Name_____ Date _____

Simplify.

1. $\dfrac{3}{18}$

2. $\dfrac{4}{6}$

3. $\dfrac{12}{60}$

4. $\dfrac{14}{28}$

5. $\dfrac{16}{36}$

6. $\dfrac{40}{50}$

Are the fractions equivalent?

7. $\dfrac{3}{8} \stackrel{?}{=} \dfrac{6}{11}$

8. $\dfrac{4}{10} \stackrel{?}{=} \dfrac{16}{40}$

9. $\dfrac{22}{32} \stackrel{?}{=} \dfrac{11}{16}$

10. $\dfrac{63}{72} \stackrel{?}{=} \dfrac{7}{9}$

11. You see 58 birds while on a bird watching tour. Of those birds, you see 12 hawks. Write and simplify the fraction of hawks you see.

Chapter 14 **Fair Game Review** (continued)

Solve the equation. Check your solution.

12. $\dfrac{d}{12} = -4$

13. $-7 = \dfrac{x}{-3}$

14. $\dfrac{1}{8}n = 5$

15. $6a = -54$

16. $10 = -2k$

17. $2.7 = -0.9y$

18. $-23.4 = -1.3w$

19. $\dfrac{1}{15}z = 6$

20. You and three friends spend \$35 on tickets at the movies. Write and solve an equation to find the price p of one ticket.

Name_____ Date _____

14.1 Ratios and Rates

For use with Activity 14.1

Essential Question   How do rates help you describe real-life problems?

---

1   ACTIVITY: Finding Reasonable Rates

Work with a partner.

   a. Match each description with a verbal rate.

   b. Match each verbal rate with a numerical rate.

   c. Give a reasonable numerical rate for each description. Then give an unreasonable rate.

Description	*Verbal Rate*	*Numerical Rate*
Your running rate in a 100-meter dash	Dollars per year	$= \dfrac{\boxed{} \text{ in.}}{\text{yr}}$
The fertilization rate for an apple orchard	Inches per year	$= \dfrac{\boxed{} \text{ lb}}{\text{acre}}$
The average pay rate for a professional athlete	Meters per second	$= \dfrac{\$\,\boxed{}}{\text{yr}}$
The average rainfall rate in a rainforest	Pounds per acre	$= \dfrac{\boxed{} \text{ m}}{\text{sec}}$

---

2   ACTIVITY: Simplifying Expressions That Contain Fractions

Work with a partner. Describe a situation where the given expression may apply. Show how you can rewrite each expression as a division problem. Then simplify and interpret your result.

a. $\dfrac{\frac{1}{2}\,\text{c}}{4 \text{ fl oz}}$

b. $\dfrac{2 \text{ in.}}{\frac{3}{4}\,\text{sec}}$

14.1 Ratios and Rates (continued)

c. $\dfrac{\dfrac{3}{8} \text{ c sugar}}{\dfrac{3}{5} \text{ c flour}}$

d. $\dfrac{\dfrac{5}{6} \text{ gal}}{\dfrac{2}{3} \text{ sec}}$

---

3 ACTIVITY: Using Ratio Tables to Find Equivalent Rates

Work with a partner. A communications satellite in orbit travels about 18 miles every 4 seconds.

a. Identify the rate in this problem.

b. Recall that you can use *ratio tables* to find and organize equivalent ratios and rates. Complete the ratio table below.

Time (seconds)	4	8	12	16	20
Distance (miles)					

c. How can you use a ratio table to find the speed of the satellite in miles per minute? miles per hour?

d. How far does the satellite travel in 1 second? Solve this problem (1) by using a ratio table and (2) by evaluating a quotient.

e. How far does the satellite travel in $\dfrac{1}{2}$ second? Explain your steps.

Name_____ Date _____

4 **ACTIVITY:** Unit Analysis

Work with a partner. Describe a situation where the product may apply. Then find each product and list the units.

a. $10 \text{ gal} \times \dfrac{22 \text{ mi}}{\text{gal}}$

b. $\dfrac{7}{2} \text{ lb} \times \dfrac{\$3}{\frac{1}{2}\text{lb}}$

c. $\dfrac{1}{2} \text{ sec} \times \dfrac{30 \text{ ft}^2}{\text{sec}}$

What Is Your Answer?

