

Unit 3

Patterns, Relationships, and Algebraic Thinking

Focal Point

Describe direct proportional relationships involving number, geometry, measurement, and probability.

CHAPTER 6 Ratio, Proportion, and Functions

BIG Idea Solve problems involving direct proportional relationships.

BIG Idea Use letters as variables in mathematical expressions to describe how one quantity changes when a related quantity changes.

BIG Idea Use letters to represent an unknown in an equation.

CHAPTER 7 Percent and Probability

BIG Idea Solve problems involving direct proportional relationships.

BIG Idea Use experimental and theoretical probability to make predictions.





Cross-Curricular Project

Math and Physical Education

Take Me Out To The Ballgame Baseball, one of America's favorite pastimes, is overflowing with mathematics. The National Baseball Statisticians Organization has asked you to step up to the plate! They need you to analyze several seasons of baseball data. You'll also be asked to create a scale drawing of a professional baseball field. The game is about to begin. Let's see if you can hit a home run!

Math  **online** Log on to tx.msmath1.com to begin.

Ratio, Proportion, and Functions

Knowledge and Skills



- Solve problems involving direct proportional relationships. **TEKS 6.3**
- Use letters to represent an unknown in an equation. **TEKS 6.5**

Key Vocabulary

proportion (p. 289)

proportional (p. 289)

ratio (p. 274)

unit rate (p. 275)

Real-World Link

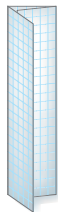
Oil Fields Discovered in 1901, the Spindletop oil field in southeastern Texas marked the birth of the modern petroleum industry. It flowed an estimated 100,000 barrels of oil per day.

FOLDABLES

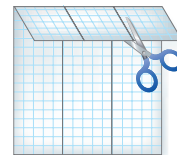
Study Organizer

Ratio, Proportion, and Functions Make this Foldable to help you organize your notes. Begin with a piece of graph paper.

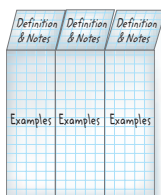
- 1 Fold** one sheet of graph paper in thirds lengthwise.



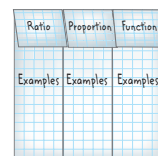
- 2 Unfold** lengthwise and fold one-fourth down widthwise. Cut to make three tabs as shown.



- 3 Unfold** the tabs. Label the paper as shown.



- 4 Refold** the tabs and label as shown.



GET READY for Chapter 6

Diagnose Readiness You have two options for checking Prerequisite Skills.

Option 2



Take the Online Readiness Quiz at tx.msmath1.com.

Option 1

Take the Quick Quiz below. Refer to the Quick Review for help.

QUICK Quiz

Write each fraction in simplest form. (Used in Lessons 6-1 through 6-4)

- $\frac{32}{48}$
- $\frac{7}{28}$
- $\frac{15}{25}$
- $\frac{30}{35}$

5. **TRAVEL** An airplane has flown 260 miles out of a total trip of 500 miles. What fraction, in simplest form, of the trip has been completed?

Solve each equation. (Used in Lesson 6-4)

- $16m = 48$
- $5x = 40$
- $15p = 150$
- $3n = 15$
- $7y = 56$
- $12z = 72$
- $8h = 96$
- $10e = 90$

Find the next three values in each pattern. (Used in Lesson 6-6)

- 4, 7, 10, 13, ...
- 62, 66, 70, 74, ...
- 1.8, 2.4, 3.0, 3.6, ...
- MUSIC** Mario played the drums for 30 minutes on Tuesday, 45 minutes on Wednesday, and 60 minutes on Thursday. At this rate, how many minutes will he play on Friday?

QUICK Review

Example 1

Write $\frac{40}{64}$ in simplest form.

$$\frac{40}{64} = \frac{5}{8}$$

Divide the numerator and denominator by the GCF, 8.

Since the GCF of 5 and 8 is 1, the fraction $\frac{5}{8}$ is in simplest form.

Example 2

Solve $14k = 84$ mentally.

$$14k = 84 \quad \text{THINK 14 times what number equals 84?}$$

$$14 \cdot 6 = 84$$
$$84 = 84$$

The solution is 6.

Example 3

Find the next three values in the pattern 5, 16, 27, 38,

Look for a pattern. Each number is obtained by adding 11 to the previous number.

$$5, 16, 27, 38, \dots$$
$$\begin{array}{cccc} & \nearrow & \nearrow & \nearrow \\ +11 & +11 & +11 & \end{array}$$

The next three numbers are 49, 60, and 71.

Main IDEA

Express ratios and rates in fraction form.



Targeted TEKS 6.1

The student represents and uses rational numbers in a variety of equivalent forms. **(B) Generate equivalent forms of rational numbers including whole numbers, fractions, and decimals.**
6.3 The student solves problems involving direct proportional relationships. **(B) Represent ratios and percents with concrete models, fractions, and decimals.** Also addresses TEKS 6.2(C), 6.12(A).

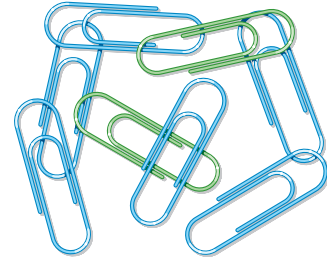
MINI Lab

Concepts in Motion

Interactive Lab tx.msmath1.com

Consider the set of paper clips shown.

1. Compare the number of blue paper clips to the number of green paper clips using the word *more* and then using the word *times*.
2. Compare the number of green paper clips to the number of blue paper clips using the word *less* and then using a fraction.



There are many different ways to compare amounts or *quantities*. A **ratio** is a comparison of two quantities by division. A ratio of 2 green paper clips to 6 blue paper clips can be written in three ways.

Ratio	Using <i>to</i>	Using <i>:</i>	Using a Fraction
green paper clips to blue paper clips	2 to 6	2:6	$\frac{2}{6}$

Read each ratio as *two to six*.

NEW Vocabulary

ratio
rate
unit rate

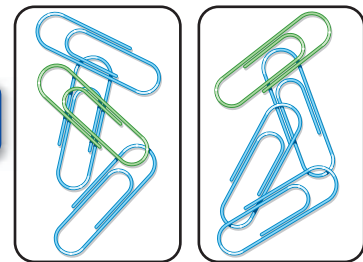
As with fractions, ratios are often expressed in simplest form.

EXAMPLE Write a Ratio in Simplest Form

- 1 Write the ratio in simplest form that compares the number of green paper clips to the number of blue paper clips in the Mini Lab. Then explain its meaning.

green paper clips → $\frac{2}{6} = \frac{1}{3}$
 blue paper clips →

The GCF of 2 and 6 is 2.



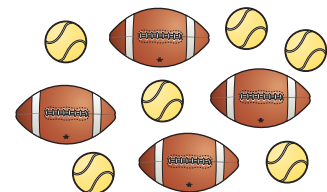
The ratio of green to blue paper clips is $\frac{1}{3}$, 1 to 3, or 1:3. This means that for every 1 green paper clip there are 3 blue paper clips.

STUDY TIP

Look Back
To review **simplifying fractions**, see Lesson 4-2.

CHECK Your Progress

- a. Write the ratio in simplest form that compares the number of footballs to the number of tennis balls. Then explain its meaning.



Ratios can also be used to compare a part to a whole.

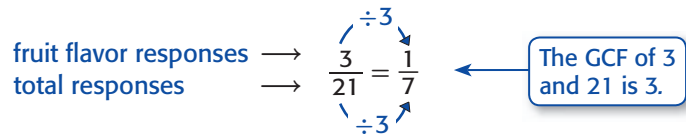
EXAMPLE

Use Ratios to Compare Parts to a Whole

2 SURVEYS Several students were asked to name their favorite flavor of gum. Write the ratio that compares the number of students who chose fruit to the total number of students who responded.

Favorite Flavor of Gum	
Flavor	Number of Responses
Peppermint	9
Cinnamon	8
Fruit	3
Spearmint	1

Three students preferred fruit out of a total of $9 + 8 + 3 + 1$ or 21 responses.



The ratio of the number of students who chose fruit to the total number of responses is $\frac{1}{7}$, 1 to 7, or 1:7. Analyzing the ratio tells us that one out of every 7 students preferred fruit-flavored gum.

CHECK Your Progress

b. **PETS** A pet store sold the animals listed in the table in one week. What was the ratio of cats to pets sold that week? Then explain its meaning.

Pet	Number Sold
Birds	10
Dogs	9
Cats	8
Gerbils	7
Lizards	2

A **rate** is a ratio comparing two quantities with different kinds of units.

Dollars and pounds are different kinds of units.

\$12 for 3 pounds

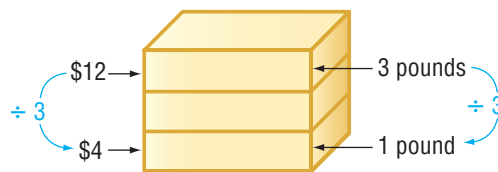
Miles and hours are different kinds of units.

60 miles in 3 hours

STUDY TIP

Unit Rates Some common unit rates are miles per hour, miles per gallon, price per pound, and dollars per hour.

The rate for one unit of a given quantity is called a **unit rate**.



The model shows that the dollars divided by the number of pounds is the number of dollars for 1 pound.

A unit rate of \$4 for 1 pound can be read as \$4 per pound.



Real-World Link

The roadrunner is the state bird of New Mexico. Roadrunners prefer running to flying. It would take 4 hours for a roadrunner to run about 54 miles.

Source: 50states.com

When written as a fraction, a unit rate has a denominator of 1. Therefore, to write a rate as a unit rate, divide the numerator and denominator of the rate by the denominator.

$$\frac{\$12}{3 \text{ pounds}} = \frac{\$4}{1 \text{ pound}}$$

(Arrows indicate dividing both numerator and denominator by 3)

EXAMPLE Find a Unit Rate

3 BIRDS Use the information at the left to find how many miles a roadrunner can run per hour.

Write the rate that compares the number of miles to the number of hours. Then divide to find the unit rate.

$$\frac{54 \text{ miles}}{4 \text{ hours}} = \frac{13.5 \text{ miles}}{1 \text{ hour}}$$

(Arrows indicate dividing both numerator and denominator by 4)

So, a roadrunner can run about 13.5 miles per hour.

CHECK Your Progress

c. WATER PARK For Carolina's birthday, her mom took her and 4 friends to Water Works in Denton, Texas. Carolina's mom paid \$40 for 5 children's tickets. What was the price for one child's ticket?

Personal Tutor at tx.msmath1.com

CHECK Your Understanding

Example 1 (p. 274) For Exercises 1–3, write each ratio as a fraction in simplest form. Then explain its meaning.



pens to pencils



pennies:dimes

3. **MOVIES** A theater is showing 8 romantic comedies and 12 action thrillers. What is the ratio of action thrillers to romantic comedies?

Example 2 (p. 275) 4. **FRUIT** Last month, Amber ate 9 apples, 5 bananas, 4 peaches, and 7 oranges. Find the ratio of bananas to the total number of pieces of fruit Amber ate last month. Then explain its meaning.

