

Vocabulary Start-Up



Use your glossary, which starts on page GL1, to complete the definitions of the vocabulary words in the table.

Definition	Examples
fraction: A number that represents part of a whole or part of a set .	$\frac{1}{2}$, $\frac{3}{4}$, $\frac{9}{12}$, $\frac{45}{3}$
ratio: A comparison of two quantities by division .	2 out of 3, 2 to 3, 2:3, $\frac{2}{3}$
rate: A ratio comparing two quantities with different kinds of units .	$\frac{36 \text{ miles}}{3 \text{ hours}}$ 36 miles for every 3 hours \$26 for 5 bags 19 songs in 5 minutes
unit rate: A rate that is simplified so that it has a denominator of 1 .	$\frac{12 \text{ miles}}{1 \text{ hour}}$, 12 miles per hour \$5.20 for 1 bag 3.8 songs in 1 minute



Essential Question

HOW do you use equivalent rates in the real world?



Vocabulary

rate
unit rate
unit price



Common Core State Standards

Content Standards
6.RP.2, 6.RP.3, 6.RP.3b

MP Mathematical Practices
1, 3, 4

$$\frac{26}{5} \div 5 = \frac{5.20}{1}$$



simplified so that it has a denominator of **1**.

1 hour
\$5.20 for 1 bag
3.8 songs in 1 minute

$\frac{1}{5}$



Real-World Link

Desiree typed a 15-character text message in 5 seconds.

- Write the rate Desiree typed as a fraction. $\frac{15 \text{ characters}}{5 \text{ seconds}}$
- What operation would you use to write the fraction in simplest form? **division**

Which **MP** **Mathematical Practices** did you use?
Shade the circle(s) that applies.

- | | |
|--|---|
| <input type="checkbox"/> 1 Persevere with Problems | <input type="checkbox"/> 5 Use Math Tools |
| <input type="checkbox"/> 2 Reason Abstractly | <input type="checkbox"/> 6 Attend to Precision |
| <input type="checkbox"/> 3 Construct an Argument | <input type="checkbox"/> 7 Make Use of Structure |
| <input type="checkbox"/> 4 Model with Mathematics | <input type="checkbox"/> 8 Use Repeated Reasoning |



The least common factor of 3 and 5 is 1. To find the unit rate of the ratio $\frac{3 \text{ miles}}{5 \text{ minutes}}$, divide both the numerator and denominator by 5. So, the unit rate in fraction form is $\frac{3}{5}$ mile per minute.

Show your work.

- a. 7 songs per minute
- b. Jonathan used $\frac{3}{4}$ cup of water per cup of flour.

How far can the dragonfly travel in 1 minute?

Write the rate as a fraction. Compare the distance to the number of minutes. Then divide.

$$\frac{18 \text{ miles}}{30 \text{ minutes}} = \frac{3 \text{ miles}}{5 \text{ minutes}}$$

(Note: Blue arrows indicate dividing both numerator and denominator by 6.)

The ratio 3 to 5 cannot be simplified to a whole number rate. It can be written as $\frac{3 \text{ miles}}{5 \text{ minutes}}$ or as a unit rate of $\frac{3}{5}$ mile to 1 minute.

Handwritten: $\frac{35}{5}$

The dragonfly can travel $\frac{3}{5}$ mile every minute.

Got it? Do these problems to find out.

- a. Ama downloaded 35 songs in 5 minutes. How many songs did she download per minute?
- b. Jonathan is baking several loaves of bread to sell in his bakery. He used 9 cups of water and 12 cups of whole wheat flour. How much water was used per cup of flour?

Handwritten: $\frac{9}{12} = \frac{3}{4}$



Star

Glossary

Index

Answers: On Off



than an adult's heart?

- Step 1** Find the unit rates.
Adult: $\frac{2,100 \text{ beats}}{30 \text{ minutes}}$ or $\frac{70 \text{ beats}}{1 \text{ minute}}$
Baby: $\frac{2,600 \text{ beats}}{20 \text{ minutes}}$ or $\frac{130 \text{ beats}}{1 \text{ minute}}$

- Step 2** Using the unit rate for each, determine the number of beats in 60 minutes.
Adult: $70 \times 60 = 4,200$ beats
Baby: $130 \times 60 = 7,800$ beats

- Step 3** Find the difference.
 $7,800 - 4,200 = 3,600$

So, a baby's heart beats 3,600 more times in 60 minutes than an adult's heart.