5. IN YOUR OWN WORDS How do rates help you describe real-life problems? Give two examples.

6. To estimate the annual salary for a given hourly pay rate, multiply by 2 and insert "000" at the end.

Sample: $10 per hour is about $20,000 per year.

a. Explain why this works. Assume the person is working 40 hours a week.

b. Estimate the annual salary for an hourly pay rate of $8 per hour.

c. You earn $1 million per month. What is your annual salary?

"We had someone apply for the job. He says he would like $1 million a month, but will settle for $8 an hour."

d. Why is the cartoon funny?

Name _____ Date _____

14.1 Practice
For use after Lesson 14.1

Write the ratio as a fraction in simplest form.

1. 8 to 14

2. 36 even : 12 odd

3. 42 vanilla to 48 chocolate

Find the unit rate.

4. $2.50 for 5 ounces

5. 15 degrees in 2 hours

6. 183 miles in 3 hours

Use the ratio table to find the unit rate with the specified units.

7. pounds per box

Boxes	0	1	2	3
Pounds	0	30	60	90

8. cost per notebook

Notebooks	0	5	10	15
Cost (dollars)	0	9.45	18.90	28.35

9. You create 15 centerpieces for a party in 5 hours.

a. What is the unit rate?

b. How long will it take you to make 42 centerpieces?

Name_____ Date _____

14.2 **Proportions**
For use with Activity 14.2

Essential Question How can proportions help you decide when things are "fair"?

1 **ACTIVITY:** Determining Proportions

Work with a partner. Tell whether the two ratios are equivalent. If they are not equivalent, change the next day to make the ratios equivalent. Explain your reasoning.

a. On the first day, you pay $5 for 2 boxes of popcorn. The next day, you pay $7.50 for 3 boxes.

First Day   Next Day

$$\frac{\$5.00}{2 \text{ boxes}} \overset{?}{=} \frac{\$7.50}{3 \text{ boxes}}$$

b. On the first day, it takes you $3\frac{1}{2}$ hours to drive 175 miles.

The next day, it takes you 5 hours to drive 200 miles.

First Day Next Day

$$\frac{3\frac{1}{2} \text{ h}}{175 \text{ mi}} \overset{?}{=} \frac{5 \text{ h}}{200 \text{ mi}}$$

c. On the first day, you walk 4 miles and burn 300 calories.

The next day, you walk $3\frac{1}{3}$ miles and burn 250 calories.

First Day   Next Day

$$\frac{4 \text{ mi}}{300 \text{ cal}} \overset{?}{=} \frac{3\frac{1}{3} \text{ mi}}{250 \text{ cal}}$$

d. On the first day, you paint 150 square feet in $2\frac{1}{2}$ hours.

The next day, you paint 200 square feet in 4 hours.

First Day   Next Day

$$\frac{150 \text{ ft}^2}{2\frac{1}{2} \text{ h}} \overset{?}{=} \frac{200 \text{ ft}^2}{4 \text{ h}}$$

14.2 **Proportions** (continued)

2 **ACTIVITY:** Checking a Proportion

Work with a partner.

a. It is said that "one year in a dog's life is equivalent to seven years in a human's life." Explain why Newton thinks he has a score of 105 points. Did he solve the proportion correctly?

$$\frac{1 \text{ year}}{7 \text{ years}} \overset{?}{=} \frac{15 \text{ points}}{105 \text{ points}}$$

Hey, at least he knows his proportions.

"I got 15 on my online test. That's 105 in dog points! Isn't that an A+?"

b. If Newton thinks his score is 98 points, how many points does he actually have? Explain your reasoning.

3 **ACTIVITY:** Determining Fairness

Work with a partner. Write a ratio for each sentence. Compare the ratios. If they are equal, then the answer is "It is fair." If they are not equal, then the answer is "It is not fair." Explain your reasoning.

a.

| You pay $184 for 2 tickets to a concert. | **&** | I pay $266 for 3 tickets to the same concert. |

➡ **Is this fair?**

14.2 **Proportions** (continued)

b.

| You get 75 points for answering 15 questions correctly. | **&** | I get 70 points for answering 14 questions correctly. | ➡ | **Is this fair?** |

c.

| You trade 24 football cards for 15 baseball cards. | **&** | I trade 20 football cards for 32 baseball cards. | ➡ | **Is this fair?** |

What Is Your Answer?