Example 3 (p. 276) Write each rate as a unit rate.

- 5. \$9 for 3 cases of soda
- 6. 25 meters in 2 seconds
- 7. **HEALTH** Shina's heart beats 410 times in 5 minutes. At this rate, how many times does Shina's heart beat per minute?

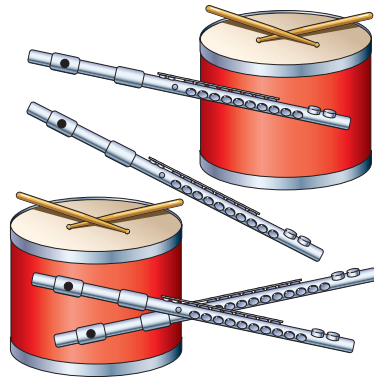
Exercises

HOMWORK HELP

For Exercises	See Examples
8–13	1
14–17	2
18–23	3

For Exercises 8–13, write each ratio as a fraction in simplest form. Then explain its meaning.

8.



flutes:drums

9.



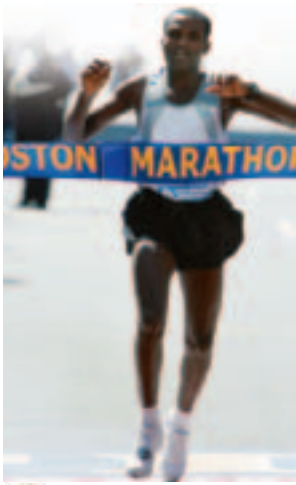
sandwiches to milk cartons

10. **SCHOOL** A class has 6 boys and 15 girls. What is the ratio of boys to girls?
11. **CARS** Audrey counted 6 motorcycles and 27 cars at the restaurant parking lot. Find the ratio of motorcycles to cars.
12. **JEWELRY** The jewelry store is having a sale on 25 emerald rings and 15 ruby rings. Find the ratio of ruby rings to emerald rings.
13. **ANIMALS** An animal shelter has 36 kittens and 12 puppies available for adoption. What is the ratio of puppies to kittens?
14. **ANALYZE TABLES** For reading class, Salvador is keeping track of the types of books he has read so far this year. Find the ratio of mystery books to the total number of books Salvador has read. Then explain its meaning.
15. **ANALYZE TABLES** Last week, a wireless phone company sold the cell phone covers listed in the table. Find the ratio of black cell phone covers to the total number of cell phone covers sold last week. Then explain its meaning.

Type	Number of Books
Mystery	10
Nonfiction	7
Science Fiction/ Fantasy	5
Western	2

Color	Number of Cell Phone Covers
Green	5
Silver	6
Red	3
Black	4

16. **CLOTHES** For a trip, Ramona packed 6 blouses, 5 pairs of shorts, 3 pairs of jeans, and 1 skirt. Find the ratio of pairs of jeans to the total number of pieces of clothing Ramona packed. Then explain its meaning.



Real-World Link . . .

The 2005 Boston Marathon winning time was 2:11:44 for the men's division.

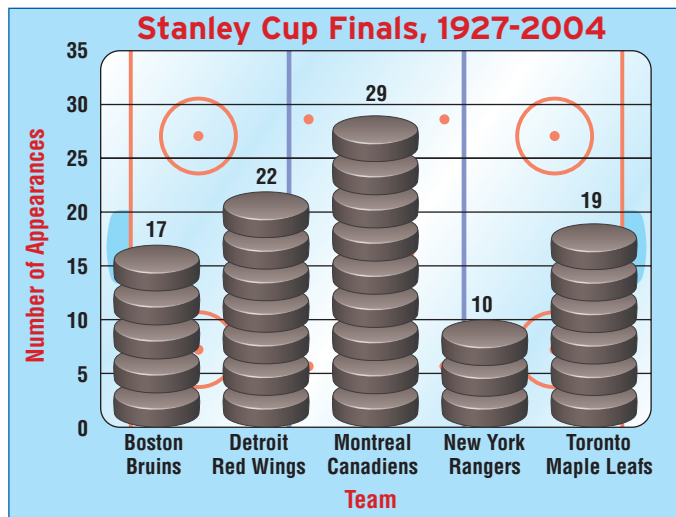
Source: thebostonchannel.com

17. **FOOD DRIVE** On the first day of the food drive, Mrs. Teasley's classes brought in 6 cans of fruit, 4 cans of beans, 7 boxes of noodles, and 4 cans of soup. Find the ratio of cans of fruit to the total number of food items collected. Then explain its meaning.

Write each rate as a unit rate.

18. 180 words in 3 minutes 19. \$36 for 4 tickets
 20. \$4 for 8 bottles of water 21. \$3 for a dozen eggs
22. **MARATHON** A marathon is approximately 26 miles. If Joshua ran the marathon in 4 hours at a constant rate, how far did he run per hour?
23. **RECYCLING** 340 trees are saved by recycling 20 tons of paper. How many trees are saved from 1 ton of recycled paper?

ANALYZE GRAPHS For Exercises 24 and 25, use the graphic. Write each ratio in simplest form. Then explain its meaning.



Source: National Hockey League

24. Write the ratio that compares the appearances made by the Rangers to the appearances made by the Red Wings?
25. Write the ratio that compares the appearances made by the Maple Leafs to the appearances made by the Bruins?
26. **FUND-RAISING** The 24 students in Mr. Brown's homeroom sold 72 magazine subscriptions. The 28 students in Mrs. Garcia's homeroom sold 98 magazine subscriptions. Whose homeroom sold more magazine subscriptions per student? Explain your reasoning.

EXTRAPRACTICE
 See pages 675, 700.
 Math **online**
 Self-Check Quiz at
tx.msmath1.com

27. **PACKAGING** A 6-pack of bottled water is on sale for \$3. The same bottled water is also available in a 24-pack for \$10. Which is less expensive per bottle: the 6-pack or the 24-pack? Explain your reasoning.

H.O.T. Problems

28. **OPEN ENDED** Create three different drawings showing a number of circles and triangles in which the ratio of circles to triangles is 2:3.
29. **CHALLENGE** Student Council sold 8 tickets to the spring dance in 15 minutes. At this rate, how many tickets will they sell per hour?

30. **FIND THE ERROR** Nicole and Mirna are writing the rate \$56 in 4 weeks as a unit rate. Who is correct? Explain your reasoning.



Nicole

$$\frac{\$56}{4 \text{ weeks}} = \frac{\$14}{1 \text{ week}}$$

$$\frac{\$56}{4 \text{ weeks}} = \frac{\$28}{2 \text{ weeks}}$$



Mirna

31. **WRITING IN MATH** What is the difference between a ratio and a rate? Give two examples of each.

TEST PRACTICE

32. While working out at the gym, Rodrigo spends 25 minutes on a treadmill and 35 minutes lifting weights. What is the ratio of the time Rodrigo spends on the treadmill to the time spent lifting weights?

- A 2 to 3
- B 5 to 7
- C 4 to 5
- D 1 to 7

33. The table shows the age ranges of the guests at Margo's birthday party. Which ratio accurately compares the number of guests ages 15 to 40 to the total number of guests at the party?

Age Range	Number of Guests
Under 15	11
15-40	6
41-65	3
Over 65	2

- F 1:2
- G 3:22
- H 1:11
- J 3:11

Spiral Review

Subtract. Write in simplest form. (Lesson 5-7)

34. $10\frac{3}{8} - 7\frac{1}{8}$

35. $5\frac{1}{6} - 3\frac{8}{9}$

36. $8\frac{2}{3} - 3\frac{6}{7}$

37. $6\frac{3}{5} - 4\frac{2}{3}$

38. **BAKING** Viho needs $2\frac{1}{4}$ cups of flour for cookies, $1\frac{2}{3}$ cups for almond bars, and $3\frac{1}{2}$ cups for cinnamon rolls. How much flour does he need in all? (Lesson 5-6)

39. **DECORATING** Janie is arranging a bookshelf, a chair, and a dresser along one wall of her bedroom. Use the *make a list* strategy to find the number of ways Janie can arrange the furniture. (Lesson 4-4)

GET READY for the Next Lesson

PREREQUISITE SKILL Write each fraction in simplest form. (Lesson 4-2)

40. $\frac{6}{10}$

41. $\frac{15}{18}$

42. $\frac{3}{12}$

43. $\frac{25}{35}$

Math Lab

Ratios and Tangrams

Main IDEA

Explore ratios and the relationship between ratio and area.

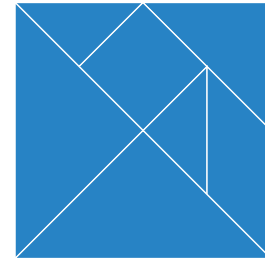


Targeted TEKS 6.3

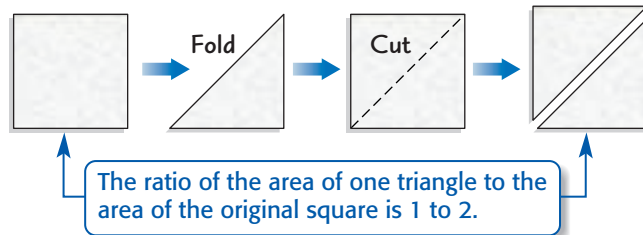
The student solves problems involving direct proportional relationships. **(B) Represent ratios** and percents with **concrete models**, fractions, and decimals.

A tangram is a puzzle that is made by cutting a square into seven geometric figures. The puzzle can be formed into many different figures.

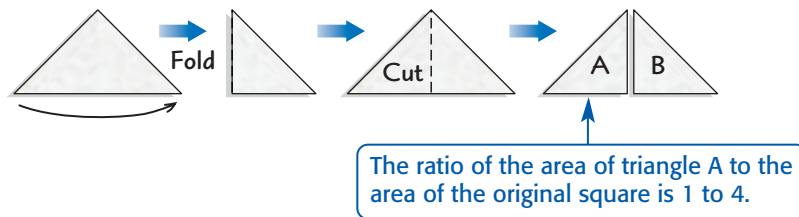
In this lab, you will use a tangram to explore ratios and the relationship between ratio and area.



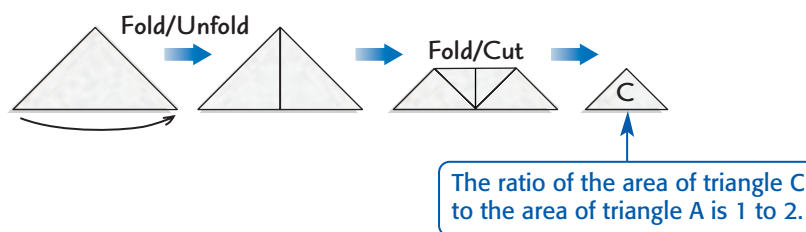
STEP 1 Begin with one sheet of patty paper. Fold the top left corner to the bottom right corner. Unfold and cut along the fold so that two large triangles are formed.



