



UNIT 2

Ratios and Proportional Relationships

MODULE 4

Rates and Proportionality



FL 7.RP.1.1, 7.RP.1.2, 7.RP.1.2a, 7.RP.1.2b, 7.RP.1.2c, 7.RP.1.2d

MODULE 5

Proportions and Percents



FL 7.RP.1.3, 7.EE.1.2, 7.EE.2.3

CAREERS IN MATH

Bicycle Tour Operator A bike tour operator organizes cycling trips for tourists all over the world. Bike tour operators use math to calculate expenses, determine rates, and compute payroll information for their employees. If tours include travel in another country, operators must understand how to calculate currency exchange rates.

If you are interested in a career as a bicycle tour operator, you should study these mathematical subjects:

- Basic Math
- Business Math

Research other careers that require the understanding of business mathematics.

Unit 2 Performance Task

At the end of the unit, check out how **bicycle tour operators** use math.

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Vocabulary Preview

Use the puzzle to preview key vocabulary from this unit. Unscramble the circled letters within found words to answer the riddle at the bottom of the page.

1. A relationship between two quantities in which the rate of change or the ratio of one quantity to the other is constant. (Lesson 4.3)

2. Describes how much a quantity decreases in comparison to the original amount. (Lesson 5.1)

3. A fixed percent of the principal. (Lesson 5.3)

4. The quantity k in a relationship described by an equation of the form $y = kx$. (Lesson 4.3)

5. A ratio that compares the amount of change in the dependent variable to the amount of change in the independent variable. (Lesson 4.2)

Q: What did the athlete order when he needed a huge helping of mashed potatoes?

A: _____!

Rates and Proportionality

MODULE



4



ESSENTIAL QUESTION

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

LESSON 4.1

Unit Rates

FL 7.RP.1.1

LESSON 4.2

Constant Rates of Change

FL 7.RP.1.2, 7.RP.1.2a, 7.RP.1.2b, 7.RP.1.2c

LESSON 4.3

Proportional Relationships and Graphs

FL 7.RP.1.2a, 7.RP.1.2b, 7.RP.1.2c, 7.RP.1.2d



Real-World Video

You can use rates to describe lots of real-world situations. A cyclist can compute rates such as miles per hour or rotations per minute.

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Are YOU Ready?

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Operations with Fractions

EXAMPLE $\frac{3}{10} \div \frac{5}{8} = \frac{3}{10} \times \frac{8}{5}$
 $= \frac{3}{\cancel{10}_5} \times \frac{\cancel{8}^4}{5}$
 $= \frac{12}{25}$

Multiply by the reciprocal of the divisor.

Divide by the common factors.

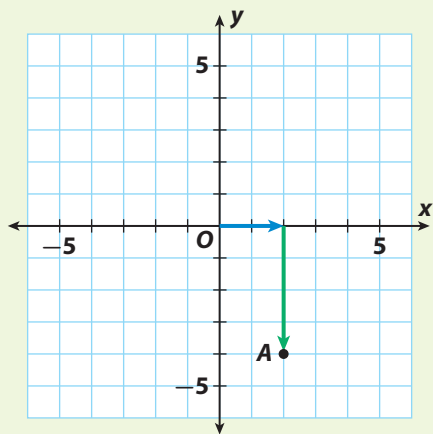
Simplify.

Divide.

1. $\frac{3}{4} \div \frac{4}{5}$ _____ 2. $\frac{5}{9} \div \frac{10}{11}$ _____ 3. $\frac{3}{8} \div \frac{1}{2}$ _____ 4. $\frac{16}{21} \div \frac{8}{9}$ _____

Ordered Pairs

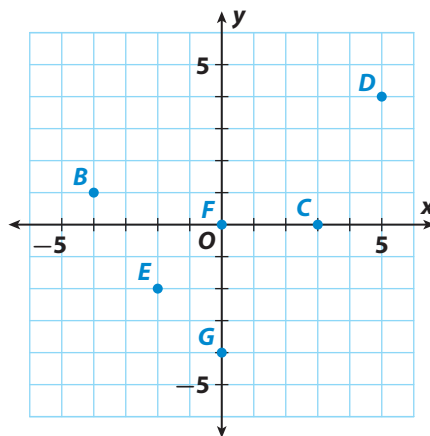
EXAMPLE



To write the ordered pair for A, start at the origin. Move 2 units right. Then move 4 units down. The ordered pair for point A is (2, -4).

Write the ordered pair for each point.

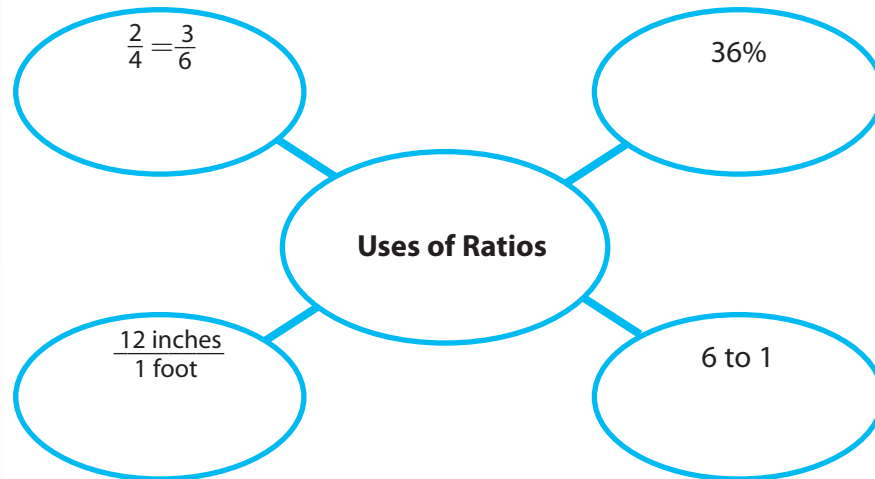
5. B _____ 6. C _____
 7. D _____ 8. E _____
 9. F _____ 10. G _____



Reading Start-Up

Visualize Vocabulary

Use the ✓ words to complete the graphic. You can put more than one word in each bubble.



Understand Vocabulary

Match the term on the left to the definition on the right.

- | | |
|-------------------|--|
| 1. rate of change | A. Statement that two rates or ratios are equivalent. |
| 2. proportion | B. A rate that describes how one quantity changes in relation to another quantity. |
| 3. unit rate | C. Rate in which the second quantity is one unit. |

Vocabulary

Review Words

- constant (*constante*)
- ✓ conversion factor (*factor de conversión*)
- ✓ equivalent ratios (*razones equivalentes*)
- ✓ percent (*porcentaje*)
rate (*tasa*)
- ✓ ratio (*razón*)

Preview Words

- complex fraction (*fracción compleja*)
- constant of proportionality (*constante de proporcionalidad*)
- proportion (*proporción*)
- proportional relationship (*relación proporcional*)
- rate of change (*tasa de cambio*)
- unit rates (*tasas unitarias*)

Active Reading

Three-Panel Flip Chart Before beginning the module, create a three-panel flip chart to help you organize what you learn. Label each flap with one of the lesson titles from this module. As you study each lesson, write important ideas like vocabulary, properties, and formulas under the appropriate flap.





MODULE 4

Unpacking the Standards

Understanding the standards and the vocabulary terms in the standards will help you know exactly what you are expected to learn in this module.



FL 7.RP.1.1

Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.

Key Vocabulary

rate (*tasa*)

A ratio that compares two quantities measured in different units.

unit rate (*tasa unitaria*)

A rate in which the second quantity in the comparison is one unit.

What It Means to You

Given a rate, you can find the equivalent unit rate by dividing the numerator by the denominator.

UNPACKING EXAMPLE 7.RP.1.1

Lisa hikes $\frac{1}{3}$ mile every $\frac{1}{6}$ hour.
How far does she hike in 1 hour?

$$\begin{aligned} \frac{\frac{1}{3}}{\frac{1}{6}} &= \frac{1}{3} \div \frac{1}{6} \\ &= \frac{1}{3} \cdot \frac{6}{1} \\ &= 2 \text{ miles} \end{aligned}$$



FL 7.RP.1.2b

Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

Key Vocabulary

constant (*constante*)

A value that does not change.

constant of proportionality (*constante de proporcionalidad*)

A constant ratio of two variables related proportionally.

What It Means to You

You will determine the constant of proportionality for proportional relationships.

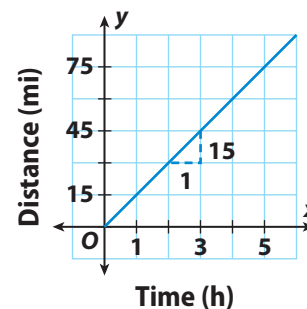
UNPACKING EXAMPLE 7.RP.1.2b

The graph shows the distance a bicyclist travels over time. How fast does the bicyclist travel?

$$\begin{aligned} \text{slope (speed)} &= \frac{\text{rise (distance)}}{\text{run (time)}} \\ &= \frac{15}{1} \end{aligned}$$

The bicyclist travels at 15 miles per hour.

The bicyclist's speed is a unit rate. It is indicated on the graphed line by the point (1, 15).



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4.1 Unit Rates



Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units.



ESSENTIAL QUESTION

How do you find and use unit rates?

EXPLORE ACTIVITY

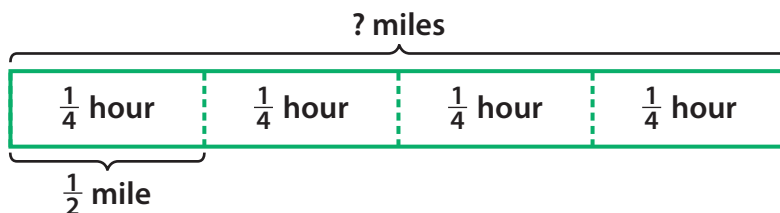


Exploring Rates

Commonly used rates like miles per hour make it easy to understand and compare rates.

Jeff hikes $\frac{1}{2}$ mile every 15 minutes, or $\frac{1}{4}$ hour. Lisa hikes $\frac{1}{3}$ mile every 10 minutes, or $\frac{1}{6}$ hour. How far do they each hike in 1 hour? 2 hours?

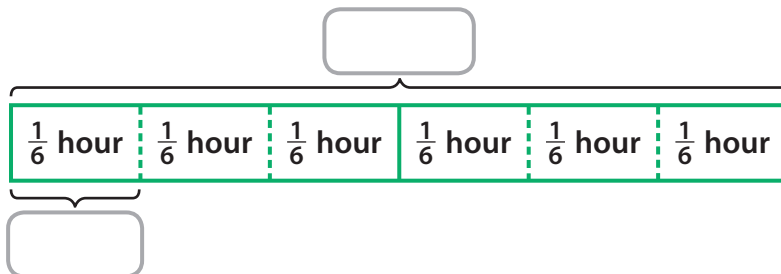
- A** Use the bar diagram to help you determine how many miles Jeff hikes. How many $\frac{1}{4}$ -hours are in 1 hour? How far does Jeff hike in 1 hour?



- B** Complete the table for Jeff's hike.

Distance (mi)	$\frac{1}{2}$				
Time (h)	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1	2

- C** Complete the bar diagram to help you determine how far Lisa hikes. How many miles does she hike in 1 hour?



- D** Complete the table for Lisa's hike.

Distance (mi)	$\frac{1}{3}$				
Time (h)	$\frac{1}{6}$	$\frac{1}{3}$	$\frac{1}{2}$	1	2

EXPLORE ACTIVITY (cont'd)**Reflect**

- How did you find Jeff's distance for $\frac{3}{4}$ hour?

- Which hiker walks farther in one hour? Which is faster?