4. Find a recipe for something you like to eat. Then show how two of the ingredient amounts are proportional when you double or triple the recipe.

5. IN YOUR OWN WORDS How can proportions help you decide when things are "fair"? Give an example.

Name_____ Date _____

Tell whether the ratios form a proportion.

1. $\dfrac{1}{5}, \dfrac{5}{15}$

2. $\dfrac{2}{3}, \dfrac{12}{18}$

3. $\dfrac{15}{2}, \dfrac{4}{30}$

4. $\dfrac{56}{21}, \dfrac{8}{3}$

5. $\dfrac{5}{8}, \dfrac{62.5}{100}$

6. $\dfrac{17}{20}, \dfrac{90.1}{106}$

7. $\dfrac{3.2}{4}, \dfrac{16}{24}$

8. $\dfrac{34}{50}, \dfrac{6.8}{10}$

Tell whether the two rates form a proportion.

9. 28 points in 3 games;
112 points in 12 games

10. 32 notes in 4 measures;
12 notes in 2 measures

11. You can type 105 words in two minutes. Your friend can type 210 words in four minutes. Are these rates proportional? Explain.

Name_____ Date _____

Use a graph to tell whether *x* and *y* are in a proportional relationship.

1.

x	2	3	4	5
y	5	7	9	11

2.

x	1	2	3	4
y	3	6	9	12

3.

x	1	2	3	4
y	2.4	4.8	7.2	9.6

4.

x	2	4	6	8
y	2	3	4	5

Name _____ Date _____

Interpret each plotted point in the graph of the proportional relationship.

5.

Car

Distance (miles)

(2, 120)

(1, 60)

(0, 0)

0 1 2 3 4 5 6 7 *x*

Hours

6.

Shrimp

Price (dollars)

(7, 70)

(4, 40)

(0, 0)

0 1 2 3 4 5 6 7 *x*

Pounds

7.

Email

Number of Emails

(4, 60)

(3, 45)

(0, 0)

0 1 2 3 4 5 6 7 *x*

Days

8.

Blueberry Pie

Blueberries (cups)

(4, 24)

(2, 12)

(0, 0)

0 1 2 3 4 5 6 7 *x*

Pies

Name_____ Date _____
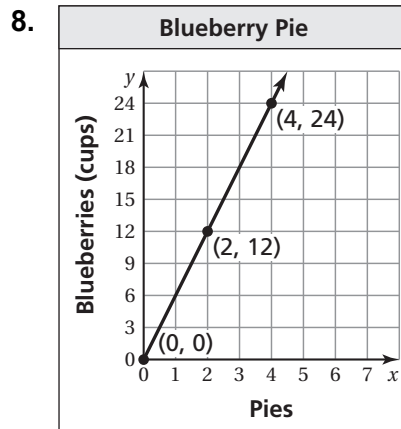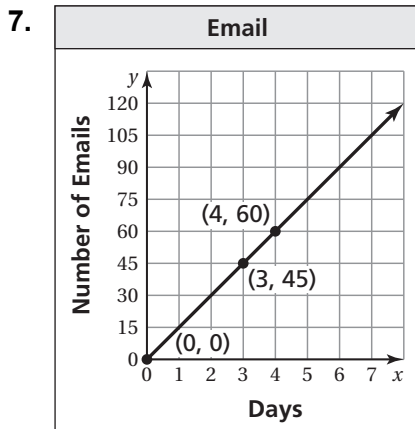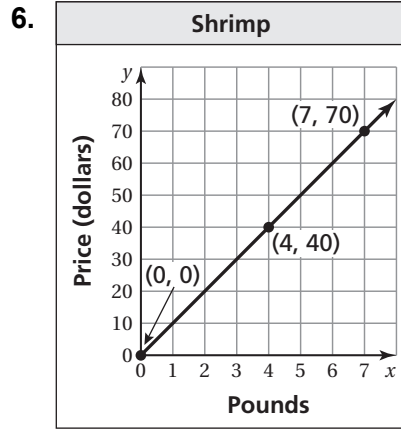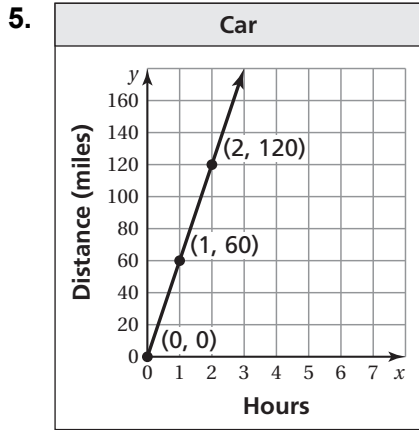
14.3 Writing Proportions
For use with Activity 14.3