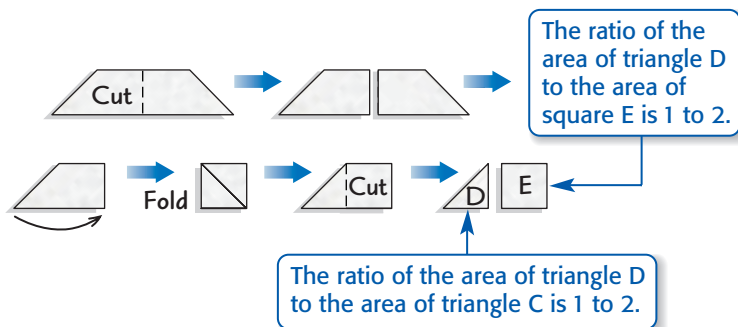
STEP 2 Use one of the cut triangles. Fold the bottom left corner to the bottom right corner. Unfold and cut along the fold. Label the triangles A and B.



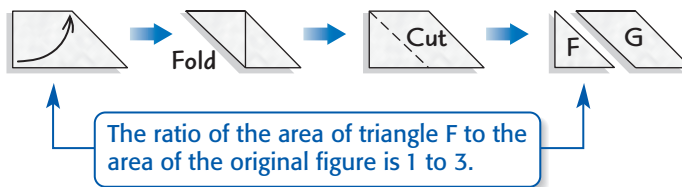
STEP 3 Use the other large triangle from step 1. Fold the bottom left corner to the bottom right corner. Make a crease and unfold. Next, fold the top down along the crease as shown. Make a crease and cut along the second crease line. Cut out the small triangle and label it C.



STEP 4 Use the remaining piece. Fold it in half from left to right. Cut along the fold. Using the left figure, fold the bottom left corner to the bottom right corner. Cut along the fold and label the triangle D and the square E.



STEP 5 Use the remaining piece. Fold the bottom left corner to the top right corner. Cut along the fold. Label the triangle F and the other figure G.



ANALYZE THE RESULTS

- Suppose the area of triangle B is 1 square unit. Find the area of each triangle.
 - triangle C
 - triangle F
- Explain how the area of each of these triangles compares to the area of triangle B.
- Explain why the ratio of the area of triangle C to the original large square is 1 to 8.
- Tell why the area of square E is equal to the area of figure G.
- Find the ratio of the area of triangle F to the original large square. Explain your reasoning.
- Complete the table. Write the fraction that compares the area of each figure to the original square. What do you notice about the denominators?

Figure	A	B	C	D	E	F	G
Fractional Part of the Large Square							

Main IDEA

Use ratio tables to represent and solve problems involving equivalent ratios.



Targeted TEKS 6.2

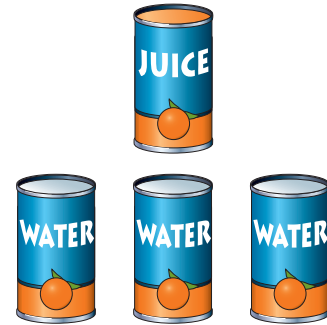
The student adds, subtracts, multiplies, and divides to solve problems and justify solutions. **(C) Use multiplication and division of whole numbers to solve problems including situations involving equivalent ratios and rates.** **6.4** The student uses letters as variables in mathematical expressions to describe how one quantity changes when a related quantity changes. **(A) Use tables and symbols to represent and describe proportional and other relationships** such as those involving conversions, arithmetic sequences (with a constant rate of change), perimeter and area. *Also addresses TEKS 6.3(A), 6.12(A).*

NEW Vocabulary

ratio table
equivalent ratio
scaling

GET READY for the Lesson

JUICE One can of frozen orange juice concentrate is mixed with 3 cans of water to make one batch of orange juice.



- How many cans of juice and how many cans of water would you need to make 2 batches that have the same taste? 3 batches? Draw a picture to support your answers.
- Find the ratio in simplest form of juice to water needed for 1, 2, and 3 batches of juice. What do you notice?

The quantities found in the activity above can be organized into a table. This table is called a **ratio table** because the columns are filled with pairs of numbers that have the same ratio.

Cans of Concentrate	1	2	3
Cans of Water	3	6	9

The ratios $\frac{1}{3}$, $\frac{2}{6}$, and $\frac{3}{9}$ are equivalent since each simplifies to a ratio of $\frac{1}{3}$.

Equivalent ratios express the same relationship between two quantities. You can use a ratio table to find equivalent ratios or rates.

EXAMPLE Equivalent Ratios of Larger Quantities

- ICING** To make yellow icing, 6 drops of yellow food coloring are added to 1 cup of white icing. Use the ratio table to find how much yellow to add to 5 cups of white icing to get the same shade.

Cups of Icing	1				5
Drops of Yellow	6				■

METHOD 1 Find a pattern and extend it.

For 2 cups of icing, you would need a total of $6 + 6$ or 12 drops.

Cups of Icing	1	2	3	4	5
Drops of Yellow	6	12	18	24	30

Continue this pattern until you reach 5 cups.

STUDY TIP

Check for Accuracy
To check your answer for Example 1, check to see if the ratio of the two new quantities is equivalent to the ratio of the original quantities.

$$\frac{5}{30} = \frac{5 \div 5}{30 \div 5} \text{ or } \frac{1}{6} \checkmark$$



Real-World Link

In 2005, Kobayashi won a contest in Hong Kong by consuming 100 roasted pork buns in just 12 minutes.

Source: news.yahoo.com

METHOD 2 Multiply each quantity by the same number.

Cups of Icing	1	5
Drops of Yellow	6	30

↖ ×5 ↘
↙ ×5 ↗

Since $1 \times 5 = 5$, multiply each quantity by 5.

So, add 30 drops of yellow food coloring to 5 cups of icing.

CHOOSE Your Method

- a. **NURSING** A patient receives 1 liter of IV fluids every 8 hours. At that rate, use the ratio table to find how many hours it will take to receive 4 liters of IV fluids.

IV Fluids (L)	1	4
Time (h)	8	■

You can also divide each quantity in a ratio by the same number to produce an equivalent ratio involving smaller quantities.

EXAMPLE Equivalent Ratios of Smaller Quantities

- 2 **HOT DOGS** In 2004, Takeru Kobayashi won a hot dog eating contest by eating nearly 54 hot dogs in 12 minutes. If he ate at a constant rate, use the ratio table to determine about how many hot dogs he ate every 2 minutes.

Hot Dogs	54	■
Time (min)	12	2

Hot Dogs	54	27	9
Time (min)	12	6	2

↖ ÷2 ↘ ↖ ÷3 ↘
↙ ÷2 ↗ ↙ ÷3 ↗

Divide each quantity by one or more common factors until you reach a quantity of 2 minutes.

So, Kobayashi ate about 9 hot dogs every 2 minutes.

CHECK Your Progress

- b. **JAM** To make cranberry jam, you need 12 cups of sugar for every 16 cups of cranberries. Use the ratio table to find the amount of sugar needed for 4 cups of cranberries.

Sugar (c)	12	■
Cranberries (c)	16	4

Multiplying or dividing two related quantities by the same number is called **scaling**. Sometimes you may need to *scale back* and then *scale forward* to find an equivalent ratio.

EXAMPLE Use Scaling

- 3 GROCERIES** Cans of corn are on sale at 10 for \$4. Use the ratio table to find the cost of 15 cans.

Cans of Corn	10		15
Cost in Dollars	4		■

There is no whole number by which you can multiply 10 to get 15. So, scale back to 5 and then scale forward to 15.

Cans of Corn	10	5	15
Cost in Dollars	4	2	6

$\swarrow \div 2 \quad \searrow \times 3$
 $\swarrow \div 2 \quad \searrow \times 3$

Divide each quantity by a common factor, 2.

Then, since $5 \times 3 = 15$, multiply each quantity by 3.

So, 15 cans of corn would cost \$6.

CHECK Your Progress

- c. **INSECTS** A butterfly's wingspan measures 105 centimeters. If 25 centimeters is about 10 inches, use the ratio table to estimate the wingspan in inches.

Wingspan (cm)	25		105
Wingspan (in.)	10		■

Real-World EXAMPLE Use a Ratio Table

- 4 MONEY** On her vacation, Leya exchanged \$50 American and received \$90 Canadian. Use a ratio table to find how many Canadian dollars she would receive for \$20 American.

Set up a ratio table.

Canadian Dollars	90		■
American Dollars	50		20

Label the rows with the two quantities being compared. Then fill in what is given.

Use scaling to find the desired quantity.

Canadian Dollars	90	9	36
American Dollars	50	5	20

$\swarrow \div 10 \quad \searrow \times 4$
 $\swarrow \div 10 \quad \searrow \times 4$

Divide each quantity by a common factor, 10.

Then, since $5 \times 4 = 20$, multiply each quantity by 4.

Leya would receive \$36 Canadian for \$20 American.

CHECK Your Progress

- d. **AUTOMOBILES** Landon owns a hybrid SUV that can travel 400 miles on a 15-gallon tank of gas. Use a ratio table to determine how many miles he can travel on 6 gallons.

Personal Tutor at tx.msmath1.com



Real-World Link

The U.S. dollar and the euro account for approximately half of all currency exchanged in the world.

Source: money.howstuffworks.com

CHECK Your Understanding

For Exercises 1–3, use the ratio tables given to solve each problem.

Example 1
(p. 282)

1. **MONEY** Santiago receives an allowance of \$7 every week. How much does he receive every 4 weeks?

Allowance	7			■
Number of Weeks	1			4

Example 2
(p. 283)

2. **EXERCISE** Tonya runs 8 kilometers in 60 minutes. At this rate, how long would it take her to run 2 kilometers?

Distance Run (km)	8		2
Time (min)	60		■

Example 3
(p. 284)

3. **BEVERAGES** A certain 12-ounce soft drink contains about 10 teaspoons of sugar. If you drink 18 ounces of this soft drink, how many teaspoons of sugar have you consumed?

Ounces of Soft Drink	12		18
Teaspoons of Sugar	10		■

Example 4
(p. 284)

4. **FOOD** Lamika buys 12 packs of juice boxes that are on sale and pays a total of \$48. Use a ratio table to determine how much Lamika will pay to buy 8 more packs of juice boxes at the same store.

Exercises

HOMework HELP

For Exercises	See Examples
5, 6	1
7, 8	2
9, 10	3
11, 12	4

For Exercises 5–10, use the ratio tables given to solve each problem.

5. **PIES** To make 5 apple pies, you need about 2 pounds of apples. How many pounds of apples do you need to make 20 apple pies?

Number of Pies	5		20
Pounds of Apples	2		■

6. **FIELD TRIP** A zoo requires that 1 adult accompany every 7 students that visit the zoo. How many adults must accompany 28 students?

Number of Adults	1			■
Number of Students	7			28

7. **MONEY** Before leaving to visit Mexico, Levant traded 270 American dollars and received 3,000 Mexican pesos. When he returned from Mexico, he had 100 pesos left. How much will he receive when he exchanges these pesos for dollars?