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Finding Unit Rates

A rate is a comparison of two quantities that have different units, such as miles and hours. Rates are often expressed as **unit rates**, that is, with a denominator of 1 unit.

$$\frac{60 \text{ miles} \div 2}{2 \text{ hours} \div 2} = \frac{30 \text{ miles}}{1 \text{ hour}} \quad \text{This means 30 miles per hour.}$$

When the two quantities being compared in the rate are both fractions, the rate is expressed as a *complex fraction*.

A **complex fraction** is a fraction that has a fraction in its numerator, denominator, or both.

$$\frac{\frac{a}{b}}{\frac{c}{d}} = \frac{a}{b} \div \frac{c}{d}$$

EXAMPLE 1**FL 7.RP.1.1**

While remodeling her kitchen, Angela is repainting. She estimates that she paints 55 square feet every half-hour. How many square feet does Angela paint per hour?

- STEP 1** Determine the units of the rate.

The rate is **area in square feet per time in hours**.

- STEP 2** Find Angela's rate of painting in area painted per time.

area painted: 55 sq ft **time:** $\frac{1}{2}$ hour

$$\frac{\text{area painted}}{\text{time}} = \frac{55 \text{ square feet}}{\frac{1}{2} \text{ hour}}$$

The fraction represents area in square feet per time in hours.

- STEP 3** Find Angela's unit rate of painting in square feet per hour.

$$\frac{55}{\frac{1}{2}} = 55 \div \frac{1}{2}$$

Rewrite the fraction as division.

$$= \frac{55}{1} \times \frac{2}{1}$$

Multiply by the reciprocal.

$$= \frac{110 \text{ square feet}}{1 \text{ hour}}$$

The unit rate has a denominator of 1.

- Angela paints 110 square feet per hour.



YOUR TURN

3. Paige mows $\frac{1}{6}$ acre in $\frac{1}{4}$ hour. How many acres does Paige mow per hour?

4. Greta uses 3 ounces of pasta to make $\frac{3}{4}$ of a serving of pasta. How many ounces of pasta are there per serving? _____



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Using Unit Rates

You can use unit rates to simplify rates and ratios that appear complicated, such as those containing fractions in both the numerator and denominator.



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EXAMPLE 2



FL 7.RP.1.1

Two pools are leaking. After 15 minutes, pool A has leaked $\frac{2}{3}$ gallon. After 20 minutes, pool B has leaked $\frac{3}{4}$ gallon. Which pool is leaking faster?

STEP 1 Find the rate in volume (gallons) per time (hours) at which each pool is leaking. First convert minutes to hours.

Pool A

$$\frac{\frac{2}{3} \text{ gal}}{15 \text{ min}} = \frac{\frac{2}{3} \text{ gal}}{\frac{1}{4} \text{ h}}$$

$$15 \text{ min} = \frac{1}{4} \text{ h}$$

Pool B

$$\frac{\frac{3}{4} \text{ gal}}{20 \text{ min}} = \frac{\frac{3}{4} \text{ gal}}{\frac{1}{3} \text{ h}}$$

$$20 \text{ min} = \frac{1}{3} \text{ h}$$

STEP 2 To find the unit rates, first rewrite the fractions.

Pool A

$$\frac{\frac{2}{3} \text{ gal}}{\frac{1}{4} \text{ h}} = \frac{2}{3} \div \frac{1}{4}$$

Pool B

$$\frac{\frac{3}{4} \text{ gal}}{\frac{1}{3} \text{ h}} = \frac{3}{4} \div \frac{1}{3}$$

STEP 3 To divide, multiply by the reciprocal.

Pool A

$$\begin{aligned} \frac{2}{3} \div \frac{1}{4} &= \frac{2}{3} \times \frac{4}{1} \\ &= \frac{8}{3}, \text{ or } 2\frac{2}{3} \text{ gal per h} \end{aligned}$$

Pool B

$$\begin{aligned} \frac{3}{4} \div \frac{1}{3} &= \frac{3}{4} \times \frac{3}{1} \\ &= \frac{9}{4}, \text{ or } 2\frac{1}{4} \text{ gal per h} \end{aligned}$$

STEP 4 Compare the unit rates.

Pool A **Pool B**

$$2\frac{2}{3} > 2\frac{1}{4}$$

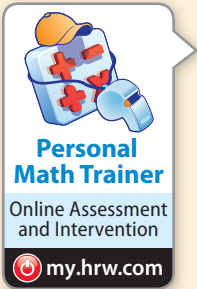
So, Pool A is leaking faster.

My Notes

Math Talk

Mathematical Practices

How do you compare mixed numbers?



YOUR TURN

5. One tank is filling at a rate of $\frac{3}{4}$ gallon per $\frac{2}{3}$ minute. A second tank is filling at a rate of $\frac{5}{8}$ gallon per $\frac{1}{2}$ minute. Which tank is filling faster?
- _____

Guided Practice

1. Brandon enters bike races. He bikes $8\frac{1}{2}$ miles every $\frac{1}{2}$ hour. Complete the table to find how far Brandon bikes for each time interval. (*Explore Activity*)

Distance (mi)	$8\frac{1}{2}$				
Time (h)	$\frac{1}{2}$	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$

Find each unit rate. (*Example 1*)

2. Julio walks $3\frac{1}{2}$ miles in $1\frac{1}{4}$ hours.

3. Kenny reads $\frac{5}{8}$ page in $\frac{2}{3}$ minute.

4. A garden snail moves $\frac{1}{6}$ foot in $\frac{1}{3}$ hour.

5. A fertilizer covers $\frac{5}{8}$ square foot in $\frac{1}{4}$ hour.

Find each unit rate. Determine which is lower. (*Example 2*)

6. Brand A: 240 mg sodium for $\frac{1}{3}$ pickle or Brand B: 325 mg sodium for $\frac{1}{2}$ pickle

7. Ingredient C: $\frac{1}{4}$ cup for $\frac{2}{3}$ serving or Ingredient D: $\frac{1}{3}$ cup for $\frac{3}{4}$ serving




ESSENTIAL QUESTION CHECK-IN

8. How can you find a unit rate when given a rate?
- _____

4.1 Independent Practice



FL 7.RP.1.1



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9. The information for two pay-as-you-go cell phone companies is given.

<p>On Call 3.5 hours: \$10</p>	<p>Talk Time $\frac{1}{2}$ hour: \$1.25</p>
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- a. What is the unit rate in dollars per hour for each company?

- b. **Analyze Relationships** Which company offers the best deal? Explain your answer.

- c. **What If?** Another company offers a rate of \$0.05 per minute. How would you find the unit rate per hour?

- d. **Draw Conclusions** Is the rate in part c a better deal than On Call or Talk Time? Explain.

10. **Represent Real-World Problems** Your teacher asks you to find a recipe that includes two ingredients with a rate of $\frac{2 \text{ units}}{3 \text{ units}}$.

- a. Give an example of two ingredients in a recipe that would meet this requirement.

- b. If you needed to triple the recipe, would the rate change? Explain.

11. A radio station requires DJs to play 2 commercials for every 10 songs they play. What is the unit rate of songs to commercials?

12. **Multistep** Terrance and Jesse are training for a long-distance race. Terrance trains at a rate of 6 miles every half hour, and Jesse trains at a rate of 2 miles every 15 minutes.

- a. What is the unit rate in miles per hour for each runner?

- b. How long will each person take to run a total of 50 miles at the given rates?

- c. Sandra runs at a rate of 8 miles in 45 minutes. How does her unit rate compare to Terrance's and to Jesse's?

- 13. Analyze Relationships** Eli takes a typing test and types all 300 words in $\frac{1}{10}$ hour. He takes the test a second time and types the words in $\frac{1}{12}$ hour. Was he faster or slower on the second attempt? Explain.



FOCUS ON HIGHER ORDER THINKING

- 14. Justify Reasoning** An online retailer sells two packages of protein bars.

Package	10-pack of 2.1 ounce bars	12-pack of 1.4 ounce bars
Cost (\$)	15.37	15.35

- a. Which package has the better price per bar?
- _____
- _____
- _____
- b. Which package has the better price per ounce?
- _____
- _____
- _____
- c. Which package do you think is a better buy? Justify your reasoning.
- _____
- _____

- 15. Check for Reasonableness** A painter painted about half a room in half a day. Coley estimated the painter would paint 7 rooms in 7 days. Is Coley's estimate reasonable? Explain.

- 16. Communicate Mathematical Ideas** If you know the rate of a water leak in gallons per hour, how can you find the number of hours it takes for 1 gallon to leak out? Justify your answer.

Work Area

LESSON 4.2 Constant Rates of Change

 **FL** 7.RP.1.2

Recognize and represent proportional relationships between quantities. Also 7.RP.1.2a, 7.RP.1.2b, 7.RP.1.2c



ESSENTIAL QUESTION

How can you identify and represent proportional relationships?

EXPLORE ACTIVITY



 **FL** 7.RP.1.2a

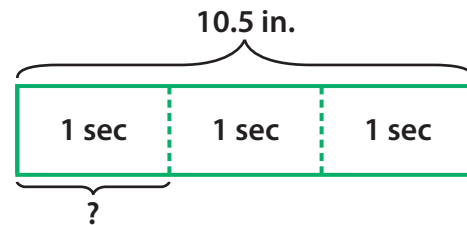
Discovering Proportional Relationships

Many real-world situations can be described by *proportional relationships*. Proportional relationships have special characteristics.

A giant tortoise moves at a slow but steady pace. It takes the giant tortoise 3 seconds to travel 10.5 inches.



- A** Use the bar diagram to help you determine how many inches a tortoise travels in 1 second. What operation did you use to find the answer?



- B** Complete the table.

Time (sec)	1	2	3	4	5
Distance (in.)			10.5		

- C** For each column of the table, find the distance and the time. Write each fraction as a decimal. Put distance in the numerator and time in the denominator.

$$\frac{\square}{\square} = \square \quad \frac{\square}{\square} = \square \quad \frac{\square}{\square} = \square \quad \frac{\square}{\square} = \square \quad \frac{\square}{\square} = \square$$

- D** What do you notice about the decimal forms of the fractions?

- E Conjecture** How do you think the distance a tortoise travels is related to the time?

EXPLORE ACTIVITY (cont'd)

Reflect

1. Suppose the tortoise travels for 12 seconds. Explain how you could find the distance the tortoise travels.

2. How would you describe the rate of speed at which a tortoise travels?



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Proportional Relationships

A **rate of change** is a rate that describes how one quantity changes in relation to another quantity. A **proportional relationship** between two quantities is one in which the rate of change is constant, or one in which the ratio of one quantity to the other is constant.

Any two rates or ratios based on a given proportional relationship can be used to form a *proportion*. A **proportion** is a statement that two rates or ratios are equivalent, for example, $\frac{6 \text{ mi}}{2 \text{ h}} = \frac{3 \text{ mi}}{1 \text{ h}}$, or $\frac{2}{4} = \frac{1}{2}$.

My Notes

EXAMPLE 1



FL 7.RP.1.2a, 7.RP.1.2b

Callie earns money by dog sitting. Based on the table, is the relationship between the amount Callie earns and the number of days a proportional relationship?

Number of Days	1	2	3	4	5
Amount Earned (\$)	16	32	48	64	80

STEP 1 Write the rates.

$$\frac{\text{Amount earned}}{\text{Number of days}} = \frac{\$16}{1 \text{ day}}$$

$$\frac{\$32}{2 \text{ days}} = \frac{\$16}{1 \text{ day}}$$

$$\frac{\$48}{3 \text{ days}} = \frac{\$16}{1 \text{ day}}$$

$$\frac{\$64}{4 \text{ days}} = \frac{\$16}{1 \text{ day}}$$

$$\frac{\$80}{5 \text{ days}} = \frac{\$16}{1 \text{ day}}$$

Put the amount earned in the numerator and the number of days in the denominator.