Essential Question How can you write a proportion that solves a problem in real life?

1 ACTIVITY: Writing Proportions

Work with a partner. A rough rule for finding the correct bat length is "the bat length should be half of the batter's height." So, a 62-inch tall batter uses a bat that is 31 inches long. Write a proportion to find the bat length for each given batter height.

a. 58 inches   **b.** 60 inches   **c.** 64 inches

2 ACTIVITY: Bat Lengths

Work with a partner. Here is a more accurate table for determining the bat length for a batter. Find all the batter heights and corresponding weights for which the rough rule in Activity 1 is exact.

	Height of Batter (inches)							
	45–48	49–52	53–56	57–60	61–64	65–68	69–72	Over 72
Under 61	28	29	29					
61–70	28	29	30	30				
71–80	28	29	30	30	31			
81–90	29	29	30	30	31	32		
91–100	29	30	30	31	31	32		
101–110	29	30	30	31	31	32		
111–120	29	30	30	31	31	32		
121–130	29	30	30	31	32	33	33	
131–140	30	30	31	31	32	33	33	
141–150	30	30	31	31	32	33	33	
151–160	30	31	31	32	32	33	33	33
161–170		31	31	32	32	33	33	34
171–180				32	33	33	34	34
Over 180					33	33	34	34

Weight of Batter (pounds)

14.3 **Writing Proportions** (continued)

3 ACTIVITY: Writing Proportions

Work with a partner. The batting average of a baseball player is the number of "hits" divided by the number of "at bats."

$$\text{batting average} = \frac{\text{hits } (H)}{\text{at Bats } (A)}$$

A player whose batting average is 0.250 is said to be "batting 250."
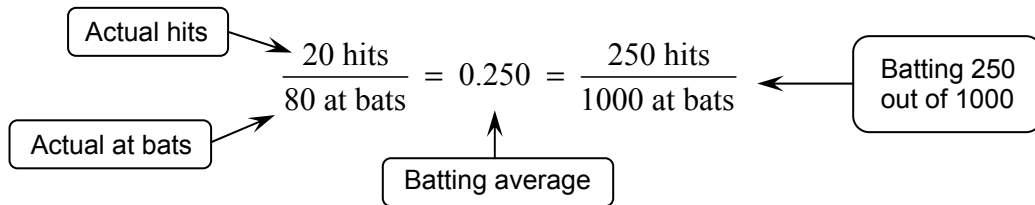
Write a proportion to find how many hits H a player needs to achieve the given batting average. Then solve the proportion.

a. 50 times at bat;
batting average is 0.200.

b. 84 times at bat;
batting average is 0.250.

c. 80 times at bat;
batting average is 0.350.

d. 1 time at bat;
batting average is 1.000.

14.3 **Writing Proportions** (continued)

What Is Your Answer?

4. **IN YOUR OWN WORDS** How can you write a proportion that solves a problem in real life?

5. Two players have the same batting average.

	At Bats	Hits	Batting Average
Player 1	132	45	
Player 2	132	45	

Player 1 gets four hits in the next five at bats. Player 2 gets three hits in the next three at bats.

a. Who has the higher batting average?

b. Does this seem fair? Explain your reasoning.

Name _____ Date _____

Write a proportion to find how many points a student needs to score on the test to get the given score.