American Dollars	270		■
Mexican Pesos	3,000		100



Real-World Link

To make a 10-Calorie solution of nectar for a hummingbird feeder, mix one part sugar with four parts water.

Source: hummingbirds.net

8. **JEWELRY** Valentina purchased 200 beads for \$48 to make necklaces. If she needs to buy 25 more beads, how much will she pay if she is charged the same rate?

Number of Beads	200		25
Cost in Dollars	48		■

9. **KNITTING** Four balls of wool will make 8 knitted caps. How many balls of wool will Malcolm need if he wants to make 6 caps?

Balls of Wool	4		■
Number of Caps	8		6

10. **BIRDS** If a hummingbird were to get all of its food from a feeder, then a 16-ounce nectar feeder could feed about 80 hummingbirds a day. How many hummingbirds would you expect to be able to feed with a 12-ounce feeder?

Ounces of Nectar	16		12
Number of Birds Fed	80		■

11. **BIKING** On a bike trip across the United States, Jason notes that he covers about 190 miles every 4 days. If he continues at this rate, use a ratio table to determine about how many miles he could bike in 6 days.

12. **PHOTOGRAPHY** When a photo is reduced or enlarged, its length to width ratio usually remains the same. Aurelia wants to enlarge this 4-inch by 6-inch photo so that it has a height of 15 inches. Use a ratio table to determine the new width of the photo.



13. **PETS** Before administering medicine, a veterinarian needs to know the animal's weight in kilograms. If 20 pounds is about 9 kilograms and a dog weighs 30 pounds, use a ratio table to find the dog's weight in kilograms. Explain your reasoning.

14. **TRAVEL** On a typical day, flights at a local airport arrive at a rate of 10 every 15 minutes. At this rate, how many flights would you expect to arrive in 1 hour?

RECIPES For Exercises 15–17, use the following information.

A punch recipe that serves 24 people calls for 4 liters of lemon-lime soda, 2 pints of sherbet, and 6 cups of ice.

15. Create a ratio table to represent this situation.
16. How much of each ingredient would you need to make an identical recipe that serves 12 people? 36 people?
17. How much of each ingredient would you need to make an identical recipe that serves 18 people? Explain your reasoning.

EXTRAPRACTICE

See pages 675, 700.

Math Online

Self-Check Quiz at
tx.msmath1.com

H.O.T. Problems

18. **CHALLENGE** Use the ratio table to determine how many people 13 subs would serve. Explain your reasoning.

Number of Subs	3	5	8	13
People Served	12	20	32	■

19. **NUMBER SENSE** There are 10 girls and 8 boys in Mr. Augello's class. If 5 more girls and 5 more boys join the class, will the ratio of girls to boys remain the same? Justify your answer using a ratio table.

20. **WRITING IN MATH** Explain two different methods that can be used to find the missing value in the ratio table.

Pages Read	60		80
Number of Days	9		■

TEST PRACTICE

21. Paul buys 5 DVDs for \$60. At this rate, how much would he pay for 3 DVDs?

- A \$10
- B \$30
- C \$36
- D \$58

22. **GRIDDABLE** Beth walks 2 blocks in 15 minutes. How many blocks would Beth walk if she walked at the same rate for an hour?

23. Jay Len is making biscuits using the recipe below.

Whole Wheat Biscuits

- 2 c Whole wheat flour
- 4 tsp Baking powder
- $\frac{1}{2}$ tsp Salt
- 2 tbsp Shortening
- 1 c Milk
- 1 Small egg



How many cups of flour will he need to make 30 biscuits?

- F $1\frac{1}{2}$ cups
- G 3 cups
- H 10 cups
- J 15 cups

Spiral Review

24. **HORSES** A horse ranch has 6 mustangs and 18 Arabians. Write the ratio of mustangs to Arabians as a fraction in simplest form. Then explain its meaning. (Lesson 6-1)

Subtract. Write in simplest form. (Lesson 5-7)

25. $6\frac{5}{8} - 3\frac{3}{4}$

26. $5 - 2\frac{1}{3}$

27. $2\frac{1}{2} - 1\frac{4}{5}$

28. List the next five common multiples after the LCM of 6 and 9. (Lesson 4-5)

GET READY for the Next Lesson

PREREQUISITE SKILL Write each rate as a unit rate. (Lesson 6-1)

29. \$24 for 3 hats

30. 130 miles in 2 hours

31. 145 students for 5 teachers

Graphing Calculator Lab Ratio Tables

Main IDEA

Use technology to compare output/input ratios for functions.



Targeted TEKS 6.12

The student communicates about Grade 6 mathematics

through informal and mathematical language, representations, and models. **(A) Communicate mathematical ideas using language, efficient tools, appropriate units, and graphical, numerical, physical, or algebraic mathematical models.** Also addresses TEKS 6.13(B).

You can use the CellSheet application on a TI-83/84 Plus graphing calculator to compare the output/input ratios of real-world functions.

ACTIVITY

1 MOVIES The total cost of purchasing 1, 2, 3, 4, and 5 DVDs for \$19 each is found by multiplying the number of DVDs purchased by 19. Create a table to model this situation. Include a column that calculates the ratio of cost to DVDs.

STEP 1 Access CellSheet by pressing **APPS** **0** **ENTER** **ENTER**.

STEP 2 Enter the heading DVDS in cell A1 by pressing **2nd** **ALPHA** **["]** **[D]** **[V]** **[D]** **[S]** **ENTER**. Similarly, enter the heading COST in cell B1 and RATIO in cell C1.

STEP 3 Enter the numbers 1 through 5 into cells A2 through A6, respectively. Then, insert the formula $=A2*19$ in cell B3 by pressing **STO▶** **ALPHA** **[A]** **2** **×** **19**.

STEP 4 Calculate the cost for each number of DVDs by copying the formula to cells B4 through B6. Move to cell B3 and press **[F3]** to copy, **[F1]** **▼** **▼** **▼** **▼** to select the range of cells, and **[F4]** to paste.

STEP 5 Use a similar procedure to insert, copy, and paste the formula $B2/A2$ in cells C3 through C6.



ANALYZE THE RESULTS

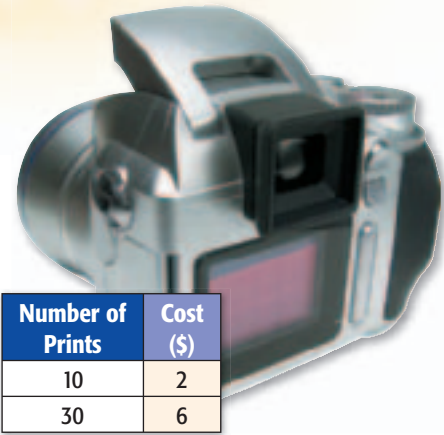
- Does the 2-column table of values for DVDs and Cost form a ratio table? Explain your reasoning.
- CLOTHING** A store offers \$5 off any purchase over \$10. Create a graphing calculator table that models the total cost of purchasing \$11 through \$14 in clothing. Include a ratio column of cost : amount.
- Does the 2-column table of values for the amount and cost form a ratio table? Explain your reasoning.

STUDY TIP

Cell Sheet To clear the sheet while in the CellSheet program, press **[F5]** to select Menu, **2** to select Edit, **3** to select Clear Sheet, and **2** to select Yes.

6-3

Proportions



Main IDEA

Determine if two ratios are proportional.



Targeted TEKS 6.2

The student adds, subtracts, multiplies, and divides to solve problems and justify solutions.

(C) Use multiplication and division of whole numbers to solve problems including situations involving equivalent ratios and rates.

6.3 The student solves problems involving direct proportional relationships.

(A) Use ratios to describe proportional situations.

(B) Represent ratios and percents with concrete models, fractions, and decimals. Also addresses TEKS 6.12(A), 6.13(B).

GET READY for the Lesson

PHOTOGRAPHY Leon spent \$2 to make 10 prints from his digital camera. Later, he went back to the same store and spent \$6 to make 30 prints.

Number of Prints	Cost (\$)
10	2
30	6

- Express the relationship between the total cost and number of prints he made for each situation as a rate in fraction form.
- Compare the relationship between the numerators of each rate you wrote in Exercise 1. Compare the relationship between the denominators of these rates.
- Are the rates you wrote in Exercise 1 equivalent? Explain.

In the situations above, there are two related quantities: the number of prints and the cost for these prints. Notice that both quantities change, but in the same way.

Number of Prints	10	30
Cost (\$)	2	6

$\begin{matrix} \nearrow \times 3 \\ \searrow \times 3 \end{matrix}$

As the number of prints triples, the cost also triples.

NEW Vocabulary

proportional
proportion

By comparing these quantities as rates in simplest form, you can see that the relationship between the two quantities stays the same.

$$\frac{10 \text{ prints}}{\$2} = \frac{5 \text{ prints}}{\$1} \quad \text{and} \quad \frac{30 \text{ prints}}{\$6} = \frac{5 \text{ prints}}{\$1}$$

$\begin{matrix} \div 2 & \div 6 \\ \div 2 & \div 6 \end{matrix}$

Two quantities are **proportional** if they have a constant ratio or rate. In the example above, the cost for making prints is proportional to the number of prints because each quantity has a constant rate of \$1 for 5 prints.

A proportional relationship is often expressed by writing a proportion.

READING in the Content Area

For strategies in reading this lesson, visit tx.msmath1.com.

KEY CONCEPT

Proportion

Words

A **proportion** is an equation stating that two ratios or rates are equivalent.

Examples

$$\frac{2}{5} = \frac{6}{15} \quad \frac{\$2}{10 \text{ prints}} = \frac{\$6}{30 \text{ prints}}$$

There are different ways to determine if the relationship between two quantities is proportional. One way is by examining unit rates.

EXAMPLES Use Unit Rates

Determine if the quantities in each pair of rates are proportional. Explain your reasoning and express each proportional relationship as a proportion.

- 1** 20 miles in 5 hours; 45 miles in 9 hours

Write each rate as a fraction. Then find its unit rate.

$$\frac{20 \text{ miles}}{5 \text{ hours}} = \frac{4 \text{ miles}}{1 \text{ hour}} \qquad \frac{45 \text{ miles}}{9 \text{ hours}} = \frac{5 \text{ miles}}{1 \text{ hour}}$$

Since the rates do not have the same unit rate, they are not equivalent. So, the number of miles is not proportional to the number of hours.

- 2** 3 T-shirts for \$21; 5 T-shirts for \$35

$$\frac{\$21}{3 \text{ T-shirts}} = \frac{\$7}{1 \text{ T-shirt}} \qquad \frac{\$35}{5 \text{ T-shirts}} = \frac{\$7}{1 \text{ T-shirt}}$$

Since the rates have the same unit rate, they are equivalent. The cost is proportional to the number of T-shirts. So, $\frac{\$21}{3 \text{ T-shirts}} = \frac{\$35}{5 \text{ T-shirts}}$.