Each rate is equal to $\frac{\$16}{1 \text{ day}}$, or \$16 per day.

STEP 2 Compare the rates. The rates are all equal. This means the rate is constant, so the relationship is proportional.

The constant rate of change is \$16 per day.

Math Talk

Mathematical Practices

How can you use the constant rate to find how much Callie earns for 10 days of dog sitting?

YOUR TURN

3. The table shows the distance Allison drove on one day of her vacation. Is the relationship between the distance and the time a proportional relationship? Did she drive at a constant speed? Explain.

Time (h)	1	2	3	4	5
Distance (mi)	65	120	195	220	300



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Writing an Equation for a Proportional Relationship

If there is a proportional relationship between x and y , you can describe that relationship using the equation $y = kx$. The variable k is called the **constant of proportionality**, and it represents the constant rate of change or constant ratio between x and y . The value of k is represented by the equation $k = \frac{y}{x}$.



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EXAMPLE 2



FL 7.RP.1.2c, 7.RP.1.2b

Two pounds of cashews shown cost \$19, and 8 pounds cost \$76. Show that the relationship between the number of pounds of cashews and the cost is a proportional relationship. Then write an equation for the relationship.

- STEP 1** Make a table relating cost in dollars to pounds.

Number of Pounds	2	3	8
Cost (\$)	19	28.50	76

- STEP 2** Write the rates. Put cost in the numerator and pounds in the denominator. Then simplify each rate.

$$\frac{\text{Cost}}{\text{Number of Pounds}} \rightarrow \frac{19}{2} = 9.50 \quad \frac{28.50}{3} = 9.50 \quad \frac{76}{8} = 9.50$$

The rates are all equal to \$9.50 per pound. They are constant, so the relationship is proportional. The constant rate of change is \$9.50 per pound.

- STEP 3** To write an equation, first tell what the variables represent.

- Let x represent the number of pounds of cashews.
- Let y represent the cost in dollars.
- Use the numerical part of the constant rate of change as the constant of proportionality.

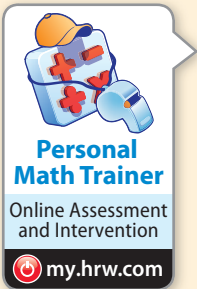
So, the equation for the relationship is $y = 9.5x$.



Math Talk

Mathematical Practices

How can you use your equation to find the cost of 6 pounds of cashews?



YOUR TURN

4. For a school field trip, there must be 1 adult to accompany 12 students, 3 adults to accompany 36 students, and 5 adults to accompany 60 students. Show that the relationship between the number of adults and the number of students is a proportional relationship. Then write an equation for the relationship.

Number of students	12	36	60
Number of adults	1	3	5

Guided Practice

1. Based on the information in the table, is the relationship between time and the number of words typed a proportional relationship?
(Explore Activity and Example 1)

Time (min)	1	2	3	4
Number of words	45	90	135	180

Number of words / Minutes: $\frac{45}{1} = \square$ $\frac{\square}{\square} = \square$ $\frac{\square}{\square} = \square$ $\frac{\square}{\square} = \square$

The relationship **is / is not** proportional.

Find the constant of proportionality k . Then write an equation for the relationship between x and y . (Example 2)

2.

x	2	4	6	8
y	10	20	30	40

3.

x	8	16	24	32
y	2	4	6	8


ESSENTIAL QUESTION CHECK-IN

4. How can you represent a proportional relationship using an equation?

4.2 Independent Practice



FL 7.RP.1.2, 7.RP.1.2a, 7.RP.1.2b, 7.RP.1.2c



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Information on three car-rental companies is given.

5. Write an equation that gives the cost y of renting a car for x days from Rent-All. _____
6. What is the cost per day of renting a car from A-1? _____
7. **Analyze Relationships** Which company offers the best deal? Why?

Rent-All				
Days	3	4	5	6
Total Cost (\$)	55.50	74.00	92.50	111.00

A-1 Rentals

The cost y of renting a car for x days is \$10.99 for each half day.

Car Town

The cost of renting a car from us is just \$19.25 per day!

8. **Critique Reasoning** A skydiver jumps out of an airplane. After 0.8 second, she has fallen 100 feet. After 3.1 seconds, she has fallen 500 feet. Emtiaz says that the skydiver should fall about 187.5 feet in 1.5 seconds. Is his answer reasonable? Explain.

Steven earns extra money babysitting. He charges \$31.25 for 5 hours and \$50 for 8 hours.

9. Explain why the relationship between how much Steven charges and time is a proportional relationship.

10. **Interpret the Answer** Explain what the constant rate of change means in the context.

11. Write an equation to represent the relationship. Tell what the variables represent.

12. How much would Steven charge for 3 hours? _____

A submarine dives 300 feet every 2 minutes, and 6,750 feet every 45 minutes.

Work Area

13. Find the constant rate at which the submarine dives. Give your answer in feet per minute and in feet per hour.

14. Let x represent the time of the dive. Let y represent the depth of the submarine. Write an equation for the proportional relationship using the rate in feet per minute.

15. **Draw Conclusions** If you wanted to find the depth of a submarine during a dive, would it be more reasonable to use an equation with the rate in feet per minute or feet per hour? Explain your reasoning.

H.O.T. FOCUS ON HIGHER ORDER THINKING

16. **Make a Conjecture** There is a proportional relationship between your distance from a thunderstorm and the time from when you see lightning and hear thunder. If there are 9 seconds between lightning and thunder, the storm is about 3 kilometers away. If you double the amount of time between lightning and thunder, do you think the distance in kilometers also double? Justify your reasoning.

17. **Communicate Mathematical Ideas** A store sells 3 ears of corn for \$1. They round prices to the nearest cent as shown in the table. Tell whether you would describe the relationship between cost and number of ears of corn as a proportional relationship. Justify your answer.

Ears of corn	1	2	3	4
Amount charged (\$)	0.33	0.67	1.00	1.34

LESSON 4.3 Proportional Relationships and Graphs

 **FL** 7.RP.1.2a

Decide whether two quantities are in a proportional relationship, e.g., by...graphing on a coordinate plane and observing whether the graph is a straight line through the origin. Also 7.RP.1.2b, 7.RP.1.2c, 7.RP.1.2d



ESSENTIAL QUESTION

How can you use graphs to represent and analyze proportional relationships?

EXPLORE ACTIVITY



 **FL** 7.RP.1.2a

Graphing Proportional Relationships

You can use a graph to explore proportional relationships.

Most showerheads that were manufactured before 1994 use 5 gallons of water per minute. Is the relationship between the number of gallons of water and the number of minutes a proportional relationship?

Each minute, 5 gallons of water are used. So for 2 minutes, $2 \cdot 5$ gallons are used.

- A** Complete the table.

Time (min)	1	2	3		10
Water Used (gal)	5			35	

- B** Based on the table, is this a proportional relationship? Explain your answer.

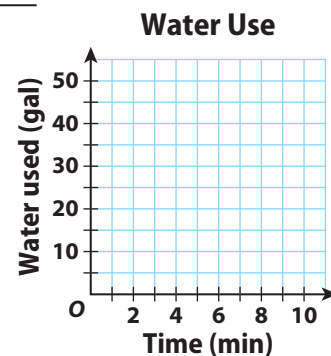
- C** Write the data in the table as ordered pairs (time, water used).

(1, 5), (2, ___), (3, ___), (___, 35), (10, ___)

- D** Plot the ordered pairs.

- E** If the showerhead is used for 0 minutes, how many gallons of water will be used? What ordered pair represents this situation? What is this location called?

- F Draw Conclusions** If you continued the table to include 23 minutes, would the point (23, 125) be on this graph? Why or why not?





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Identifying Proportional Relationships

In addition to using a table to determine if a relationship is proportional, you also can use a graph. A relationship is a proportional relationship if its graph is a straight line through the origin.

EXAMPLE 1



FL 7.RP.1.2a, 7.RP.1.2d

A house cleaning company charges \$45 per hour. Is the relationship a proportional relationship? Explain.

Each hour costs \$45. So for 2 hours, the cost is $2 \cdot \$45 = \90 .

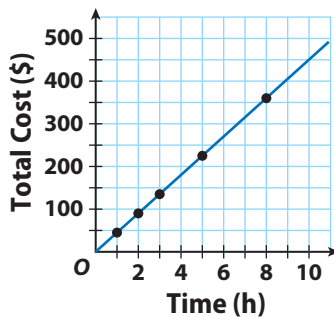
STEP 1 Make a table.

Time (h)	1	2	3	5	8
Total cost (\$)	45	90	135	225	360

STEP 2 Write the data in the table as ordered pairs (time, cost).

(1, 45), (2, 90), (3, 135), (5, 225), (8, 360)

STEP 3 Graph the ordered pairs.



Place time on the x-axis and total cost on the y-axis.

Plot each point.

Connect the points with a line.

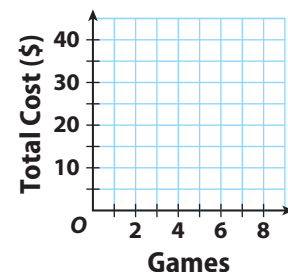
The graph is a line that goes through the origin.

So, the relationship is proportional. The point (1, 45) on the graph shows that the unit rate is \$45 for 1 hour.

YOUR TURN

- Jared rents bowling shoes for \$6 and pays \$5 per bowling game. Is the relationship a proportional relationship? Explain.

Games	1	2	3	4
Total Cost (\$)	11	16	21	26



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Analyzing Graphs

Recall that you can describe a proportional relationship with the equation $y = kx$. The constant of proportionality k tells you how steep the graph of the relationship is. The greater the absolute value of k , the steeper the line.



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EXAMPLE 2



FL 7.RP.1.2d, 7.RP.1.2b, 7.RP.1.2c

The graph shows the relationship between time in minutes and the number of miles Damon runs. Write an equation for this relationship.

STEP 1 Choose a point on the graph and tell what the point represents.

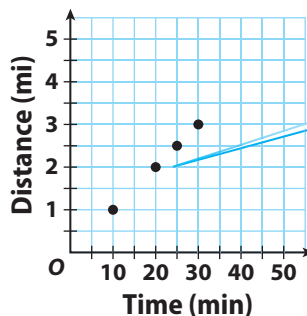
The point (25, 2.5) represents the distance (2.5 miles) that Damon runs in 25 minutes.

STEP 2 What is the constant of proportionality?

Because $\frac{\text{distance}}{\text{time}} = \frac{2.5 \text{ mi}}{25 \text{ min}} = \frac{1}{10}$, the constant of proportionality is $\frac{1}{10}$.

STEP 3 Write an equation in the form $y = kx$.

$$y = \frac{1}{10}x$$



The points appear to form a line through the origin so the relationship is proportional.

Reflect

2. **Communicate Mathematical Ideas** What does the point (0, 0) on the graph represent?

3. **What If?** Suppose you drew a graph representing the relationship $y = \frac{1}{8}x$ between time in minutes and the number of miles Esther runs. How would the graph compare to the one for Damon? Explain.

Math Talk

Mathematical Practices



What is the meaning of the point on the graph in Exercise 4 with x-coordinate 1?