1. test worth 50 points; test score of 84%

2. test worth 75 points; test score of 96%

Use the table to write a proportion.

3.

	Trip 1	Trip 2
Miles	104	78
Gallons	4	g

4.

	Tree 1	Tree 2
Inches	15	x
Years	4	3

Solve the proportion.

5. $\dfrac{1}{3} = \dfrac{x}{12}$

6. $\dfrac{5}{9} = \dfrac{25}{y}$

7. $\dfrac{26}{z} = \dfrac{13}{22}$

8. $\dfrac{b}{30} = \dfrac{2.6}{1.5}$

9. A local Humane Society houses 300 animals. The ratio of cats to all animals is 7 : 15.

   a. Write a proportion that gives the number of cats c.

   b. How many cats are in the Humane Society?

Name_____ Date _____

Essential Question How can you use ratio tables and cross products to solve proportions?

1 ACTIVITY: Solving a Proportion in Science

Work with a partner. You can use ratio tables to determine the amount of a compound (like salt) that is dissolved in a solution. Determine the unknown quantity. Explain your procedure.

a. **Salt Water**

Salt Water	1 L	3 L
Salt	250 g	x g
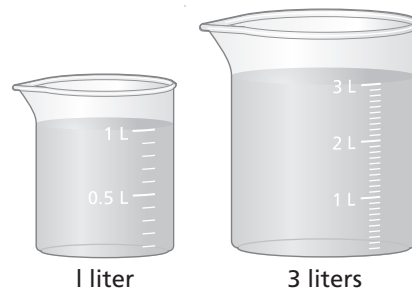
l liter   3 liters

There are _____ grams of salt in the 3-liter solution.

b. **White Glue Solution**

Water	$\frac{1}{2}$ cup	1 cup
White Glue	$\frac{1}{2}$ cup	x cups
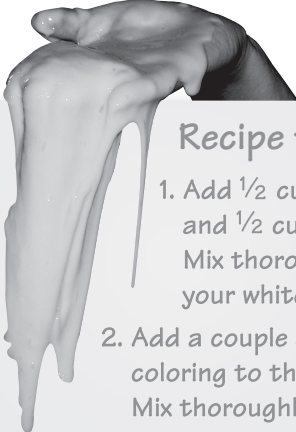
c. **Borax Solution**

Borax	1 tsp	2 tsp
Water	1 cup	x cups

14.4 **Solving Proportions** (continued)

d. Slime (See recipe.)

Borax Solution	$\dfrac{1}{2}$ cup	1 cup
White Glue Solution	y cups	x cups

Recipe for **SLIME**

1. Add ½ cup of water and ½ cup white glue. Mix thoroughly. This is your white glue solution.

2. Add a couple drops of food coloring to the glue solution. Mix thoroughly.

3. Add 1 teaspoon of borax to 1 cup of water. Mix thoroughly. This is your borax solution (about 1 cup).

4. Pour the borax solution and the glue solution into a separate bowl.

5. Place the slime that forms in a plastic bag and squeeze the mixture repeatedly to mix it up.

2 **ACTIVITY:** The Game of Criss Cross

Preparation:

- Cut index cards to make 48 playing cards.

- Write each number on a card.
  1, 1, 1, 2, 2, 2, 3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6, 7, 7, 7, 8, 8, 8, 9, 9, 9, 10, 10, 10, 12, 12, 12, 13, 13, 13, 14, 14, 14, 15, 15, 15, 16, 16, 16, 18, 20, 25

- Make a copy of the game board.

CRISS CROSS

To play:

- Play with a partner.

- Deal 8 cards to each player.

- Begin by drawing a card from the remaining cards. Use four of your cards to try and form a proportion.

- Lay the four cards on the game board. If you form a proportion, then say "Criss Cross." You earn 4 points. Place the four cards in a discard pile. Now it is your partner's turn.

- If you cannot form a proportion, then it is your partner's turn.

- When the original pile of cards is empty, shuffle the cards in the discard pile. Start again.