Got it? Do this problem to find out.

- c. A hummingbird's heart rate while resting is about 7,500 beats every 30 minutes. How many more beats does a hummingbird's heart beat in 60 minutes than a human baby's heart?

Key Phrases
Key phrases such as *per*, *in*, and *for every* are often used to describe unit rates.

hummingbird

Baby's

Handwritten work showing calculations for the hummingbird problem. It includes a multiplication problem: $2600 \times 3 = 7800$ and a subtraction problem: $7500 - 15000 = -7500$. There are some corrections and scribbles in the work.

Show your work.

Handwritten work showing a subtraction problem: $15000 - 7800 = 7200$. The result 7200 is circled in blue and labeled "7,200 more beats".

So, the price per potted plant is \$22.00.

Guided Practice

Write each rate as a **unit rate** (Examples 1 and 2)

1. 44 points in 4 quarters = $\frac{11 \text{ points}}{1 \text{ quarter}}$

Show your work. $\frac{44 \div 4}{4 \div 4} = \frac{11}{1}$

3. 360 miles traveled on 12 gallons of gasoline = $\frac{30 \text{ miles per}}{\text{gallon}}$

$\frac{360 \div 12}{12 \div 12} = \frac{30}{1}$

5. Molly shot 20 baskets in 4 minutes. Nico shot 42 baskets in 6 minutes. How many more baskets did Nico shoot per minute? (Example 3) $\frac{2 \text{ baskets per minute}}$

6. For Carolina's birthday, her mom took her and 4 friends to a water park. Carolina's mom paid \$40 for 5 student

2. 125 feet in 5 seconds = $\frac{25 \text{ feet}}{1 \text{ second}}$

$\frac{125 \div 5}{5 \div 5} = \frac{25}{1}$

4. 12 meters in 28 seconds =

$\frac{12 \div 4}{28 \div 4} = \frac{3}{7}$

$\frac{20 \div 4}{4 \div 4} = \frac{5}{1}$

Rate Yourself


$$\frac{30}{12} = \frac{5}{2}$$
$$\frac{30}{12} \div \frac{12}{12} = \frac{30}{1}$$

$$\frac{20}{4} = \frac{5}{1}$$

$$\frac{20}{4} = \frac{5}{1}$$

5. Molly shot 20 baskets in 4 minutes. Nico shot 42 baskets in 6 minutes. How many more baskets did Nico shoot per minute? (Example 3) 2 baskets per minute

6. For Carolina's birthday, her mom took her and 4 friends to a water park. Carolina's mom paid \$40 for 5 student tickets. What was the price for one student ticket? (Example 4)
\$8

7.  **Building on the Essential Question** How are rates and ratios related? Sample answer: A rate is a ratio that compares two quantities with different kinds of units, such as miles per hour.

Rate Yourself

I understand how to find a unit rate.

 Great! You're ready for more.

I still have questions.

 No Problem! Click here to access a Personalized Learning Plan.



Independent Practice

Go online for Step-by-Step Solutions

eHelp



Write each rate as a unit rate. (Examples 1 and 2)

1. 72 ounces in 6 steaks = $\frac{12 \text{ oz}}{1 \text{ steak}}$



3 Marcella divided 40.8 gallons of paint among 8 containers. How much paint is in each container? (Example 1) $\frac{5.1 \text{ gal}}{1 \text{ container}}$

5. The results of a car race are shown. Determine who drove the fastest. Explain.

(Example 3) $\frac{35}{84}$, $\frac{42}{96.6}$, $\frac{38}{102.6}$
 Divide the time by the number of laps.
 Evans drove the fastest at 2.3 minutes per lap.