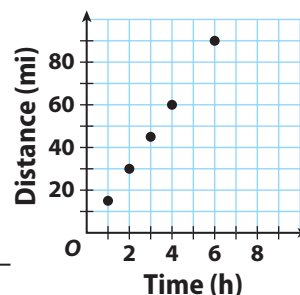
YOUR TURN

4. The graph shows the relationship between the distance a bicyclist travels and the time in hours.

a. What does the point (4, 60) represent?

b. What is the constant of proportionality? _____

c. Write an equation in the form $y = kx$ for this relationship. _____



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Guided Practice

Complete each table. Tell whether the relationship is a proportional relationship. Explain why or why not. (Explore Activity)

1. A student reads 65 pages per hour.

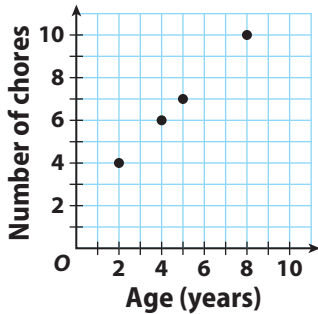
Time (h)	3	5		10
Pages			585	

2. A babysitter makes \$7.50 per hour.

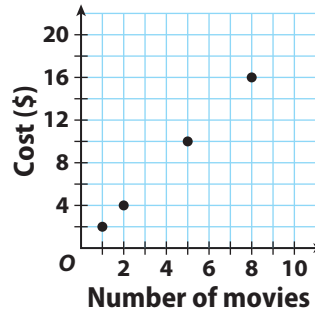
Time (h)	2		5	
Pages		22.50		60

Tell whether the relationship is a proportional relationship. Explain why or why not. (Explore Activity and Example 1)

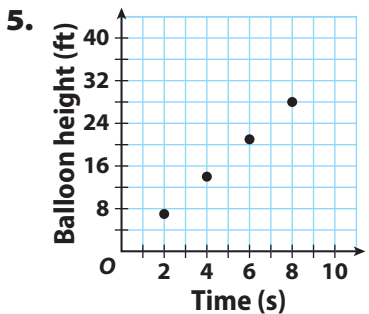
3. Chores

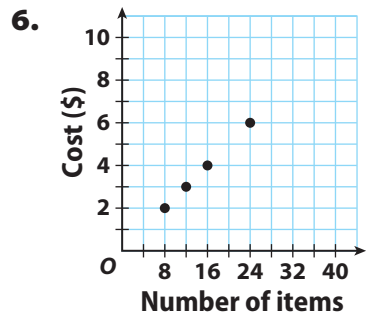


4. Movie Rentals



Write an equation of the form $y = kx$ for the relationship shown in each graph. (Example 2)






ESSENTIAL QUESTION CHECK-IN

7. How does a graph show a proportional relationship?

4.3 Independent Practice



FL 7.RP.1.2a, 7.RP.1.2b, 7.RP.1.2c, 7.RP.1.2d

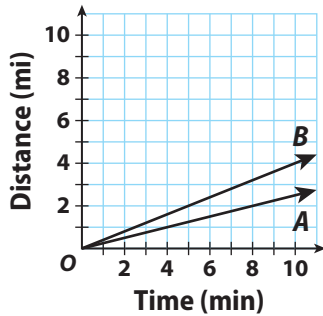


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For Exercises 8–12, the graph shows the relationship between time and distance run by two horses.



8. Explain the meaning of the point (0, 0).

9. How long does it take each horse to run a mile?

10. **Multiple Representations** Write an equation for the relationship between time and distance for each horse.

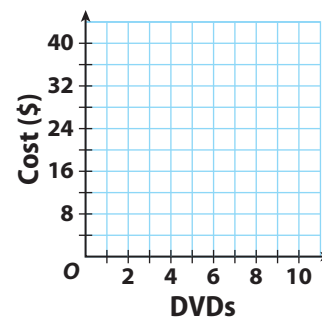
11. **Draw Conclusions** At the given rates, how far would each horse run in 12 minutes?

12. **Analyze Relationships** Draw a line on the graph representing a horse that runs faster than horses A and B.

13. A bullet train can travel at 170 miles per hour. Will a graph representing distance in miles compared to time in hours show a proportional relationship? Explain.

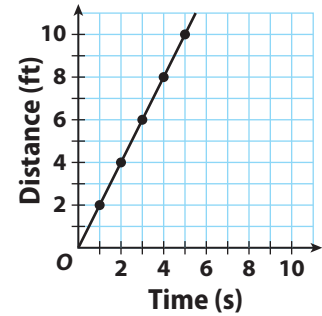
14. **Critical Thinking** When would it be more useful to represent a proportional relationship with a graph rather than an equation?

15. **Multiple Representations** Bargain DVDs cost \$5 each at Mega Movie.
 - a. Graph the proportional relationship that gives the cost y in dollars of buying x bargain DVDs.



- b. Give an ordered pair on the graph and explain its meaning in the real world context.

The graph shows the relationship between distance and time as Glenda swims.



16. How far did Glenda swim in 4 seconds? _____

17. **Communicate Mathematical Ideas** Is this a proportional relationship? Explain your reasoning.

18. **Multiple Representations** Write an equation that shows the relationship between time and distance. _____

H.O.T. FOCUS ON HIGHER ORDER THINKING

19. **Make a Conjecture** If you know that a relationship is proportional and are given one ordered pair that is not (0, 0), how can you find another pair?

Work Area

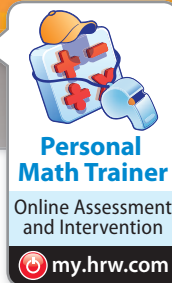
The tables show the distance traveled by three cars.

Car 1		Car 2		Car 3	
Time (h)	Distance (mi)	Time (h)	Distance (mi)	Time (h)	Distance (mi)
0	0	0	0	0	0
2	120	5	200	1	65
3	180	10	400	2	85
5	300	15	600	3	105
6	360	20	800	4	125

20. **Communicate Mathematical Ideas** Which car is not traveling at a constant speed? Explain your reasoning.

21. **Make a Conjecture** Car 4 is traveling at twice the rate of speed of car 2. How will the table values for car 4 compare to the table values for car 2?

Ready to Go On?



4.1 Unit Rates

Find each unit rate. Round to the nearest hundredth, if necessary.

1. \$140 for 18 ft² _____ 2. 14 lb for \$2.99 _____

Circle the better deal in each pair. Then give the unit rate for the better deal.

3. $\frac{\$56}{25 \text{ gal}}$ or $\frac{\$32.05}{15 \text{ gal}}$ _____ 4. $\frac{\$160}{5 \text{ g}}$ or $\frac{\$315}{9 \text{ g}}$ _____

4.2 Constant Rates of Change

5. The table shows the amount of money Tyler earns for mowing lawns. Is the relationship a proportional relationship? Why or why not?

Number of Lawns	1	2	3	4
Amount Earned (\$)	15	30	48	64

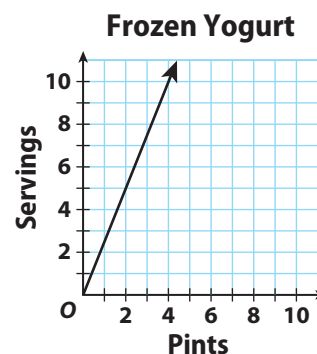
6. On a recent day, 8 euros were worth \$9 and 24 euros were worth \$27. Write an equation of the form $y = kx$ to show the relationship between the number of euros and the value in dollars.

_____, where y is dollars and x is euros

4.3 Proportional Relationships and Graphs

7. The graph shows the number of servings in different amounts of frozen yogurt listed on a carton. Write an equation that gives the number of servings y in x pints.

8. A refreshment stand makes 2 large servings of frozen yogurt from 3 pints. Add the line to the graph and write its equation.

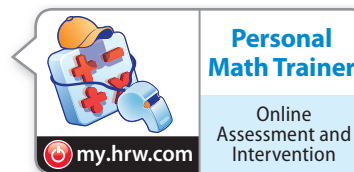


ESSENTIAL QUESTION

9. How can you use rates to determine whether a situation is a proportional relationship?



Assessment Readiness



Selected Response

- Kori spent \$46.20 on 12 gallons of gasoline. What was the price per gallon?

(A) \$8.35 (C) \$2.59
(B) \$3.85 (D) \$0.26
- A rabbit can run short distances at a rate of 35 miles per hour. A fox can run short distances at a rate of 21 miles per half hour. Which animal is faster, and by how much?

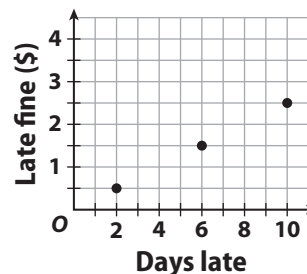
(A) The rabbit; 7 miles per hour
(B) The fox; 7 miles per hour
(C) The rabbit; 14 miles per hour
(D) The fox; 14 miles per hour
- A pet survey found that the ratio of dogs to cats is $\frac{2}{5}$. Which proportion shows the number of dogs if the number of cats is 140?

(A) $\frac{2 \text{ dogs}}{5 \text{ cats}} = \frac{140 \text{ dogs}}{350 \text{ cats}}$
(B) $\frac{2 \text{ dogs}}{5 \text{ cats}} = \frac{140 \text{ cats}}{350 \text{ dogs}}$
(C) $\frac{2 \text{ dogs}}{5 \text{ cats}} = \frac{28 \text{ dogs}}{140 \text{ cats}}$
(D) $\frac{2 \text{ dogs}}{5 \text{ cats}} = \frac{56 \text{ dogs}}{140 \text{ cats}}$
- What is the cost of 2 kilograms of flour if 3 kilograms cost \$4.86 and the unit price for each package of flour is the same?

(A) \$0.81 (C) \$3.24
(B) \$2.86 (D) \$9.72
- One gallon of paint covers about 450 square feet. How many square feet will 1.5 gallons of paint cover?

(A) 300 ft² (C) 675 ft²
(B) 451.5 ft² (D) 900 ft²

- The graph shows the relationship between the late fines the library charges and the number of days late.



What is an equation for the relationship?

- (A) $y = 0.25x$ (C) $y = 0.50x$
(B) $y = 0.40x$ (D) $y = 0.75x$

Mini-Task

- School is 2 miles from home along a straight road. The table shows your distance from home as you walk home at a constant rate.

Time (min)	10	20	30
Distance from home (mi)	1.5	1	0.5

- Is the relationship in the table proportional?

- Find your distance from school for each time in the table.

- Write an equation representing the relationship between the distance from school and time walking.

Proportions and Percent

MODULE



5



ESSENTIAL QUESTION

How can you use proportions and percent to solve real-world problems?

LESSON 5.1

Percent Increase and Decrease

FL 7.RP.1.3

LESSON 5.2

Rewriting Percent Expressions

FL 7.RP.1.3, 7.EE.1.2, 7.EE.2.3

LESSON 5.3

Applications of Percent

FL 7.RP.1.3, 7.EE.2.3



Real-World Video

A store may have a sale with deep discounts on some items. They can still make a profit because they first markup the wholesale price by as much as 40%, then markdown the retail price.

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Percents and Decimals

EXAMPLE $147\% = 100\% + 47\%$

$$= \frac{100}{100} + \frac{47}{100}$$

$$= 1 + 0.47$$

$$= 1.47$$

Write the percent as the sum of 1 whole and a percent remainder.

Write the percents as fractions.

Write the fractions as decimals.

Simplify.

Write each percent as a decimal.

1. 22% _____ 2. 75% _____ 3. 6% _____ 4. 189% _____

Write each decimal as a percent.

5. 0.59 _____ 6. 0.98 _____ 7. 0.02 _____ 8. 1.33 _____

Find the Percent of a Number

EXAMPLE 30% of 45 = ?

$$30\% = 0.30$$

$$45$$

$$\times 0.3$$

$$\hline 13.5$$

Write the percent as a decimal.

Multiply.