- The first player to reach 20 points wins.
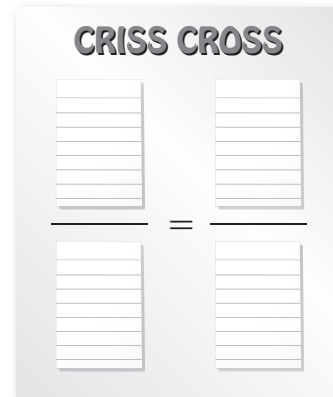
14.4 **Solving Proportions** (continued)

What Is Your Answer?

3. **IN YOUR OWN WORDS** How can you use ratio tables and cross products to solve proportions? Give an example.

4. **PUZZLE** Use each number once to form three proportions.

| 1 | 2 | 10 | 4 | 12 | 20 |

| 15 | 5 | 16 | 6 | 8 | 3 |

Name _____ Date _____

14.4 Practice
For use after Lesson 14.4

Use multiplication to solve the proportion.

1. $\dfrac{a}{40} = \dfrac{3}{10}$

2. $\dfrac{6}{11} = \dfrac{c}{77}$

3. $\dfrac{b}{65} = \dfrac{7}{13}$

Use the Cross Products Property to solve the proportion.

4. $\dfrac{k}{6} = \dfrac{8}{16}$

5. $\dfrac{5.4}{7} = \dfrac{27}{h}$

6. $\dfrac{8}{11} = \dfrac{4}{y+2}$

Write and solve a proportion to complete the statement.

7. 42 in. = _____ cm

8. 12.6 kg ≈ _____ lb

9. 3 oz ≈ _____ g

10. A cell phone company charges \$5 for 250 text messages. How much does the company charge for 300 text messages?

Name_____ Date _____

Essential Question How can you compare two rates graphically?

1 ACTIVITY: Comparing Unit Rates

Work with a partner. The table shows the maximum speeds of several animals.

   a. Find the missing speeds. Round your answers to the nearest tenth.

   b. Which animal is fastest? Which animal is slowest?

   c. Explain how you convert between the two units of speed.

Animal	Speed (miles per hour)	Speed (feet per second)
Antelope	61.0	
Black mamba snake		29.3
Cheetah		102.6
Chicken		13.2
Coyote	43.0	
Domestic pig		16.0
Elephant		36.6
Elk		66.0
Giant tortoise	0.2	
Giraffe	32.0	
Gray fox		61.6
Greyhound	39.4	
Grizzly bear		44.0
Human		41.0
Hyena	40.0	
Jackal	35.0	
Lion		73.3
Peregrine falcon	200.0	
Quarter horse	47.5	
Spider		1.76
Squirrel	12.0	
Thomson's gazelle	50.0	
Three-Toed sloth		0.2
Tuna	47.0	

Name _____ Date _____

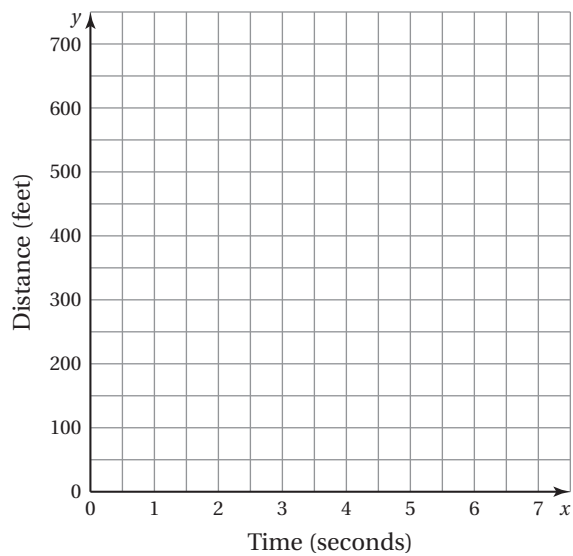**2 ACTIVITY:** Comparing Two Rates Graphically

Work with a partner. A cheetah and a Thomson's gazelle run at maximum speeds.

a. Use the table in Activity 1 to calculate the missing distances.

	Cheetah	Gazelle
Time (seconds)	Distance (feet)	Distance (feet)
0		
1		
2		
3		
4		
5		
6		
7		

b. Use the table to write ordered pairs. Then plot the ordered pairs and connect the points for each animal. What do you notice about the graphs?

c. Which graph is steeper? The speed of which animal is greater?