- 3** **READING** Felisa read the first 60 pages of a book in 3 days. She read the last 90 pages in 6 days. Are these reading rates proportional? Explain your reasoning.

$$\frac{60 \text{ pages}}{3 \text{ days}} = \frac{20 \text{ pages}}{1 \text{ day}} \qquad \frac{90 \text{ pages}}{6 \text{ days}} = \frac{15 \text{ pages}}{1 \text{ day}}$$

Since the rates do not have the same unit rate, they are not equivalent. So, Felisa's reading rates were not proportional.

CHECK Your Progress

- 10 bracelets for 5 friends; 12 bracelets for 4 friends
- \$9 for 6 notebooks; \$27 for 18 notebooks
- FUND-RAISING** Club A raised \$168 by washing 42 cars. Club B raised \$152 by washing 38 cars. Are these fund-raising rates proportional? Explain your reasoning.

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STUDY TIP

Unit Rates The unit rate in Example 2, $\frac{\$7}{1 \text{ T-shirt}}$ or \$7 per T-shirt, is called the *unit price* since it gives the cost per unit.



Real-World Link

In 2004, in the U.S. DVD sales totaled \$15.5 billion.

Source: USA Today

If a unit rate is not easily found, check to see if the rates are equivalent. If they are, then the quantities are proportional.

EXAMPLES Use Equivalent Fractions

Determine if the quantities in each pair of ratios or rates are proportional. Explain your reasoning and express each proportional relationship as a proportion.

- 4** 3 free throws made out of 7 attempts;
9 free throws made out of 14 attempts

Write each ratio as a fraction.

$$\frac{3 \text{ free throws}}{7 \text{ attempts}} \stackrel{\times 3}{\underset{\times 2}{\neq}} \frac{9 \text{ free throws}}{14 \text{ attempts}}$$

The numerator and the denominator are not multiplied by the same number. So, the fractions are not equivalent.

The number of free throws made is not proportional to the number of attempts.

- 5** 6 DVDs for \$90; 3 DVDs for \$45

$$\frac{6 \text{ DVDs}}{\$90} \stackrel{\div 2}{\underset{\div 2}{=}} \frac{3 \text{ DVDs}}{\$45}$$

The numerator and the denominator are divided by the same number. So, the fractions are equivalent.

The number of DVDs is proportional to the cost.

CHECK Your Progress

- d. 5 packs of baseball cards for \$15; 10 packs of baseball cards for \$30
e. 12 girls out of 16 students; 4 girls out of 8 students

CHECK Your Understanding

Determine if the quantities in each pair of ratios or rates are proportional. Explain your reasoning and express each proportional relationship as a proportion.

Examples 1, 2
(p. 290)

Examples 4, 5
(p. 291)

Example 3
(p. 290)

- \$24 saved after 3 weeks; \$52 saved after 7 weeks
- 270 Calories in 3 servings; 450 Calories in 5 servings
- 3 hours worked for \$12; 9 hours worked for \$36
- 16 breaths in 60 seconds; 14 breaths in 15 seconds
- FITNESS** Micah can do 75 push-ups in 3 minutes. Eduardo can do 130 push-ups in 5 minutes. Are these rates proportional? Explain.

Exercises

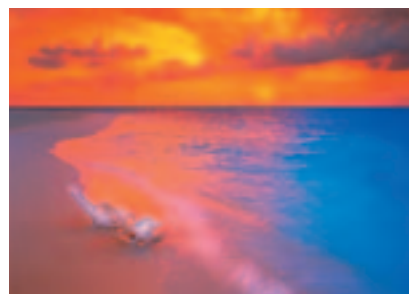
HOMESCHOOL HELP

For Exercises	See Examples
6–9	1, 2
10–13	4, 5
14, 15	3

Determine if the quantities in each pair of ratios or rates are proportional. Explain your reasoning and express each proportional relationship as a proportion.

- \$12 for 3 paperback books; \$28 for 7 paperback books
- 16 points scored in 4 games; 48 points scored in 8 games
- 96 words typed in 3 minutes; 160 words typed in 5 minutes
- \$3 for 6 bagels; \$9 for 24 bagels
- 288 miles driven on 12 gallons of fuel; 240 miles driven on 10 gallons of fuel
- 15 computers for 45 students; 45 computers for 135 students
- 12 minutes to drive 30 laps; 48 minutes to drive 120 laps
- 16 out of 28 students own pets; 240 out of 560 students own pets

14. **PHOTOGRAPHY** Jade enlarged the photograph at the right to a poster. The size of the poster is 60 inches by 100 inches. Is the size of the poster proportional to the size of the photograph? Explain your reasoning.



3 in.

5 in.

15. **SURVEY** One school survey showed that 3 out of 5 students buy their lunch. Another survey showed that 12 out of 19 students buy their lunch. Are these results proportional? Explain.

BASEBALL For Exercises 16–18, refer to the table below. Determine if each pair of players made proportionally the same number of hits. Explain.

- Mark DeRosa and Dustan Mohr
- Ramon Hernandez and Mark DeRosa
- Adam Dunn and Matt Treanor

2005 Spring Batting Statistics			
Player	Team	At Bats	Hits
Mark DeRosa	Texas Rangers	48	12
Adam Dunn	Cincinnati Reds	64	18
Ramon Hernandez	San Diego Padres	45	15
Dustan Mohr	Colorado Rockies	60	15
Matt Treanor	Florida Marlins	32	9

Source: espn.go.com

19. **ANALYZE TABLES** Of the players listed in the table above, did the player who made the most hits have the best record? Explain.

EXTRAPRACTICE

See pages 676, 700.

Math Online

Self-Check Quiz at
tx.msmath1.com

- TESTS** On a math test, it took Kiera 30 minutes to do 6 problems. Heath finished 18 problems in 40 minutes. Did the students work proportionally at the same rate? Explain your reasoning.
- SAVINGS** Rosalinda saved \$35 in 5 weeks. Her sister saved \$56 in 56 days. Did each sister save proportionally the same amount of money? Explain.

H.O.T. Problems

22. **OPEN ENDED** The Agriculture Club is raising animals in a ratio of 4 pigs for every 5 cows. Write two different ratios that are proportional to this ratio.

CHALLENGE A survey showed that 7 out of 10 youth use instant messaging. Create proportional relationships to predict how many of the following youth you would expect to use instant messaging.

23. 100 youth 24. 250 youth 25. 3,000 youth
26. **WRITING IN MATH** Ashley and Regina are mixing red and white fabric dye. Ashley used more red and more white dye than Regina. Which of the following statements is true? Explain your reasoning.
- Ashley mixed the darker shade of red.
 - Regina mixed the darker shade of red.
 - Their mixtures were the same shade of red.
 - There is not enough information to tell whose mixture is darker.


TEST PRACTICE

27. The ratio of girls to boys in the junior high band is 3 to 4. Which of these shows possible numbers of the girls and boys in the band?

- 30 girls, 44 boys
- 27 girls, 36 boys
- 22 girls, 28 boys
- 36 girls, 50 boys

28. Which of the following shows an equivalent way to show the cost of the tomatoes?

HOME-GROWN VEGETABLES	
Cucumbers	6 for \$2
Peppers	12 for \$9
Tomatoes	6 for \$4

- 15 for \$10
- 20 for \$15
- 12 for \$9
- 8 for \$6


Spiral Review

29. **SHOPPING** Walter purchased 2 CDs for \$26. Use a ratio table to find how much he would pay for 6 CDs. (Lesson 6-2)
30. **HEIGHT** Joaquin is $65\frac{1}{2}$ inches tall. José is $61\frac{3}{4}$ inches tall. How much taller is Joaquin than José? (Lesson 5-7)

Find the prime factorization of each number. (Lesson 1-2)

31. 15 32. 94 33. 102 34. 126


GET READY for the Next Lesson

PREREQUISITE SKILL Write each rate as a unit rate. (Lesson 6-1)

35. 56 wins in 8 years 36. \$12 for 5 hot dogs 37. \$21 for 3 hours

Main IDEA

Solve proportions.

**Targeted TEKS 6.2**

The student adds, subtracts, multiplies, and divides to solve problems and justify solutions. **(C) Use multiplication and division of whole numbers to solve problems including situations involving equivalent ratios and rates.** **6.3** The student solves problems involving direct proportional relationships. **(C) Use ratios to make predictions in proportional situations.** Also addresses TEKS 6.1(B), 6.3(A), 6.3(B), 6.4(A), 6.11(A).

GET READY for the Lesson

FLOWERS A florist is using roses to make bouquets for a wedding.

1. Are the number of roses proportional to the number of bouquets?
2. Write a proportion to express the relationship between the 18 roses for 3 bouquets and the number of roses n for 10 bouquets.
3. How many roses would it take to make 10 bouquets? Explain.

Number of Bouquets	Number of Roses
3	18
4	24
5	30
6	36

When you find an unknown value in a proportion, you are *solving the proportion*. As you discovered in Lesson 6-3, there are different methods to determine if a relationship is proportional. You can use these same methods to solve a proportion.

EXAMPLES Solve Using Equivalent Fractions

Solve each proportion.

$$1 \quad \frac{4}{7} = \frac{m}{35}$$

Find a value for m so the fractions are equivalent.

$$\frac{4}{7} = \frac{m}{35}$$

Since $7 \times 5 = 35$, multiply the numerator and denominator by 5.

$$\frac{4}{7} = \frac{20}{35} \quad \text{Since } 4 \times 5 = 20, m = 20.$$

$$2 \quad \frac{12}{15} = \frac{4}{y}$$

$$\frac{12}{15} = \frac{4}{y}$$

Since $12 \div 3 = 4$, divide the numerator and denominator by 3.

$$\frac{12}{15} = \frac{4}{5} \quad \text{Since } 15 \div 3 = 5, y = 5.$$

STUDY TIP

Check Your Answer

Write each ratio in simplest form. If they simplify to the same ratio, they are equivalent.

$$3 \quad \frac{x}{16} = \frac{7}{8}$$

$$\begin{array}{c} \div 2 \\ \swarrow \quad \searrow \\ \frac{x}{16} = \frac{7}{8} \\ \swarrow \quad \searrow \\ \div 2 \end{array}$$

Since $16 \div 2 = 8$, divide the numerator and denominator by 2.

$$\frac{14}{16} = \frac{7}{8}$$

THINK What number divided by 2 is 7? The answer is 14.

So, $x = 14$.

CHECK Your Progress

Solve each proportion.

a. $\frac{2}{3} = \frac{n}{9}$

b. $\frac{30}{54} = \frac{z}{9}$

c. $\frac{5}{8} = \frac{40}{x}$

Proportions can also be used to make predictions.

EXAMPLE

Make Predictions in Proportional Situations

- 4 **TOOTHPASTE** If 8 of the 32 students in a health class prefer using gel toothpaste, use this ratio to predict how many would prefer using gel toothpaste in a school of 500 students.

Write and solve a proportion. Let s represent the number of students who can be expected to prefer gel toothpaste.