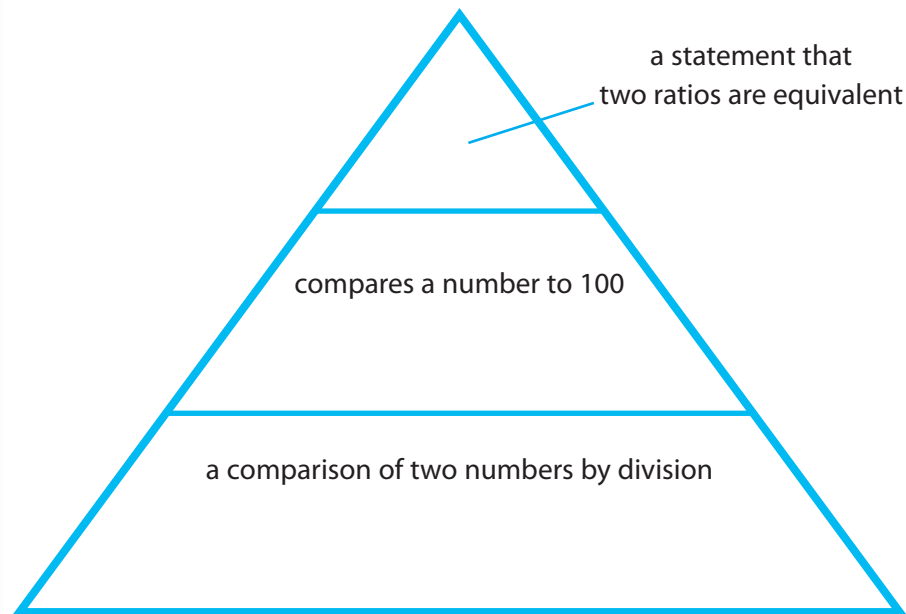
Find the percent of each number.

9. 50% of 64 _____ 10. 7% of 30 _____ 11. 15% of 160 _____
12. 32% of 62 _____ 13. 120% of 4 _____ 14. 6% of 1,000 _____

Reading Start-Up

Visualize Vocabulary

Use the ✓ words to complete the triangle. Write the review word that fits the description in each section of the triangle.



Vocabulary

Review Words

- ✓ proportion (*proporción*)
- ✓ percent (*porcentaje*)
rate (*tasa*)
- ✓ ratio (*razón*)
unit rate (*tasa unitaria*)

Preview Words

- percent decrease (*porcentaje de disminución*)
- percent increase (*porcentaje de aumento*)
- principal (*capital*)
- simple interest (*interés simple*)

Understand Vocabulary

Complete the sentences using the preview words.

1. A fixed percent of the principal is _____.
2. The original amount of money deposited or borrowed is the _____.
3. A _____ is the amount of increase divided by the original amount.

Active Reading

Tri-Fold Before beginning the module, create a tri-fold to help you learn the concepts and vocabulary in this module. Fold the paper into three sections. Label the columns “What I Know,” “What I Need to Know,” and “What I Learned.” Complete the first two columns before you read. After studying the module, complete the third.





MODULE 5

Unpacking the Standards

Understanding the Standards and the vocabulary terms in the Standards will help you know exactly what you are expected to learn in this module.

FL 7.RP.1.3

Use proportional relationships to solve multistep ratio and percent problems.

Key Vocabulary

proportion (*proporción*)

An equation that states that two ratios are equivalent.

ratio (*razón*)

A comparison of two quantities by division.

percent (*porcentaje*)

A ratio that compares a part to the whole using 100.

What It Means to You

You will use proportions to solve problems involving ratio and percent.

UNPACKING EXAMPLE 7.RP.1.3

Find the amount of sales tax if the sales tax rate is 5% and the cost of the item is \$40.

$$5\% = \frac{5}{100} = \frac{1}{20}$$

Multiply $\frac{1}{20}$ times the cost to find the sales tax.

$$\frac{1}{20} \times 40 = 2$$

The sales tax is \$2.

FL 7.EE.1.2

Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related.

Key Vocabulary

expression (*expresión*)

A mathematical phrase containing variables, constants and operation symbols.

What It Means to You

You will find helpful ways to rewrite an expression in an equivalent form.

UNPACKING EXAMPLE 7.EE.1.2

A store advertises that all bicycle helmets will be sold at 10% off the regular price. Find two expressions that represent the value of the sale price p for the helmets that are on sale.

Sale price = original price minus 10% of the price

$$= p - 0.10p$$

Equivalently,

$$p - 0.10p = p(1 - 0.10) = 0.90p$$



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LESSON 5.1 Percent Increase and Decrease

 **FL** 7.RP.1.3

Use proportional relationships to solve multistep ratio and percent problems.



ESSENTIAL QUESTION

How do you use percents to describe change?

Finding Percent Increase

Percents can be used to describe how an amount changes.

$$\text{Percent Change} = \frac{\text{Amount of Change}}{\text{Original Amount}}$$

The change may be an increase or a decrease. **Percent increase** describes how much a quantity increases in comparison to the original amount.



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EXAMPLE 1



FL 7.RP.1.3

Amber got a raise, and her hourly wage increased from \$8 to \$9.50. What is the percent increase?

STEP 1 Find the amount of change.

$$\begin{aligned}\text{Amount of Change} &= \text{Greater Value} - \text{Lesser Value} \\ &= 9.50 - 8.00 && \text{Substitute values.} \\ &= 1.50 && \text{Subtract.}\end{aligned}$$

STEP 2 Find the percent increase. Round to the nearest percent.

$$\begin{aligned}\text{Percent Change} &= \frac{\text{Amount of Change}}{\text{Original Amount}} \\ &= \frac{1.50}{8.00} && \text{Substitute values.} \\ &= 0.1875 && \text{Divide.} \\ &\approx 19\% && \text{Write as a percent and round.}\end{aligned}$$

Reflect

1. What does a 100% increase mean?

YOUR TURN

2. The price of a pair of shoes increases from \$52 to \$64. What is the percent increase to the nearest percent? _____



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Finding Percent Decrease

When the change in the amount decreases, you can use a similar approach to find percent decrease. **Percent decrease** describes how much a quantity decreases in comparison to the original amount.

EXAMPLE 2



FL 7.RP.1.3

My Notes

David moved from a house that is 89 miles away from his workplace to a house that is 51 miles away from his workplace. What is the percent decrease in the distance from his home to his workplace?

STEP 1

Find the amount of change.

$$\begin{aligned} \text{Amount of Change} &= \text{Greater Value} - \text{Lesser Value} \\ &= 89 - 51 && \text{Substitute values.} \\ &= 38 && \text{Subtract.} \end{aligned}$$

STEP 2

Find the percent decrease. Round to the nearest percent.

$$\begin{aligned} \text{Percent Change} &= \frac{\text{Amount of Change}}{\text{Original Amount}} \\ &= \frac{38}{89} && \text{Substitute values.} \\ &\approx 0.427 && \text{Divide.} \\ &= 43\% && \text{Write as a percent and round.} \end{aligned}$$

Reflect

3. **Critique Reasoning** David considered moving even closer to his workplace. He claims that if he had done so, the percent of decrease would have been more than 100%. Is David correct? Explain your reasoning.

YOUR TURN

4. The number of students in a chess club decreased from 18 to 12. What is the percent decrease? Round to the nearest percent. _____
5. Officer Brimberry wrote 16 tickets for traffic violations last week, but only 10 tickets this week. What is the percent decrease? _____



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Using Percent of Change

Given an original amount and a percent increase or decrease, you can use the percent of change to find the new amount.



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EXAMPLE 3



FL 7.RP.1.3

The grizzly bear population in Yellowstone National Park in 1970 was about 270. Over the next 35 years, it increased by about 115%. What was the population in 2005?



STEP 1 Find the amount of change.

$$\begin{aligned} 1.15 \times 270 &= 310.5 && \text{Find 115\% of 270. Write 115\% as a decimal.} \\ &\approx 311 && \text{Round to the nearest whole number.} \end{aligned}$$

STEP 2 Find the new amount.

$$\begin{aligned} \text{New Amount} &= \text{Original Amount} + \text{Amount of Change} \\ &= 270 + 311 && \text{Substitute values.} \\ &= 581 && \text{Add.} \end{aligned}$$

Add the amount of change because the population increased.

The population in 2005 was about 581 grizzly bears.

Reflect

6. Why will the percent of change always be represented by a positive number?

7. **Draw Conclusions** If an amount of \$100 in a savings account increases by 10%, then increases by 10% again, is that the same as increasing by 20%? Explain.

YOUR TURN

A TV has an original price of \$499. Find the new price after the given percent of change.

8. 10% increase _____ 9. 30% decrease _____



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Guided Practice

Find each percent increase. Round to the nearest percent. (Example 1)

- From \$5 to \$8 _____
- From 20 students to 30 students _____
- From 86 books to 150 books _____
- From \$3.49 to \$3.89 _____
- From 13 friends to 14 friends _____
- From 5 miles to 16 miles _____
- Nathan usually drinks 36 ounces of water per day. He read that he should drink 64 ounces of water per day. If he starts drinking 64 ounces, what is the percent increase? Round to the nearest percent. (Example 1) _____

Find each percent decrease. Round to the nearest percent. (Example 2)

- From \$80 to \$64 _____
- From 95°F to 68°F _____
- From 90 points to 45 points _____
- From 145 pounds to 132 pounds _____
- From 64 photos to 21 photos _____
- From 16 bagels to 0 bagels _____
- Over the summer, Jackie played video games 3 hours per day. When school began in the fall, she was only allowed to play video games for half an hour per day. What is the percent decrease? Round to the nearest percent. (Example 2) _____

Find the new amount given the original amount and the percent of change. (Example 3)

- \$9; 10% increase _____
- 48 cookies; 25% decrease _____
- 340 pages; 20% decrease _____
- 28 members; 50% increase _____
- \$29,000; 4% decrease _____
- 810 songs; 130% increase _____
- Adam currently runs about 20 miles per week, and he wants to increase his weekly mileage by 30%. How many miles will Adam run per week? (Example 3) _____



ESSENTIAL QUESTION CHECK-IN

22. What process do you use to find the percent change of a quantity?

5.1 Independent Practice



FL 7.RP.1.3

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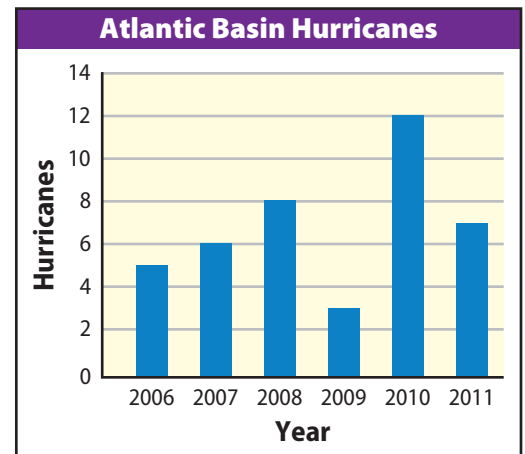
23. Complete the table.

Item	Original Price	New Price	Percent Change	Increase or Decrease
Bike	\$110	\$96		
Scooter	\$45	\$56		
Tennis Racket	\$79		5%	Increase
Skis	\$580		25%	Decrease

24. **Multiple Representations** The bar graph shows the number of hurricanes in the Atlantic Basin from 2006–2011.

- a. Find the amount of change and the percent of decrease in the number of hurricanes from 2008 to 2009 and from 2010 to 2011. Compare the amounts of change and percents of decrease.

- b. Between which two years was the percent of change the greatest? What was the percent of change during that period?



25. **Represent Real-World Problems** Cheese sticks that were previously priced at “5 for \$1” are now “4 for \$1”. Find each percent of change and show your work.