14.5 **Slope** (continued)

What Is Your Answer?

3. **IN YOUR OWN WORDS** How can you compare two rates graphically? Explain your reasoning. Give some examples with your answer.

4. **REPEATED REASONING** Choose 10 animals from Activity 1.

   a. Make a table for each animal similar to the table in Activity 2.

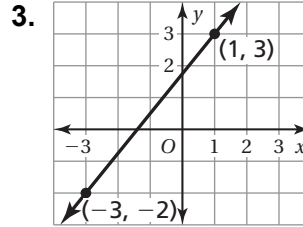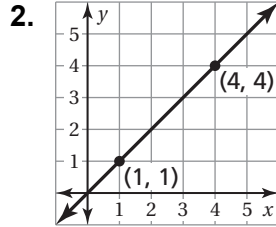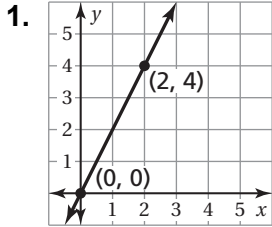   **b.** Sketch a graph of the distances for each animal.
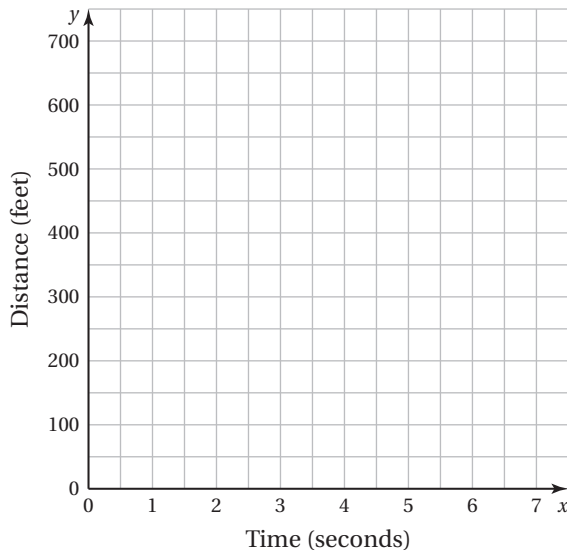
   c. Compare the steepness of the 10 graphs. What can you conclude?

Name _____ Date _____

14.5 **Practice**
For use after Lesson 14.5

Find the slope of the line.

1.

2.

3.

Graph the data. Then find and interpret the slope of the line through the points.

4.

Minutes, *x*	0	1	3	5
Pages, *y*	0	1.5	4.5	7.5

5.

Miles, *x*	0	1	2	3
Calories, *y*	0	135	270	405
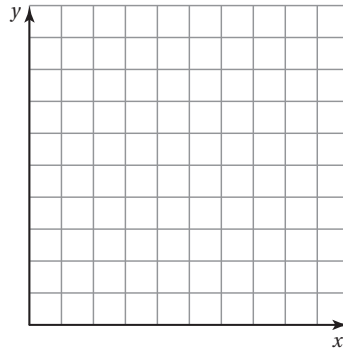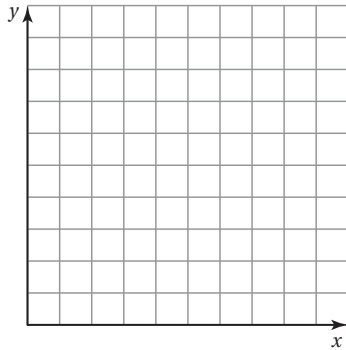
6. By law, the maximum slope of a wheelchair ramp is $\dfrac{1}{12}$.

   a. A ramp is designed that is 4 feet high and has a horizontal length of 50 feet. Does this ramp meet the law? Explain.

   b. What could be adjusted on an unacceptable ramp so that it meets the law?

Name_____ Date _____

14.6 Direct Variation
For use with Activity 14.6

Essential Question How can you use a graph to show the relationship between two quantities that vary directly? How can you use an equation?