Class		School
prefer gel toothpaste	$\rightarrow \frac{8}{32} = \frac{s}{500} \leftarrow$	prefer gel toothpastes
total students	$\rightarrow \frac{8}{32} = \frac{s}{500} \leftarrow$	total students

The denominator 32 and 500 are not easily related by multiplication, so simplify the ratio 8 out of 32. Then solve using equivalent fractions.

$$\begin{array}{c} \div 8 \quad \times 125 \\ \swarrow \quad \searrow \\ \frac{8}{32} = \frac{1}{4} = \frac{125}{500} \\ \swarrow \quad \searrow \\ \div 8 \quad \times 125 \end{array}$$

Since $4 \times 125 = 500$, multiply the numerator and denominator by 125.

So, about 125 out of 500 students in the school can be expected to prefer gel toothpaste.

CHECK Your Progress

- d. **ICE CREAM** There are 810 Calories in 3 scoops of vanilla ice cream. About how many Calories are there in 7 scoops of ice cream?
- e. **BED TIME** If 15 out of 25 students go to bed before 10 P.M., predict how many go to bed before 10 P.M. in a school of 1,000 students.



Real-World Career . . .

How Does a Dentist Use Math? Dentists use math when determining the amount of material needed to fill a cavity in a patient's tooth.



For more information, go to tx.msmath1.com.

You can also examine unit rates to solve a proportion.

EXAMPLE Solve Using Unit Rates

- 5 DRIVING** The Millers drove 105 miles on 3 gallons of gas. At this rate, how many miles can they drive on 10 gallons of gas?

Step 1 Set up the proportion. Let a represent the number of miles that can be driven on 10 gallons of gas.

$$\frac{105 \text{ miles}}{3 \text{ gallons of gas}} = \frac{a \text{ miles}}{10 \text{ gallons of gas}}$$

Step 2 Find the unit rate.

$$\frac{105 \text{ miles}}{3 \text{ gallons of gas}} = \frac{35 \text{ miles}}{1 \text{ gallon of gas}}$$

Find an equivalent fraction with a denominator of 1.

Step 3 Rewrite the proportion using the unit rate and solve using equivalent fractions.

$$\frac{105 \text{ miles}}{3 \text{ gallons of gas}} = \frac{35 \text{ miles}}{1 \text{ gallon of gas}} = \frac{350 \text{ miles}}{10 \text{ gallons of water}}$$

So, the value of a is 350. At the given rate, the Millers can drive 350 miles on 10 gallons of gas.

CHECK Your Progress

- f. **NUTRITION** Three average-size apples contain 180 Calories. How many average-size apples contain 300 Calories?

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CHECK Your Understanding

Examples 1–3
(pp. 294–295)

Solve each proportion.

1. $\frac{3}{4} = \frac{x}{20}$

2. $\frac{5}{4} = \frac{a}{36}$

3. $\frac{18}{20} = \frac{9}{n}$

Example 4
(p. 295)

4. **PETS** Out of 30 students surveyed, 17 have a dog. Based on these results, predict how many of the 300 students in the school have a dog.

5. **LOCKERS** If one out of 12 students at a school share a locker, predict how many share a locker in school of 456 students.

Example 5
(p. 296)

6. **PARTIES** If 84 cookies will serve 28 students, how many cookies are needed for 30 students?

7. **SUNGLASSES** Chet spent \$24 on two pairs of sunglasses. At this rate, how much would 6 pairs of sunglasses cost?

Exercises

HOMESCHOOL HELP

For Exercises	See Examples
8–15	1–3
16, 17	4
18–21	5

Solve each proportion.

8. $\frac{2}{5} = \frac{w}{15}$ 9. $\frac{3}{4} = \frac{z}{28}$ 10. $\frac{7}{d} = \frac{35}{10}$ 11. $\frac{4}{x} = \frac{16}{28}$
 12. $\frac{p}{3} = \frac{25}{15}$ 13. $\frac{h}{8} = \frac{6}{16}$ 14. $\frac{6}{7} = \frac{18}{c}$ 15. $\frac{21}{35} = \frac{3}{r}$

16. **NEWSPAPER** A recent survey reported that out of 50 teenagers, 9 said they get most of their news from a newspaper. At this rate, how many out of 300 teenagers would you expect to get their news from a newspaper?

17. **HORSES** A Clydesdale drinks about 120 gallons of water every 4 days. At this rate, about how many gallons of water does a Clydesdale drink in 28 days?

18. **DVDs** Nata spent \$28 on 2 DVDs. At this rate, how much would 5 DVDs cost?

19. **LUNCH** Four students spent \$12 on school lunch. At this rate, find the amount 10 students would spend on the same school lunch.

20. **BASEBALL** If 15 baseballs weigh 75 ounces, how many baseballs weigh 15 ounces?

21. **HEALTH** In 10 minutes, a heart can beat 700 times. At this rate, in how many minutes will a heart beat 140 times?

Solve each proportion.

22. $\frac{11}{13} = \frac{x}{91}$ 23. $\frac{96}{128} = \frac{12}{c}$ 24. $\frac{5}{12} = \frac{x}{6}$

25. **SCHOOL** Suppose 8 out of every 20 students are absent from school less than five days a year. Predict how many students would be absent from school less than five days a year in a school system of 40,000 students.

26. **ANALYZE TABLES** The table shows which physical education activities are favored by a group of students. Write and solve a proportion that could be used to predict the number of students out of 300 that would pick sit-ups as their favorite physical education activity.

Favorite Physical Education Activity	
Activity	Number of Responses
pull-ups	2
running	7
push-ups	3
sit-ups	8

27. **YOGA** Liliana takes 4 breaths per 10 seconds during yoga. At this rate, about how many breaths would Liliana take in 2 minutes of yoga?

28. **PRIZES** For a special promotion, a \$5 movie rental certificate is placed in 3 out of every 72 cases of soda. If there are 384 cases of this soda on display in a store, how many of the cases will contain a certificate?



Real-World Link

A Clydesdale consumes about 20 quarts of feed and 40 to 50 pounds of hay each day.

Source: seaworld.org

EXTRAPRACTICE


See pages 676, 700.

Math  OnlineSelf-Check Quiz at
tx.msmath1.com

29. **ANALYZE TABLES** There were 340,000 cattle placed on feed in Texas in February 2005. Write a proportion that could be used to find how many of these cattle were between 700 and 799 pounds. How many of the 340,000 cattle placed on feed were between 700 and 799 pounds?

Cattle Placed on Feed in Texas, February 2005	
Weight Group	Fraction of Total Cattle
Less than 600 pounds	$\frac{1}{5}$
600–699 pounds	$\frac{11}{50}$
700–799 pounds	$\frac{2}{5}$
800 pounds	$\frac{9}{50}$

Source: National Agriculture Statistics Service

30.  **FIND THE DATA** Refer to the Texas Data File on pages 16–19. Choose some data and write a real-world problem in which you would write and solve a proportion.

H.O.T. Problems

31. **OPEN ENDED** One rate of a proportion is $\frac{9}{n}$. Select two other rates to form the proportion, one that can be solved using equivalent fractions and the other that can be solved with unit rates. Then solve the proportion using each method.

32. **FIND THE ERROR** Noah and Yoko are setting up a proportion to solve the following problem. Who set up their proportion correctly? Explain your reasoning.

Angelina's mom teaches at a preschool. There is 1 teacher for every 12 students at the preschool. There are 276 students at the preschool. How many teachers are there at the preschool?



Noah

$$\frac{12}{1} = \frac{x}{276}$$

$$\frac{1}{12} = \frac{x}{276}$$



Yoko

33. **REASONING** Tell whether the following statement is *sometimes*, *always*, or *never* true for numbers greater than zero. Explain.

In a proportion, if the numerator of the first ratio is greater than the denominator of the first ratio, then the numerator of the second ratio is greater than the denominator of the second ratio.

34. **CHALLENGE** Suppose 25 out of 175 people said they like to play disc golf and 5 out of every 12 of the players have a personalized flying disc. At the same rate, in a group of 252 people, predict how many you would expect to have a personalized flying disc.
35. **WRITING IN MATH** Jonah can run 3 laps in 24 minutes. At the same rate, about how many laps can Jonah run in 50 minutes? Explain your reasoning.

36. A spinner is divided into equal sections. There are 6 green sections and 4 yellow sections. Damon spins the spinner 30 times. Which proportion can be used to find y , the number of times that the spinner can be expected to land on a yellow section?

- A $\frac{y}{30} = \frac{4}{6}$
- B $\frac{y}{30} = \frac{6}{10}$
- C $\frac{y}{30} = \frac{4}{10}$
- D $\frac{y}{30} = \frac{6}{4}$

37. **GRIDDABLE** Student Council sells bottled water at the cheerleading competition. They sold 3 cases in 20 minutes. If they continue selling bottled water at this rate, how many cases of bottled water would they sell in 3 hours?

38. The ratio of green pepper plants to red pepper plants in Adeline's garden is about 3 to 5. If there are 20 red pepper plants, about how many green pepper plants are there?

- F 35
- G 16
- H 12
- J 6

Spiral Review

Determine if the quantities in each pair of rates are proportional. Explain your reasoning and express each proportional relationship as a proportion. (Lesson 6-3)

- 39. \$36 for 4 baseball hats; \$56 for 7 baseball hats
- 40. 12 posters for 36 students; 21 posters for 63 students
- 41. **TUTORS** A tutor charges \$30 for 2 hours. Use the ratio table to determine how much she charges for 5 hours. (Lesson 6-2)

Cost	30		■
Number of Hours	2		5

- 42. Order $\frac{1}{4}$, $\frac{7}{40}$, $\frac{1}{5}$, $\frac{3}{20}$ from least to greatest. (Lesson 4-8)

WEATHER For Exercises 43 and 44, refer to the table at the right. (Lesson 2-2)

- 43. Make a line graph of the data.
- 44. Describe the change in the daily high temperature from Tuesday to Friday.

5-Day Forecast	
Day	High Temperature (°F)
Monday	76
Tuesday	81
Wednesday	78
Thursday	62
Friday	53

▶ GET READY for the Next Lesson


- 45. **PREREQUISITE SKILL** The Sears Tower in Chicago has 30 stories more than the Aon Centre in Chicago. Together, both buildings have 190 stories. Find the number of stories in each building. Use the *guess and check* strategy. (Lesson 1-7)

Mid-Chapter Quiz

Lessons 6-1 through 6-4

- CLASSES** Tyson's math class has 12 boys and 8 girls. What is the ratio of boys to girls? (Lesson 6-1)
- SALES** At a bake sale, 15 cookies and 40 brownies were sold. What is the ratio of cookies sold to brownies sold? (Lesson 6-1)

Write each rate as a unit rate. (Lesson 6-1)

- 171 miles in 3 hours
- \$15 for 3 pounds
-  **TEST PRACTICE** A hockey team made four of their 10 attempted goals. Which ratio compares the number of goals made to the number of goals attempted? (Lesson 6-1)
 - $\frac{4}{5}$
 - $\frac{3}{5}$
 - $\frac{5}{2}$
 - $\frac{2}{5}$

For Exercises 6 and 7, use the ratio tables given to solve each problem. (Lesson 6-2)


- MONEY** Peyton spends \$15 on lunch every week. At this rate, how much money will he spend in 5 weeks?