2. 162 water bottles in 9 cases = $\frac{18 \text{ water bottles}}{\text{per case}}$

4. Central Subs made 27 sandwiches using 12 pounds of turkey. How much turkey was used per sandwich? (Example 2)
 They used $\frac{4}{9}$ pound of turkey per sandwich.

Drivers' Times		
Driver	Laps	Time (min)
Cutwright	35	84
Evans	42	96.6
Loza	38	102.6



6. Theo's mom bought an eight-pack of juice boxes at the store for \$4. Find the unit rate for the juice boxes. (Example 4) \$0.50 for 1 juice box

7. Joshua's cousin pledged \$12 for a charity walk. If Joshua walked 3 miles, how much did his cousin pay per mile? (Example 4)
\$4 per mile

8. **MP Justify Conclusions** The Lovin' Lemon Company sells a 4-gallon jug of lemonade for \$24. The Sweet and Sour Company sells an eight-pack of 1-quart bottles of lemonade for \$16.00. Which company has a higher unit price? Explain your answer. Sweet and Sour Company; Sample answer: The Sweet and Sour Company's unit price is \$2 per quart compared to \$1.50 at the Lovin' Lemon Company.

9 The Shanghai Maglev Train is one of the fastest trains in the world, traveling about 2,144 miles in 8 hours.

a. How many miles does it travel in one hour? 268 miles

b. The distance between Columbus, Ohio, and New York City is about 560 miles. How many hours would it take the train to travel between the cities? about 2 h



10. **MP Multiple Representations** The table shows the approximate population and areas of five states. *Population density* is the number of people per square unit of an area.

- a. **Numbers** Find the population density of each state. Round to the nearest tenth.

California: 223.0 people/sq mi; Florida:

278.3 people/sq mi; Iowa: 53.1 people/sq mi;

New Jersey: 996.3 people/sq mi;

Wyoming: 5.3 people/sq mi

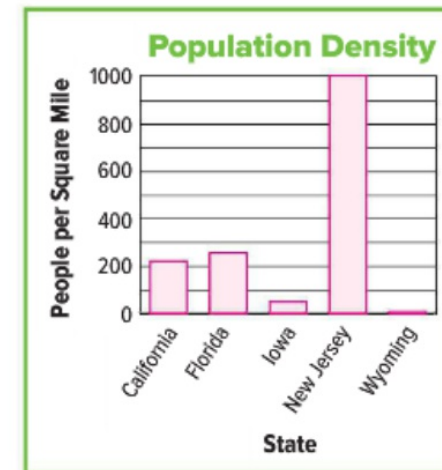
- b. **Graph** Make a bar graph of the five population densities.

- c. **Words** Connecticut has about the same population as Iowa, but its area is 4,875 square miles. Without calculating, compare Connecticut's population density to Iowa's. Justify your answer.

Sample answer: Connecticut has a higher population

density because approximately the same number of people are distributed among a smaller space.

State	Population Estimate (as of July 2007)	Area (square miles)
California	36,500,000	163,707
Florida	18,300,000	65,758
Iowa	2,990,000	56,276
New Jersey	8,690,000	8,722
Wyoming	522,000	97,818






H.O.T. Problems Higher Order Thinking

11. **MP Find the Error** Julie wrote the rate \$108 in 6 weeks as a unit rate. Find her mistake and correct it.

A unit rate has a denominator of 1.

$$\frac{\$108}{6 \text{ weeks}} = \frac{\$18}{1 \text{ week}}$$



$$\frac{\$108}{6 \text{ weeks}} = \frac{\$54}{3 \text{ weeks}}$$

12. **MP Persevere with Problems** The ratio of red jelly beans to yellow jelly beans in a dish is 3:4. If Greg eats 3 red jelly beans and 6 yellow ones, the ratio is 4:5. How many yellow jelly beans were originally in the dish?

36 yellow jelly beans

13. **MP Justify Conclusions** If you travel at a rate of 45 miles per hour, how many minutes will it take you to travel 1 mile? Justify your response.

$1\frac{1}{3}$ min, or about 1 min, 20 s; 45 mph = $\frac{45}{60}$ mi per s, so $\frac{60}{45}$ gives the

seconds per mile