1 ACTIVITY: Math in Literature

Gulliver's Travels was written by Jonathan Swift and published in 1726. Gulliver was shipwrecked on an island in Lilliput, where the people were only 6 inches tall. When the Lilliputians decided to make a shirt for Gulliver, a Lilliputian tailor stated that he could determine Gulliver's measurements by simply measuring the distance around Gulliver's thumb. He said "Twice around the thumb equals once around the wrist. Twice around the wrist is once around the neck. Twice around the neck is once around the waist."

Work with a partner. Use the tailor's statement to complete the table.

| Thumb, *t*	Wrist, *w*	Neck, *n*	Waist, *x*
0 in.			
1 in.			
	4 in.		
		12 in.	
			32 in.
	10 in.		

14.6 **Direct Variation** (continued)

2 **ACTIVITY:** Drawing a Graph

Work with a partner. Use the information from Activity 1.

a. In your own words, describe the relationship between t and w.

b. Use the table to write ordered pairs (t, w). Then plot the ordered pairs.

c. What do you notice about the graph of the ordered pairs?

d. Choose two points and find the slope of the line between them.

e. The quantities t and w are said to *vary directly*. An equation that describes the relationship is $w = $ _____ t.
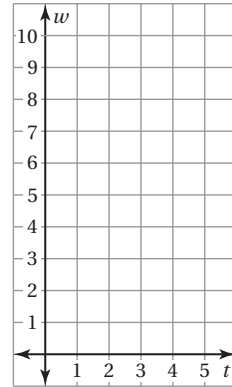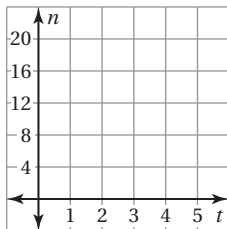
3 **ACTIVITY:** Drawing a Graph and Writing an Equation

Work with a partner. Use the information from Activity 1 to draw a graph of the relationship. Write an equation that describes the relationship between the two quantities.
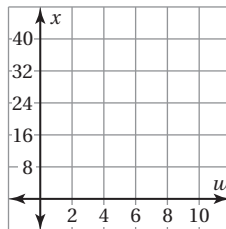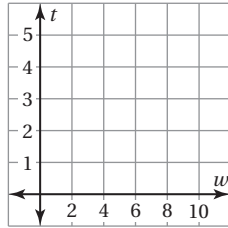
a. Thumb t and neck n

$$\left(n = \boxed{} \; t \right)$$

b. Wrist w and waist x

$$\left(x = \boxed{} \; w \right)$$

14.6 **Direct Variation** (continued)

c. Wrist w and thumb t

$$\left(t = \boxed{} w \right)$$

d. Waist x and wrist w

$$\left(w = \boxed{} x \right)$$
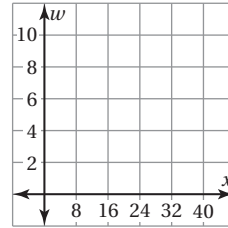
What Is Your Answer?

4. IN YOUR OWN WORDS How can you use a graph to show the relationship between two quantities that vary directly? How can you use an equation?

5. STRUCTURE How are all the graphs in Activity 3 alike?

6. Give a real-life example of two variables that vary directly.

7. Work with a partner. Use string to find the distance around your thumb, wrist, and neck. Do your measurements agree with the tailor's statements in *Gulliver's Travels*? Explain your reasoning.

Name _____ Date _____

Tell whether *x* and *y* show direct variation. Explain your reasoning. If so, find *k*.

1.

x	1	2	3	4
y	3	6	9	12

2.

x	−1	0	1	2
y	1	3	7	13

3.

x	0	2	4	6
y	8	5	2	−1

4. $y + 2 = x$

5. $3y = x$

6. $\dfrac{y}{x} = 4$

The variables *x* and *y* vary directly. Use the values to find the constant of proportionality and write an equation that relates *x* and *y*.

7. $y = 8; x = 2$

8. $y = 14, x = 16$

9. $y = 25, x = 35$

10. The table shows the cups *c* of dog food needed to feed a dog that weighs *p* pounds. Graph the data. Tell whether *p* and *c* show direct variation. If so, write an equation that represents the line.

Pounds, *p*	10	20	40	70
Food, *c*	$\dfrac{3}{4}$	$1\dfrac{1}{4}$	2	$2\dfrac{3}{4}$