Number of Weeks	1				5
Money Spent (\$)	15				■

- DISHES** Charlee washes 10 dishes in 8 minutes. At this rate, how long will it take her to wash 25 dishes?


Number of Dishes	10		25
Number of Minutes	8		■

Determine if the quantities in each pair of ratios or rates are proportional. Explain your reasoning and express each proportional relationship as a proportion. (Lesson 6-3)

- \$4 for 12 doughnuts; \$9 for 36 doughnuts
- 24 pages read in 8 minutes; 72 pages read in 24 minutes
- 48 out of 64 students own cell phones; 192 out of 258 students own cell phones
-  **TEST PRACTICE** The ratio of brown tiles to tan tiles in a mosaic is 2 to 3. Which of these shows the possible numbers of brown tiles and tan tiles in the mosaic? (Lesson 6-3)
 - 16 brown tiles, 24 tan tiles
 - 14 brown tiles, 20 tan tiles
 - 12 brown tiles, 19 tan tiles
 - 8 brown tiles, 9 tan tiles

Solve each proportion. (Lesson 6-4)

- $\frac{x}{6} = \frac{12}{18}$
- $\frac{8}{20} = \frac{30}{x}$
- $\frac{3}{d} = \frac{9}{15}$
- $\frac{24}{72} = \frac{x}{6}$

-  **TEST PRACTICE** Christina made 4 bracelets in 36 minutes. At this rate, how many bracelets would she make in 108 minutes? (Lesson 6-4)
 - 8
 - 9
 - 12
 - 16

- HEALTH** Suppose 27 out of 50 people living in one neighborhood of a community exercise regularly. At the same rate, predict how many people in a similar community of 2,600 people can be expected to exercise regularly. (Lesson 6-4)

6-5

Problem-Solving Investigation

MAIN IDEA: Solve problems by looking for a pattern.



Targeted TEKS 6.11 The student applies Grade 6 mathematics to solve problems connected to everyday experiences, investigations in other disciplines, and activities in and outside of school. **(C) Select or develop an appropriate problem-solving strategy from a variety of different types, including . . . looking for a pattern . . . to solve a problem.** Also Addresses TEKS 6.11(B).

P.S.I. TERM +

e-Mail: LOOK FOR A PATTERN

YOUR MISSION: Look for a pattern to solve problems.

THE PROBLEM: How much longer until Emelia's and Juwan's friend Casey arrives?



JUWAN: It is now 1:15 P.M.
Casey said he would be on
the first bus after 6:00 P.M.



EMELIA: Buses arrive every
30 minutes starting at 1:45 P.M.

EXPLORE	You know that the first bus arrives at 1:45 P.M., and they arrive every 30 minutes. Your need to find the time the first bus arrives after 6:00 P.M.										
PLAN	Start with the time of the first bus and look for a pattern.										
SOLVE	<table border="1"> <thead> <tr> <th>Bus</th> <th>Arrival Time</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1:45 P.M.</td> </tr> <tr> <td>2</td> <td>1:45 P.M. + 30 minutes = 2:15 P.M.</td> </tr> <tr> <td>3</td> <td>2:15 P.M. + 30 minutes = 2:45 P.M.</td> </tr> <tr> <td>4</td> <td>2:45 P.M. + 30 minutes = 3:15 P.M.</td> </tr> </tbody> </table> <p>So, the first bus to arrive after 6:00 P.M. is the 6:15 P.M. bus. Since it is now 1:15 P.M., Casey will not arrive for another 5 hours.</p>	Bus	Arrival Time	1	1:45 P.M.	2	1:45 P.M. + 30 minutes = 2:15 P.M.	3	2:15 P.M. + 30 minutes = 2:45 P.M.	4	2:45 P.M. + 30 minutes = 3:15 P.M.
Bus	Arrival Time										
1	1:45 P.M.										
2	1:45 P.M. + 30 minutes = 2:15 P.M.										
3	2:15 P.M. + 30 minutes = 2:45 P.M.										
4	2:45 P.M. + 30 minutes = 3:15 P.M.										
CHECK	Continue adding 30 minutes to the previous arrival time until you reach 6:15 P.M. Then add up the 30-minute increments.										

The buses arrive every 15 and 45 minutes after the hour.

Analyze The Strategy

1. Explain when you would use the look for a pattern strategy to solve a problem.
2. **WRITING IN MATH** Write a problem that can be solved by looking for a pattern. Then write the steps you would take to find the solution.

Mixed Problem Solving

Use the *look for a pattern* strategy to solve Exercises 3–5.

3. **NUMBER SENSE** Describe the pattern below. Then find the missing number.
30, 300, ■, 30,000
4. **MONEY** In 2000, Celina earned \$19,500 per year, and Roger earned \$17,500. Each year Roger received a \$1,000 raise, and Celina received a \$500 raise. In what year will they earn the same amount of money? How much will it be?
5. **GEOMETRY** Draw the next two figures in the pattern below.



Use any strategy to solve Exercises 6–11. Some strategies are shown below.

PROBLEM-SOLVING STRATEGIES

- Use the four-step plan.
- Guess and check.
- Look for a pattern.

6. **FOOD** Which is more, $\frac{3}{8}$ of a pizza or $\frac{1}{3}$ of a pizza?
7. **MONEY** The admission for a health fair is \$6 for adults, \$4 for children, and \$3 for senior citizens. Twelve people paid a total of \$50 for admission. If 8 children attended the health fair, how many adults and senior citizens attended?
8. **FOOD** About how much more money is spent on strawberry and grape jelly than the other types of jelly each year?

Yearly Jelly Sales (thousands)	
strawberry and grape	\$366.2
all others	\$291.5

Source: Nielsen Marketing Research

9. **NUMBER THEORY** The numbers below are called *triangular numbers*. Find the next two triangular numbers.



10. **LANGUAGE ARTS** On Monday, 86 science fiction books were sold at a book sale. This is 8 more than twice the amount sold on Thursday. How many science fiction books were sold on Thursday?
11. **SURVEYS** Avery took a survey of the dates of birth in his classroom. He listed them in a stem-and-leaf plot. Which is greater for this set of data, the mode or the median?

Dates of Birth	
Stem	Leaf
0	1 1 2 3 5 5 8 9
1	1 2 3 3 7 8 8
2	0 3 5 5 6 7 7 7
3	0 0 1 4 = 14th day of the month

Select the Operation

For Exercises 12–14, select the appropriate operation(s) to solve the problem. Justify your selection(s) and solve the problem.

12. **MONEY** What was the price of the sweatshirt before taxes?
- | Sweatshirt Price | Tax | Total Cost |
|------------------|--------|------------|
| ■ | \$2.50 | \$42.49 |
13. **TRAVEL** Mr. Ishikawa left Houston at 3:00 P.M. and arrived in Dallas at 8:00 P.M., driving a distance of approximately 240 miles. During his trip, he took a one-hour dinner break. What was Mr. Ishikawa's average speed in miles per hour?
14. **FIELD TRIPS** Mrs. Samuelson had \$350 to spend on a field trip for herself and 18 students. The rate of admission was \$13 per person and lunch cost about \$5 per person. How much money was left after the trip?

Main IDEA

Extend and describe arithmetic sequences using algebraic expressions.

**Targeted TEKS 6.4**

The student uses letters as variables in mathematical

expressions to describe how one quantity changes when a related quantity changes.

(A) Use tables and symbols to represent and describe proportional and other relationships such as those involving conversions, arithmetic sequences (with a constant rate of change), perimeter and area. 6.12 The student communicates about Grade 6 mathematics through informal and mathematical language, representations, and models. **(A) Communicate mathematical ideas using language,** efficient tools, appropriate units, and graphical, numerical, physical, or **algebraic mathematical models.** Also addresses TEKS 6.2(E), 6.11(D).

GET READY for the Lesson

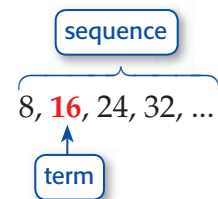
PIZZA The table shows the number of slices of pizza for different numbers of large pizzas.

- Find the rate of slices to the number of pizzas for each row in the table.
- Is the number of pizzas proportional to the number of slices? Explain your reasoning.
- Make an ordered list of the number of slices and describe the pattern between consecutive numbers in this list.
- What relationship appears to exist between the pattern found in Exercise 3 and the rates found in Exercise 1?

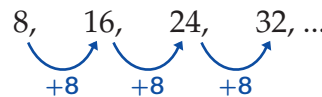
The Pizza Palace	
Number of Pizzas	Number of Slices
1	8
2	16
3	24
4	32



The number of slices in the table above is an example of a sequence. A **sequence** is a list of numbers in a specific order. Each number in the list at the right is called a **term** of the sequence.



This sequence is an **arithmetic sequence** because each term is found by adding the same number to the previous term.



There are several ways of showing a sequence. In addition to being shown as a list, a sequence can also be shown in a table. The table gives both the position of each term in the list and the value of the term.

List

8, 16, 24, 32, ...

Table

Position	1	2	3	4
Value of Term	8	16	24	32

NEW Vocabulary

sequence

term

arithmetic sequence

REVIEW Vocabulary

function a relationship that assigns exactly one output value to one input value
(Lesson 1-6)

You can also write an algebraic expression to describe a sequence. The value of each term can be described as a function of its position in the sequence.

EXAMPLES

Describe Sequences

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the tenth term in the sequence.

1	Position	1	2	3	4	n
	Value of Term	3	6	9	12	■

Notice that the value of each term is 3 times its position number. So the value of the term in position n is $3n$.

Position	Multiply by 3	Value of Term
1	1×3	3
2	2×3	6
3	3×3	9
4	4×3	12
n	$n \times 3$	$3n$

Now find the value of the tenth term.

$$3n = 3 \cdot 10 \quad \text{Replace } n \text{ with } 10.$$

$$= 30 \quad \text{Multiply.}$$

The value of the tenth term in the sequence is 30.

2	Position	6	7	8	9	n
	Value of Term	2	3	4	5	■

The value of each term is 4 less than its position number. So the value of the term in position n is $n - 4$.

Position	Subtract 4	Value of Term
6	$6 - 4$	2
7	$7 - 4$	3
8	$8 - 4$	4
9	$9 - 4$	5
n	$n - 4$	$n - 4$

Now find the value of the tenth term.

$$n - 4 = 10 - 4 \quad \text{Replace } n \text{ with } 10.$$

$$= 6 \quad \text{Subtract.}$$

The value of the tenth term in the sequence is 6.

CHECK Your Progress

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the eighth term in the sequence.

a.

Position	10	11	12	13	n
Value of Term	7	8	9	10	■

b.

Position	2	3	4	5	n
Value of Term	12	18	24	30	■

STUDY TIP

Look Back You can review **evaluating algebraic expressions** in Lesson 1-5.

