. Show your work.

- b. Kaylee measured the room she wants to paint and calculated a total area of 825 square feet. If the paint is only available in one-gallon cans, how many cans of paint should she buy? Justify your answer.

2. Davette wants to buy flannel sheets. She reads that a weight of at least 190 grams per square meter is considered high quality.

- a. Davette finds a sheet that has a weight of 920 grams for 5 square meters. Does this sheet satisfy the requirement for high-quality sheets? If not, what should the weight be for 5 square meters? Explain.

- b. Davette finds 3 more options for flannel sheets:

Option 1: 1,100 g of flannel in 6 square meters, \$45

Option 2: 1,260 g of flannel in 6.6 square meters, \$42

Option 3: 1,300 g of flannel in 6.5 square meters, \$52

She would like to buy the sheet that meets her requirements for high quality and has the lowest price per square meter. Which option should she buy? Justify your answer.



UNIT 3 MIXED REVIEW Assessment Readiness



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Selected Response

- Q** 1. The deepest part of a swimming pool is 12 feet deep. The shallowest part of the pool is 3 feet deep. What is the ratio of the depth of the deepest part of the pool to the depth of the shallowest part of the pool?

(A) 4:1
(B) 12:15
(C) 1:4
(D) 15:12

2. How many centimeters are in 15 meters?

(A) 0.15 centimeters
(B) 1.5 centimeters
(C) 150 centimeters
(D) 1,500 centimeters

3. Barbara can walk 3,200 meters in 24 minutes. How far can she walk in 3 minutes?

(A) 320 meters
(B) 400 meters
(C) 640 meters
(D) 720 meters

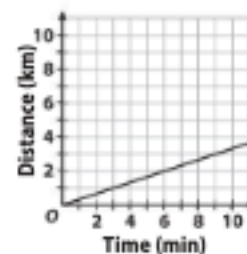
4. The table below shows the number of windows and panes of glass in the windows.

Windows	2	3	4	5
Panes	12	18	24	30

Which represents the number of panes?

(A) windows \times 5
(B) windows \times 6
(C) windows $+$ 10
(D) windows $+$ 15

5. The graph below represents Donovan's speed while riding his bike.



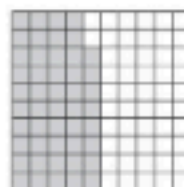
Which would be an ordered pair on the line?

(A) (1, 3)
(B) (2, 2)
(C) (6, 4)
(D) (9, 3)



Read the graph or diagram as closely as you read the actual test question. These visual aids contain important information.

6. Which percent does this shaded grid represent?



(A) 42%
(B) 48%
(C) 52%
(D) 58%

- Q** 7. Ivan saves 20% of his monthly paycheck for music equipment. He earned \$335 last month. How much money did Ivan save for music equipment?

(A) \$65
(B) \$67
(C) \$70
(D) \$75

8. How many 0.6-liter glasses can you fill up with a 4.5-liter pitcher?

(A) 1.33 glasses
(B) 3.9 glasses
(C) 7.3 glasses
(D) 7.5 glasses

9. Which shows the integers in order from greatest to least?

(A) 22, 8, 7, 2, -11
(B) 2, 7, 8, -11, 22
(C) -11, 2, 7, 8, 22
(D) 22, -11, 8, 7, 2

10. How do you convert 15 feet to centimeters?

(A) Multiply 15 ft by $\frac{1 \text{ ft}}{12 \text{ in.}}$ and $\frac{2.54 \text{ cm}}{1 \text{ in.}}$
(B) Multiply 15 ft by $\frac{1 \text{ ft}}{12 \text{ in.}}$ and $\frac{1 \text{ in.}}{2.54 \text{ cm}}$
(C) Multiply 15 ft by $\frac{12 \text{ in.}}{1 \text{ ft}}$ and $\frac{2.54 \text{ cm}}{1 \text{ in.}}$
(D) Multiply 15 ft by $\frac{12 \text{ in.}}{1 \text{ ft}}$ and $\frac{1 \text{ cm}}{2.54 \text{ in.}}$

Mini Task

- Q** 11. Claire and Malia are training for a race.
a. Claire runs 10 km in 1 hour. How many kilometers does she run in half an hour? in $2\frac{1}{2}$ hours?

- b. Malia runs 5 miles in 1 hour. How many miles does she run in half an hour? in $2\frac{1}{2}$ hours?

- c. On Tuesday, Claire and Malia both ran for $2\frac{1}{2}$ hours. Who ran the farther distance?

12. A department store is having a sale.

- Q** a. Malcolm bought 6 bowls for \$13.20. What is the unit rate?

- b. The store is having a promotion. For every 8 glasses you buy, you get 3 free plates. Malcolm got 9 free plates. How many glasses did he buy?

- c. The unit rate of the glasses was \$1.80 per glass. How much did Malcolm spend on glasses?

13. A recipe calls for 6 cups of water and 4 cups of flour.

- Q** a. What is the ratio of water to flour?

- b. If the recipe is increased to use 6 cups of flour, how much water should be used?

- c. If the recipe is decreased to use 2 cups of water, how much flour should be used?