- a. Find the percent decrease in the number of cheese sticks you can buy for \$1.

- b. Find the percent increase in the price per cheese stick.

- 26.** Percent error calculations are used to determine how close to the true values, or how accurate, experimental values really are. The formula is similar to finding percent of change.

$$\text{Percent Error} = \frac{|\text{Experimental Value} - \text{Actual Value}|}{\text{Actual Value}} \times 100$$

In chemistry class, Charlie records the volume of a liquid as 13.3 milliliters. The actual volume is 13.6 milliliters. What is his percent error? Round to the nearest percent. _____



FOCUS ON HIGHER ORDER THINKING

- 27. Look for a Pattern** Leroi and Sylvia both put \$100 in a savings account. Leroi decides he will put in an additional \$10 each week. Sylvia decides to put in an additional 10% of the amount in the account each week.

a. Who has more money after the first additional deposit? Explain.

b. Who has more money after the second additional deposit? Explain.

c. How do you think the amounts in the two accounts will compare after a month? A year?

- 28. Critical Thinking** Suppose an amount increases by 100%, then decreases by 100%. Find the final amount. Would the situation change if the original increase was 150%? Explain your reasoning.

- 29. Look for a Pattern** Ariel deposited \$100 into a bank account. Each Friday she will withdraw 10% of the money in the account to spend. Ariel thinks her account will be empty after 10 withdrawals. Do you agree? Explain.

LESSON 5.2 Rewriting Percent Expressions

 **FL** 7.EE.1.2

Understand that rewriting an expression in different forms in a problem context can shed light on the problem and how the quantities in it are related. Also 7.RP.1.3, 7.EE.2.3



ESSENTIAL QUESTION

How can you rewrite expressions to help you solve markup and markdown problems?

Calculating Markups

A *markup* is one kind of percent increase. You can use a bar model to represent the *retail price* of an item, that is, the total price including the markup.

EXAMPLE 1



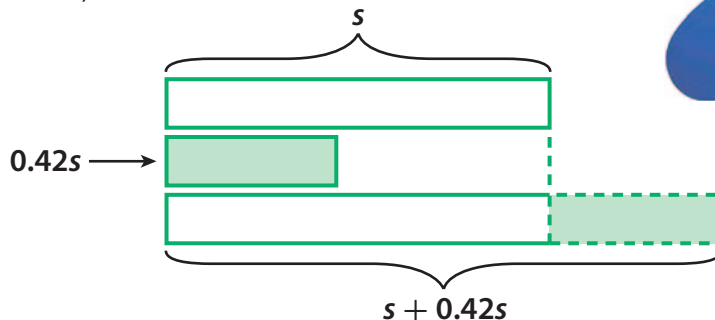
FL 7.EE.1.2, 7.RP.1.3, 7.EE.2.3

To make a profit, stores mark up the prices on the items they sell. A sports store buys skateboards from a supplier for s dollars. What is the retail price for skateboards that the manager buys for \$35 and \$56 after a 42% markup?

STEP 1 Use a bar model.

Draw a bar for the cost of the skateboard s .

Then draw a bar that shows the markup: 42% of s , or $0.42s$.



These bars together represent the cost plus the markup, $s + 0.42s$.

STEP 2 Retail price = Original cost + Markup

$$\begin{aligned} &= s + 0.42s \\ &= 1s + 0.42s \\ &= 1.42s \end{aligned}$$

STEP 3 Use the expression to find the retail price of each skateboard.

$$s = \$35 \rightarrow \text{Retail price} = 1.42(\$35) = \$49.70$$

$$s = \$56 \rightarrow \text{Retail price} = 1.42(\$56) = \$79.52$$

Reflect

- What If?** The markup is changed to 34%; how does the expression for the retail price change?



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Math Talk

Mathematical Practices

Why write the retail price as the sum of two terms? as one term?



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YOUR TURN

2. Rick buys remote control cars to resell. He applies a markup of 10%.
 - a. Write two expressions that represent the retail price of the cars.

 - b. If Rick buys a remote control car for \$28.00, what is his selling price?

3. An exclusive clothing boutique triples the price of the items it purchases for resale.
 - a. What is the boutique's markup percent? _____
 - b. Write two expressions that represent the retail price of the clothes.



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Calculating Markdowns

An example of a percent decrease is a *discount*, or *markdown*. A price after a markdown may be called a sale price. You can also use a bar model to represent the price of an item including the markdown.

EXAMPLE 2



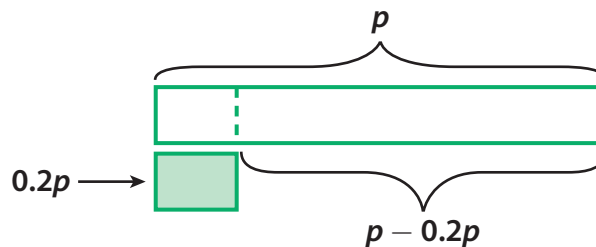
FL 7.EE.1.2, 7.RP.1.3, 7.EE.2.3

A discount store marks down all of its holiday merchandise by 20% off the regular selling price. Find the discounted price of decorations that regularly sell for \$16 and \$23.


STEP 1 Use a bar model.

Draw a bar for the regular price p .

Then draw a bar that shows the discount: 20% of p , or $0.2p$.



The difference between these two bars represents the price minus the discount, $p - 0.2p$.



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STEP 2 Sale price = Original price – Markdown

$$\begin{aligned} &= p - 0.2p \\ &= 1p - 0.2p \\ &= 0.8p \end{aligned}$$

STEP 3 Use the expression to find the sale price of each decoration.

$p = \$16 \rightarrow$ Retail price = $0.8(\$16) = \12.80

$p = \$23 \rightarrow$ Retail price = $0.8(\$23) = \18.40

Reflect

4. **Conjecture** Compare the single term expression for retail price after a markup from Example 1 and the single term expression for sale price after a markdown from Example 2. What do you notice about the coefficients in the two expressions?

YOUR TURN

5. A bicycle shop marks down each bicycle's selling price b by 24% for a holiday sale.
- a. Draw a bar model to represent the problem.

b. What is a single term expression for the sale price? _____

6. Jane sells pillows. For a sale, she marks them down 5%.

a. Write two expressions that represent the sale price of the pillows.

b. If the original price of a pillow is \$15.00, what is the sale price?

Math Talk

Mathematical Practices

Is a 20% markup equal to a 20% markdown? Explain.



Guided Practice

1. Dana buys dress shirts from a clothing manufacturer for s dollars each, and then sells the dress shirts in her retail clothing store at a 35% markup.

(Example 1)

- a. Write the markup as a decimal. _____
- b. Write an expression for the retail price of the dress shirt. _____
- c. What is the retail price of a dress shirt that Dana purchased for \$32.00? _____
- d. How much was added to the original price of the dress shirt? _____

List the markup and retail price of each item. Round to two decimal places when necessary. (Example 1)

	Item	Price	Markup %	Markup	Retail Price
2.	Hat	\$18	15%		
3.	Book	\$22.50	42%		
4.	Shirt	\$33.75	75%		
5.	Shoes	\$74.99	33%		
6.	Clock	\$48.60	100%		
7.	Painting	\$185.00	125%		

Find the sale price of each item. Round to two decimal places when necessary. (Example 2)

8. Original price: \$45.00; Markdown: 22%

9. Original price: \$89.00; Markdown: 33%

10. Original price: \$23.99; Markdown: 44%

11. Original price: \$279.99, Markdown: 75%




ESSENTIAL QUESTION CHECK-IN

12. How can you determine the sale price if you are given the regular price and the percent of markdown?

5.2 Independent Practice



FL 7.RP.1.3, 7.EE.1.2, 7.EE.2.3



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- 13.** A bookstore manager marks down the price of older hardcover books, which originally sell for b dollars, by 46%.
- Write the markdown as a decimal. _____
 - Write an expression for the sale price of the hardcover book.

 - What is the sale price of a hardcover book for which the original retail price was \$29.00? _____
 - If you buy the book in part **c**, how much do you save by paying the sale price? _____
- 14.** Raquela’s coworker made price tags for several items that are to be marked down by 35%. Match each Regular Price to the correct Sale Price, if possible. Not all sales tags match an item.

Regular Price \$3.29	Regular Price \$4.19	Regular Price \$2.79	Regular Price \$3.09	Regular Price \$3.77
Sale Price \$2.01	Sale Price \$2.45	Sale Price \$1.15	Sale Price \$2.72	Sale Price \$2.24

- 15. Communicate Mathematical Ideas** For each situation, give an example that includes the original price and final price after markup or markdown.
- A markdown that is greater than 99% but less than 100%

 - A markdown that is less than 1%

 - A markup that is more than 200%

- 16. Represent Real-World Problems** Harold works at a men's clothing store, which marks up its retail clothing by 27%. The store purchases pants for \$74.00, suit jackets for \$325.00, and dress shirts for \$48.00. How much will Harold charge a customer for two pairs of pants, three dress shirts, and a suit jacket?

- 17. Analyze Relationships** Your family needs a set of 4 tires. Which of the following deals would you prefer? Explain.

(I) Buy 3, get one free (II) 20% off (III) $\frac{1}{4}$ off



FOCUS ON HIGHER ORDER THINKING

- 18. Critique Reasoning** Margo purchases bulk teas from a warehouse and marks up those prices by 20% for retail sale. When teas go unsold for more than two months, Margo marks down the retail price by 20%. She says that she is *breaking even*, that is, she is getting the same price for the tea that she paid for it. Is she correct? Explain.

- 19. Problem Solving** Grady marks down some \$2.49 pens to \$1.99 for a week and then marks them back up to \$2.49. Find the percent of increase and the percent of decrease to the nearest tenth. Are the percents of change the same for both price changes? If not, which is a greater change?

- 20. Persevere in Problem Solving** At Danielle's clothing boutique, if an item does not sell for eight weeks, she marks it down by 15%. If it remains unsold after that, she marks it down an additional 5% each week until she can no longer make a profit. Then she donates it to charity.

Rafael wants to buy a coat originally priced \$150, but he can't afford more than \$110. If Danielle paid \$100 for the coat, during which week(s) could Rafael buy the coat within his budget? Justify your answer.

LESSON 5.3 Applications of Percent

FL 7.RP.1.3

Use proportional relationships to solve multistep ratio and percent problems. *Also* 7.EE.2.3



ESSENTIAL QUESTION

How do you use percents to solve problems?

Finding Total Cost

Sales tax, which is the tax on the sale of an item or service, is a percent of the purchase price that is collected by the seller.

EXAMPLE 1



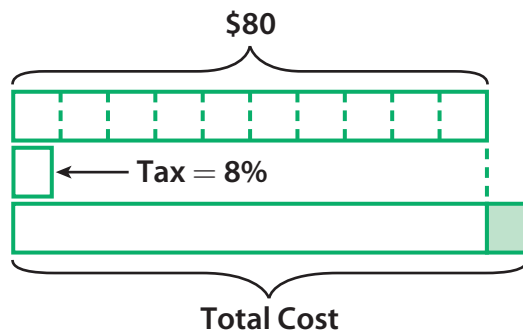
FL 7.RP.1.3, 7.EE.2.3

Marcus buys a varsity jacket from a clothing store in Arlington. The price of the jacket is \$80 and the sales tax is 8%. What is the total cost of the jacket?

STEP 1 Use a bar model to find the amount of the tax.

Draw a bar for the price of the jacket, \$80. Divide it into 10 equal parts. Each part represents 10% of \$80, or \$8.

Then draw a bar that shows the sales tax: 8% of \$80.



Because 8% is $\frac{4}{5}$ of 10%, the tax is $\frac{4}{5}$ of one part of the whole bar.

Each part of the whole bar is \$8.

So, the sales tax is $\frac{4}{5}$ of \$8.

$$\frac{4}{5} \times \$8 = \$6.40$$

The sales tax is \$6.40.

STEP 2 To find the total cost of the jacket, add the price of the jacket and the sales tax.

Jacket price + Sales tax = Total cost

$$\$80 \quad \$6.40 \quad = \$86.40$$



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Math Talk

Mathematical Practices

How could you find the tax without drawing a model of the situation?



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YOUR TURN

- Sharon wants to buy a shirt that costs \$20. The sales tax is 5%. How much is the sales tax? What is her total cost for the shirt? _____

Finding Simple Interest

When you deposit money in a savings account, your money usually earns interest. When you borrow money, you must pay back the original amount of the loan plus interest. **Simple interest** is a fixed percent of the *principal*. The **principal** is the original amount of money deposited or borrowed.

EXAMPLE 2



FL 7.RP.1.3, 7.EE.2.3

Terry deposits \$200 into a bank account that earns 3% simple interest per year. What is the total amount in the account after 2 years?

STEP 1

Find the amount of interest earned in one year. Then calculate the amount of interest for 2 years.

Write 3% as a decimal: **0.03**

Interest Rate \times Initial Deposit = Interest for 1 year

$$0.03 \times \$200 = \$6$$

Interest for 1 year \times 2 years = Interest for 2 years

$$\$6 \times 2 = \$12$$

STEP 2

Add the interest for 2 years to the initial deposit to find the total amount in his account after 2 years.

Initial deposit + Interest for 2 years = Total

$$\$200 + \$12 = \$212$$

The total amount in the account after 2 years is \$212.


Reflect

- Write an expression you can use to find the total amount in Terry's account.

YOUR TURN

- Ariane borrows \$400 on a 4-year loan. She is charged 5% simple interest per year. How much interest is she charged for 4 years? What is the total amount she has to pay back? _____

My Notes



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Using Multiple Percents

Some situations require applying more than one percent to a problem. For example, when you dine at a restaurant, you might pay a tax on the meal, and pay a tip to the wait staff. The tip is usually paid on the amount before tax. When you pay tax on a sale item, you pay tax only on the discounted price.



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EXAMPLE 3

Problem Solving



FL 7.EE.2.3, 7.RP.1.3

The Maxwell family goes out for dinner, and the price of the meal is \$60. The sales tax on the meal is 7%, and they also want to leave a 15% tip. What is the total cost of the meal?



Analyze Information

Identify the important information.

- The bill for the meal is \$60.
- The sales tax is 7%, or 0.07.
- The tip is 15%, or 0.15.

The total cost will be the sum of the bill for the meal, the sales tax, and the tip.

Formulate a Plan

Calculate the sales tax separately, then calculate the tip, and then add the products to the bill for the meal to find the total.

Solve

$$\text{Sales tax: } 0.07 \times \$60 = \$4.20 \qquad \text{Tip: } 0.15 \times \$60 = \$9.00$$

$$\text{Meal} + \text{Sales tax} + \text{Tip} = \text{Total cost}$$

$$\$60 + \$4.20 + \$9 = \$73.20$$

The total cost is \$73.20.

Justify and Evaluate

Estimate the sales tax and tip. Sales tax is about 10% plus 15% for tip gives 25%. Find 25% of the bill: $0.25 \times \$60 = \15 . Add this to the bill: $\$60 + \$15 = \$75$. The total cost should be about \$75.

YOUR TURN

4. Samuel orders four DVDs from an online music store. Each DVD costs \$9.99. He has a 20% discount code, and sales tax is 6.75%. What is the total cost of his order?



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Guided Practice

1. 5% of \$30 = _____
2. 15% of \$70 = _____
3. 0.4% of \$100 = _____
4. 150% of \$22 = _____
5. 1% of \$80 = _____
6. 200% of \$5 = _____
7. Brandon buys a radio for \$43.99 in a state where the sales tax is 7%.
(Example 1)
 - a. How much does he pay in taxes? _____
 - b. What is the total Brandon pays for the radio? _____
8. Luisa's restaurant bill comes to \$75.50, and she leaves a 15% tip. What is Luisa's total restaurant bill? (Example 1)

9. Joe borrowed \$2,000 from the bank at a rate of 7% simple interest per year. How much interest did he pay in 5 years? (Example 2)

10. You have \$550 in a savings account that earns 3% simple interest each year. How much will be in your account in 10 years? (Example 2)

11. Martin finds a shirt on sale for 10% off at a department store. The original price was \$20. Martin must also pay 8.5% sales tax. (Example 3)
 - a. How much is the shirt before taxes are applied? _____
 - b. How much is the shirt after taxes are applied? _____
12. Teresa's restaurant bill comes to \$29.99 before tax. If the sales tax is 6.25% and she tips the waiter 20%, what is the total cost of the meal? (Example 3)




ESSENTIAL QUESTION CHECK-IN

13. How can you determine the total cost of an item including tax if you know the price of the item and the tax rate?

5.3 Independent Practice



FL 7.RP.1.3, 7.EE.2.3



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14. Emily's meal costs \$32.75 and Darren's meal costs \$39.88. Emily treats Darren by paying for both meals, and leaves a 14% tip. Find the total cost.

15. The Jayden family eats at a restaurant that is having a 15% discount promotion. Their meal costs \$78.65, and they leave a 20% tip. If the tip applies to the cost of the meal before the discount, what is the total cost of the meal?

16. A jeweler buys a ring from a jewelry maker for \$125. He marks up the price by 135% for sale in his store. What is the selling price of the ring with 7.5% sales tax?

17. Luis wants to buy a skateboard that usually sells for \$79.99. All merchandise is discounted by 12%. What is the total cost of the skateboard if Luis has to pay a state sales tax of 6.75%?

18. Kedar earns a monthly salary of \$2,200 plus a 3.75% *commission* on the amount of his sales at a men's clothing store. What would he earn this month if he sold \$4,500 in clothing? Round to the nearest cent.

19. Danielle earns a 7.25% commission on everything she sells at the electronics store where she works. She also earns a base salary of \$750 per week. How much did she earn last week if she sold \$4,500 in electronics merchandise? Round to the nearest cent.

20. Francois earns a weekly salary of \$475 plus a 5.5% commission on sales at a gift shop. How much would he earn in a week if he sold \$700 in goods? Round to the nearest cent.

21. Sandra is 4 feet tall. Pablo is 10% taller than Sandra, and Michaela is 8% taller than Pablo.
 - a. Explain how to find Michaela's height with the given information.

 - b. What is Michaela's approximate height in feet and inches?

22. Eugene wants to buy jeans at a store that is giving \$10 off everything. The tag on the jeans is marked 50% off. The original price is \$49.98.
 - a. Find the total cost if the 50% discount is applied before the \$10 discount.

 - b. Find the total cost if the \$10 discount is applied before the 50% discount.

23. Multistep Eric downloads the coupon shown and goes shopping at Gadgets Galore, where he buys a digital camera for \$95 and an extra battery for \$15.99.



a. What is the total cost if the coupon is applied to the digital camera?

b. What is the total cost if the coupon is applied to the extra battery?

c. To which item should Eric apply the discount? Explain.

d. Eric has to pay 8% sales tax after the coupon is applied. How much is his total bill?

24. Two stores are having sales on the same shirts. The sale at Store 1 is “2 shirts for \$22” and the sale at Store 2 is “Each \$12.99 shirt is 10% off”.

a. Explain how much will you save by buying at Store 1.

b. If Store 3 has shirts originally priced at \$20.98 on sale for 55% off, does it have a better deal than the other stores? Justify your answer.

H.O.T. FOCUS ON HIGHER ORDER THINKING

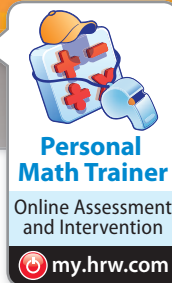
25. Analyze Relationships Marcus can choose between a monthly salary of \$1,500 plus 5.5% of sales or \$2,400 plus 3% of sales. He expects sales between \$5,000 and \$10,000 a month. Which salary option should he choose? Explain.

26. Multistep In chemistry class, Bob recorded the volume of a liquid as 13.2 mL. The actual volume was 13.7 mL. Use the formula to find percent error of Bob’s measurement to the nearest tenth of a percent.

$$\text{Percent Error} = \frac{|\text{Experimental Value} - \text{Actual Value}|}{\text{Actual Value}} \times 100$$

Work Area

Ready to Go On?



5.1 Percent Increase and Decrease

Find the percent change from the first value to the second.

1. 36; 63 _____
2. 50; 35 _____
3. 40; 72 _____
4. 92; 69 _____

5.2 Markup and Markdown

Use the original price and the markdown or markup to find the retail price.

5. Original price: \$60; Markup: 15%; Retail price: _____
6. Original price: \$32; Markup: 12.5%; Retail price: _____
7. Original price: \$50; Markdown: 22%; Retail price: _____
8. Original price: \$125; Markdown: 30%; Retail price: _____

5.3 Applications of Percent

9. Mae Ling earns a weekly salary of \$325 plus a 6.5% commission on sales at a gift shop. How much would she make in a work week if she sold \$4,800 worth of merchandise? _____
10. Ramon earns \$1,735 each month and pays \$53.10 for electricity. To the nearest tenth of a percent, what percent of Ramon's earnings are spent on electricity each month? _____
11. James, Priya, and Siobhan work in a grocery store. James makes \$7.00 per hour. Priya makes 20% more than James, and Siobhan makes 5% less than Priya. How much does Siobhan make per hour? _____
12. The Hu family goes out for lunch, and the price of the meal is \$45. The sales tax on the meal is 6%, and the family also leaves a 20% tip on the pre-tax amount. What is the total cost of the meal? _____

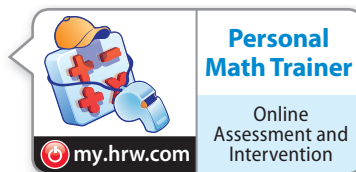


ESSENTIAL QUESTION

13. Give three examples of how percents are used in the real-world. Tell whether each situation represents a percent increase or a percent decrease.



Assessment Readiness



Selected Response

- Zalmon walks $\frac{3}{4}$ of a mile in $\frac{3}{10}$ of an hour. What is his speed in miles per hour?
 - (A) 0.225 miles per hour
 - (B) 2.3 miles per hour
 - (C) 2.5 miles per hour
 - (D) 2.6 miles per hour
- Find the percent change from 70 to 56.
 - (A) 20% decrease (C) 25% decrease
 - (B) 20% increase (D) 25% increase
- The rainfall total two years ago was 10.2 inches. Last year's total was 20% greater. What was last year's rainfall total?
 - (A) 8.16 inches (C) 12.24 inches
 - (B) 11.22 inches (D) 20.4 inches
- A pair of basketball shoes was originally priced at \$80, but was marked up 37.5%. What was the retail price of the shoes?
 - (A) \$50 (C) \$110
 - (B) \$83 (D) \$130
- The sales tax rate in Jan's town is 7.5%. If she buys 3 lamps for \$23.59 each and a sofa for \$769.99, how much sales tax does she owe?
 - (A) \$58.85 (C) \$67.26
 - (B) \$63.06 (D) \$71.46
- The day after a national holiday, decorations were marked down 40%. Before the holiday, a patriotic banner cost \$5.75. How much did the banner cost after the holiday?
 - (A) \$1.15 (C) \$3.45
 - (B) \$2.30 (D) \$8.05

- Dustin makes \$2,330 each month and pays \$840 for rent. To the nearest tenth of a percent, what percent of Dustin's earnings are spent on rent?
 - (A) 84.0% (C) 56.4%
 - (B) 63.9% (D) 36.1%
- A scuba diver is positioned at -30 feet. How many feet will she have to rise to change her position to -12 feet?
 - (A) -42 ft (C) 18 ft
 - (B) -18 ft (D) 42 ft
- A bank offers an annual simple interest rate of 8% on home improvement loans. Tobias borrowed \$17,000 over a period of 2 years. How much did he repay altogether?
 - (A) \$1,360 (C) \$18,360
 - (B) \$2,720 (D) \$19,720

Mini-Task

- The granola Summer buys used to cost \$6.00 per pound, but it has been marked up 15%.
 - a. How much did it cost Summer to buy 2.6 pounds of granola at the old price?

 - b. How much does it cost her to buy 2.6 pounds of granola at the new price?

 - c. Suppose Summer buys 3.5 pounds of granola. How much more does it cost at the new price than at the old price?

MODULE 4 Rates and Proportionality



ESSENTIAL QUESTION

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

EXAMPLE 1

A store sells onions by the pound. Is the relationship between the cost of an amount of onions and the number of pounds proportional? If so, write an equation for the relationship, and represent the relationship on a graph.

Number of pounds	2	5	6
Cost (\$)	3.00	7.50	9.00

Write the rates.

$$\frac{\text{cost}}{\text{number of pounds}} : \frac{\$3.00}{2 \text{ pounds}} = \frac{\$1.50}{1 \text{ pound}}$$

$$\frac{\$7.50}{5 \text{ pounds}} = \frac{\$1.50}{1 \text{ pound}}$$

$$\frac{\$9.00}{6 \text{ pounds}} = \frac{\$1.50}{1 \text{ pound}}$$

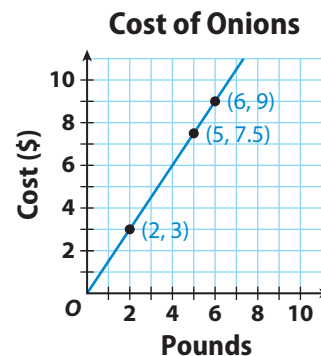
The rates are constant, so the relationship is proportional.

The constant rate of change is \$1.50 per pound, so the constant of proportionality is 1.5. Let x represent the number of pounds and y represent the cost.

The equation for the relationship is $y = 1.5x$.

Plot the ordered pairs (pounds, cost): (2, 3), (5, 7.5), and (6, 9).

Connect the points with a line.



Key Vocabulary

complex fraction (*fracción compleja*)

constant of proportionality (*constante de proporcionalidad*)

proportion (*proporción*)

proportional relationship (*relación proporcional*)

rate of change (*tasa de cambio*)

unit rate (*tasa unitaria*)

EXERCISES

1. Steve uses $\frac{8}{9}$ gallon of paint to paint 4 identical birdhouses. How many gallons of paint does he use for each birdhouse?

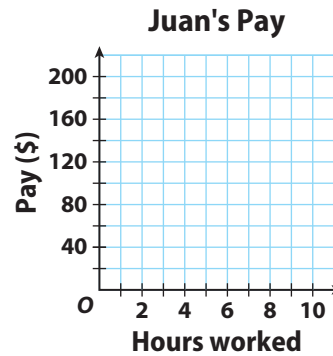
(Lesson 4.1) _____

2. Ron walks 0.5 mile on the track in 10 minutes. Stevie walks 0.25 mile on the track in 6 minutes. Find the unit rate for each walker in miles per hour. Who is the faster walker?

(Lesson 4.1) _____

3. The table below shows the proportional relationship between Juan's pay and the hours he works. Complete the table. Plot the data and connect the points with a line. (Lessons 4.2, 4.3)

Hours worked	2		5	6
Pay (\$)	40	80		



MODULE 5 Proportions and Percent

ESSENTIAL QUESTION

How can you use proportions and percent to solve real-world problems?

EXAMPLE 1

Donata had a 25-minute commute from home to work. Her company moved, and now her commute to work is 33 minutes long. Does this situation represent an increase or a decrease? Find the percent increase or decrease in her commute to work.

This situation represents an increase. Find the percent increase.

amount of change = greater value – lesser value

$$33 - 25 = 8$$

$$\text{percent increase} = \frac{\text{amount of change}}{\text{original amount}}$$

$$\frac{8}{25} = 0.32 = 32\%$$

Donata's commute increased by 32%.

- Michelle purchased 25 audio files in January. In February she purchased 40 audio files. Find the percent increase. (Lesson 5.1) _____
- Sam's dog weighs 72 pounds. The vet suggests that for the dog's health, its weight should decrease by 12.5 percent. According to the vet, what is a healthy weight for the dog? (Lesson 5.1) _____
- The original price of a barbecue grill is \$79.50. The grill is marked down 15%. What is the sale price of the grill? (Lesson 5.2) _____
- A sporting goods store marks up the cost s of soccer balls by 250%. Write an expression that represents the retail cost of the soccer balls. The store buys soccer balls for \$5.00 each. What is the retail price of the soccer balls? (Lesson 5.2) _____

Key Vocabulary

percent decrease

(porcentaje de disminución)

percent increase (porcentaje de aumento)

principal (capital)

simple interest (interés simple)

Unit 2 Performance Tasks

1. **CAREERS IN MATH** **Bicycle Tour Operator** Viktor is a bike tour operator and needs to replace two of his touring bikes. He orders two bikes from the sporting goods store for a total of \$2,000 and pays using his credit card. When the bill arrives, he reads the following information:

Balance: \$2,000

Annual interest rate: 14.9%

Minimum payment due: \$40

Late fee: \$10 if payment not received by 3/1/2013

- a. To keep his good credit, Viktor promptly sends in a minimum payment of \$40. When the next bill arrives, it looks a lot like the previous bill.

Balance: \$1,984.34

Annual interest rate: 14.9%

Minimum payment due: \$40

Late fee: \$10 if payment not received by 4/1/2013

Explain how the credit card company calculated the new balance. Notice that the given interest rate is annual, but the payment is monthly.

- b. Viktor was upset about the new bill, so he decided to send in \$150 for his April payment. The minimum payment on his bill is calculated as 2% of the balance (rounded to the nearest dollar) or \$20, whichever is greater. Fill out the details for Viktor's new bill.

Balance: _____

Annual interest rate: _____

Minimum payment due: _____

Late fee: \$10 if payment not received by _____

- c. Viktor's bank offers a credit card with an introductory annual interest rate of 9.9%. He can transfer his current balance for a fee of \$40. After one year, the rate will return to the bank's normal rate, which is 13.9%. The bank charges a late fee of \$15. Give two reasons why Viktor should transfer the balance, and two reasons why he should not.

Unit 2 Performance Tasks (cont'd)

2. The table below shows how far several animals can travel at their maximum speeds in a given time.

Animal Distances		
Animal	Distance traveled (ft)	Time (s)
elk	33	$\frac{1}{2}$
giraffe	115	$2\frac{1}{2}$
zebra	117	2

- a. Write each animal's speed as a unit rate in feet per second.

- b. Which animal has the fastest speed?

- c. How many miles could the fastest animal travel in 2 hours if it maintained the speed you calculated in part a? Use the formula $d = rt$ and round your answer to the nearest tenth of a mile. Show your work.

- d. The data in the table represents how fast each animal can travel at its maximum speed. Is it reasonable to expect the animal from part b to travel that distance in 2 hours? Explain why or why not.

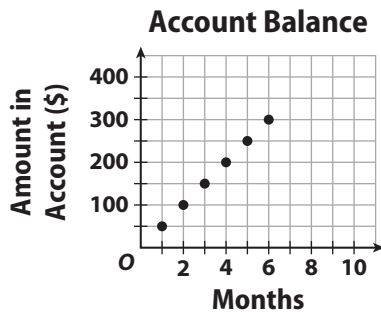


Assessment Readiness



Selected Response

- If the relationship between distance y in feet and time x in seconds is proportional, which rate is represented by $\frac{y}{x} = 0.6$?
 - 3 feet in 5 s
 - 3 feet in 9 s
 - 10 feet in 6 s
 - 18 feet in 3 s
- The Baghrams make regular monthly deposits in a savings account. The graph shows the relationship between the number x of months and the amount y in dollars in the account.



What is the equation for the deposit?

- $\frac{y}{x} = \$25/\text{month}$
- $\frac{y}{x} = \$40/\text{month}$
- $\frac{y}{x} = \$50/\text{month}$
- $\frac{y}{x} = \$75/\text{month}$



Read graphs and diagrams carefully. Look at the labels for important information.

- What is the decimal form of $-4\frac{7}{8}$?
 - 4.9375
 - 4.875
 - 4.75
 - 4.625
- Find the percent change from 72 to 90.
 - 20% decrease
 - 20% increase
 - 25% decrease
 - 25% increase
- A store had a sale on art supplies. The price p of each item was marked down 60%. Which expression represents the new price?

<ol style="list-style-type: none">$0.4p$	<ol style="list-style-type: none">$1.4p$
<ol style="list-style-type: none">$0.6p$	<ol style="list-style-type: none">$1.6p$
- Clarke borrows \$16,000 to buy a car. He pays simple interest at an annual rate of 6% over a period of 3.5 years. How much does he pay altogether?
 - \$18,800
 - \$19,360
 - \$19,920
 - \$20,480
- To which set or sets does the number 37 belong?
 - integers only
 - rational numbers only
 - integers and rational numbers only
 - whole numbers, integers, and rational numbers

8. In which equation is the constant of proportionality 5?

- (A) $x = 5y$
- (B) $y = 5x$
- (C) $y = x + 5$
- (D) $y = 5 - x$

9. Suri earns extra money by dog walking. She charges \$6.25 to walk a dog once a day 5 days a week and \$8.75 to walk a dog once a day 7 days a week. Which equation represents this relationship?

- (A) $y = 7x$
- (B) $y = 5x$
- (C) $y = 2.50x$
- (D) $y = 1.25x$

10. Randy walks $\frac{1}{2}$ mile in each $\frac{1}{5}$ hour. How far will Randy walk in one hour?

- (A) $\frac{1}{2}$ miles
- (B) 2 miles
- (C) $2\frac{1}{2}$ miles
- (D) 5 miles

11. On a trip to Spain, Sheila bought a piece of jewelry that cost \$56.75. She paid for it with her credit card, which charges a foreign transaction fee of 3%. How much was the foreign transaction fee?

- (A) \$0.17
- (B) \$1.07
- (C) \$1.70
- (D) \$17.00

12. A baker is looking for a recipe that has the lowest unit rate for flour per batch of muffins. Which recipe should she use?

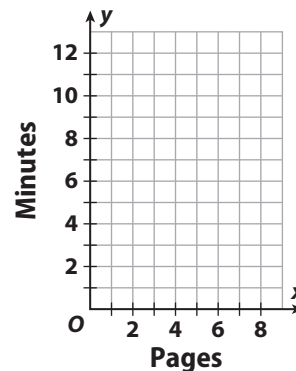
- (A) $\frac{1}{2}$ cup flour for $\frac{2}{3}$ batch
- (B) $\frac{2}{3}$ cup flour for $\frac{1}{2}$ batch
- (C) $\frac{3}{4}$ cup flour for $\frac{2}{3}$ batch
- (D) $\frac{1}{3}$ cup flour for $\frac{1}{4}$ batch

Mini-Task

13. Kevin was able to type 2 pages in 5 minutes, 3 pages in 7.5 minutes, and 5 pages in 12.5 minutes.

a. Make a table of the data.

b. Graph the relationship between the number of pages typed and the number of minutes.



c. Explain how to use the graph to find the unit rate.