STUDY TIP

Arithmetic Sequences Some arithmetic sequences are proportional. In Example 2, $\frac{6}{2} \neq \frac{7}{3} \neq \frac{8}{4} \neq \frac{9}{5}$. However, all arithmetic sequences can be described by an algebraic expression.

**Real-World EXAMPLE****Make a Table**

- 3 MEASUREMENT** There are 12 inches in 1 foot. Make a table and write an algebraic expression relating the number of feet to the number of inches. Then find Becca's height in feet if she is 60 inches tall.

Notice that the number of inches divided by 12 gives the number of feet. So, to find Becca's height, use the expression $n \div 12$.

$$\begin{aligned} n \div 12 &= 60 \div 12 && \text{Replace } n \text{ with } 60. \\ &= 5 && \text{Divide.} \end{aligned}$$

So, Becca is 5 feet tall.

Inches	Feet
12	1
24	2
36	3
48	4
n	$n \div 12$

**CHECK Your Progress**

- c. **RUNNING** There are 3 feet in 1 yard. Make a table and write an algebraic expression relating the number feet to the number of yards. Then find how many feet Summer ran if she ran 400 yards.

**TEST EXAMPLE**

- 4** Which expression was used to create the table at the right?

- A $n + 3$ C $2n + 3$
 B $2n$ D $n - 3$

Position	Value of Term
1	5
2	7
3	9
n	■

Test-Taking Tip

Eliminate Answer Choices As you examine a multiple-choice test item, eliminate answer choices you know to be incorrect.

Read the Test Item To find the expression, determine the function.

Solve the Test Item Notice that the values 5, 7, 9, ... increase by 2, so the rule contains $2n$. Therefore choices A and D can be eliminated.

If the rule were simply $2n$, then the value for position 1 would be 2×1 or 2. But this value is 5. So, choice B can be eliminated.

This leaves choice C. Test a few values.

Row 1: $2n + 3 = 2(1) + 3 = 2 + 3$ or 5

Row 3: $2n + 3 = 2(3) + 3 = 6 + 3$ or 9

So, the answer is C.

**CHECK Your Progress**

- d. Which expression was used to create the table at the right?

- F $5n - 1$ H $n + 1$
 G $5n$ J $n + 5$

Position	Value of Term
1	4
2	9
3	14
n	■



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✓ CHECK Your Understanding

Examples 1, 2
(p. 304)

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the fifteenth term in the sequence.

1.

Position	1	2	3	4	n
Value of Term	2	4	6	8	■


2.

Position	3	4	5	6	n
Value of Term	10	11	12	13	■

Example 3
(p. 305)

3. **MEASUREMENT** There are 16 ounces in 1 pound. Make a table and write an algebraic expression relating the number of ounces to the number of pounds. Then find the number of ounces of potatoes Mr. Padilla bought if he bought a ten-pound bag of potatoes.

Example 4
(p. 305)

4.  **TEST PRACTICE** The table at the right shows the fee for overdue books at a library, based on the number of weeks the book is overdue. Which expression was used to find the fee for a book that is n weeks overdue?

- A $n + 1$ C $n - 1$
B $2n$ D $2n + 1$

Weeks Overdue	Fee (\$)
1	3
2	5
3	7
4	9
n	■

Exercises

HOMEWORK HELP

For Exercises	See Examples
5–8	1, 2
9, 10	3
11, 12, 28, 29	4

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the twelfth term in the sequence.

5.

Position	3	4	5	6	n
Value of Term	12	13	14	15	■

6.

Position	6	7	8	9	n
Value of Term	2	3	4	5	■

7.

Position	1	2	3	4	n
Value of Term	5	10	15	20	■

8.

Position	2	3	4	5	n
Value of Term	24	36	48	60	■

9. **MEASUREMENT** There are 60 minutes in 1 hour. Make a table and write an algebraic expression relating the number of hours to the number of minutes. Then find the duration of the movies in hours if Hannah and her friends watched two movies that together were 240 minutes long.



Real-World Link
About 15 years ago, there were only 3 rock gyms in the U.S. Today, there are over 700 rock gyms.

Source: healthatoz.com

10. **MEASUREMENT** There are 12 months in 1 year. Make a table and write an algebraic expression relating the number of months to the number of years. Then find Andre's age in months if he is 12 years old.

•• **ANALYZE TABLES** Use the table at the right and the following information for Exercises 11 and 12.

The table shows the amount it costs to rock climb at an indoor rock climbing facility, based on the number of hours.

Time (h)	Amount (\$)
1	13
2	21
3	29
4	37
n	■

11. How does the cost change with each additional hour?
12. What is the rule to find the amount charged to rock climb for n hours?

Determine how the next term in each sequence can be found. Then find the next two terms in the sequence.

13. 1, 4, 7, 10, ... 14. 4, 16, 28, 40, ... 15. 2.3, 3.2, 4.1, 5.0, ...
16. 1.5, 3.9, 6.3, 8.7, ... 17. $1\frac{1}{2}$, 3, $4\frac{1}{2}$, 6, ... 18. $2\frac{1}{4}$, $2\frac{3}{4}$, $3\frac{1}{4}$, $3\frac{3}{4}$, ...

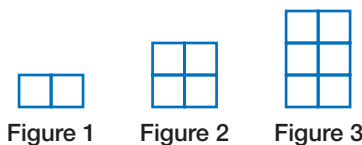
Find the missing number in each sequence.

19. 7, ■, 16, $20\frac{1}{2}$, ... 20. 14.6, ■, 24, 28.7
21. 30, ■, 19, $13\frac{1}{2}$, ... 22. 43.8, 36.7, ■, 22.5, ...

23. **MEASUREMENT** There are 24 hours in 1 day. Make a table and write an algebraic expression relating the number of hours to the number of days. Then find the number of hours in 1 week.

24. **GEOMETRY** Assume the pattern below continues. Write an algebraic expression to find the number of squares in Figure 8. Then find the number of squares in Figure 8.

EXTRAPRACTICE
See pages 677, 700.
Math **n** **10**
Self-Check Quiz at
tx.msmath1.com



H.O.T. Problems

25. **OPEN ENDED** Create a sequence in which $1\frac{1}{4}$ is added to each number.
26. **SELECT A TECHNIQUE** Gene charges a base fee of \$5 for each lawn he mows plus \$2 for the number of hours it takes to complete the job. Which of the following techniques might Gene use to determine an expression he can use to represent the total charge for mowing a lawn based on the number of hours? Justify your selection(s). Then use the technique(s) to solve the problem.

Mental math

Number sense

Estimation

27. **ANALYZE TABLES** Use words and symbols to generalize the relationship of each term as a function of its position. Then determine the value of the term when $n = 100$.

Position	1	2	3	4	5	n
Value of Term	1	4	9	16	25	■

28. **WRITING IN MATH** Write a problem about a real-world situation in which you would use a sequence to describe a pattern.

TEST PRACTICE

29. What is the rule to find the value of the missing term in the sequence below?

Position, x	Value of Term
1	1
2	5
3	9
4	13
5	17
x	■

- A $x + 4$
 B $4x - 3$
 C $4x$
 D $x - 3$

30. The table shows Samantha's age and Ling's age over four consecutive years.

Samantha's Age, x (years)	Ling's Age, y (years)
9	6
10	7
11	8
12	9

Which expression represents Ling's age in terms of Samantha's age?

- F $y - 3$
 G $3x$
 H $3y$
 J $x - 3$

Spiral Review

31. **ART** Mr. Torres is hanging his students' drawings in rows on one wall of his classroom. He places 1 drawing on the top row, 3 on the second row, and 5 on the third row. If this pattern continues, how many drawings will be on the seventh row? (Lesson 6-5)

Solve each proportion. (Lesson 6-4)

32. $\frac{3}{4} = \frac{a}{28}$

33. $\frac{5}{x} = \frac{45}{63}$

34. $\frac{24}{38} = \frac{12}{m}$

35. $\frac{x}{75} = \frac{5}{25}$

GET READY for the Next Lesson

PREREQUISITE SKILL Determine what number should be added to the first number to get the second number. (Lesson 5-6)

36. $4\frac{1}{4}, 4\frac{1}{2}$

37. $8\frac{1}{2}, 10$

38. $9, 12\frac{1}{2}$

39. $1\frac{2}{3}, 2\frac{1}{3}$

Main IDEA

Write an equation to describe a proportional situation.

**Targeted TEKS 6.4**

The student uses letters as variables in mathematical

expressions to describe how one quantity changes when a related quantity changes.

(A) Use tables and symbols to represent and describe proportional and other relationships such as those involving conversions, arithmetic sequences (with a constant rate of change), perimeter and area. **6.5** The student uses letters to represent an unknown in an equation. *Also addresses TEKS 6.2(C), 6.12(A).*

GET READY for the Lesson

BABY-SITTING The table at the right shows the amount of money Carli earns based on the number of hours she baby-sits.

- Write a sentence that describes the relationship between the number of hours she baby-sits and her earnings.
- Is the relationship proportional? Explain.
- What is the rule to find the amount Carli earns for baby-sitting h hours?
- If e represents the amount Carli earns, what equation can you use to represent this situation?

Hours Baby-Sitting	Earnings (\$)
1	5
2	10
3	15
4	20

In Lesson 6-6, you used algebraic expressions to determine how to find the value of a term in a sequence. Similarly, you can use an equation to represent a function.

EXAMPLE Write an Equation for a Function**REVIEW Vocabulary**

input the number on which a function machine performs one or more operations to produce an output (Explore 1-6)

output the resulting value when a function machine performs one or more operations on an input value (Explore 1-6)

- 1** Write an equation to represent the function displayed in the table.

Input, x	1	2	3	4	5
Output, y	9	18	27	36	45

Examine how the value of each input and output changes. Each output x is equal to 9 times the input y . So, the equation that represents the function is $y = 9x$.

Input, x	Multiply by 9	Output, y
1	1×9	9
2	2×9	18
3	3×9	27
4	4×9	36
5	5×9	45

CHECK Your Progress

- a. Write an equation to represent the function displayed in the table.

Input, x	1	2	3	4	5
Output, y	16	32	48	64	80

You can often use an equation to represent a real-world situation.

Real-World EXAMPLES

FUND-RAISING The cheerleading squad is holding a car wash to raise money. They are charging \$7 for each car they wash.

- 2 Make a table to show the relationship between the number of cars washed c and the total amount earned t .

The total earned (output) is equal to \$7 times the number of cars washed (input).

Cars Washed, c	Multiply by 7	Total Earned (\$), y
1	1×7	7
2	2×7	14
3	3×7	21
4	4×7	28

- 3 Write an equation to find the total amount earned t for washing c cars.

Study the table from Example 2. The total earned equals \$7 times the number of cars washed.

Words	Total earned equals \$7 times the number of cars washed.
Variable	Let t represent the total earned and c represent the number of cars washed.
Equation	$t = 7 \cdot c$

So, the equation is $t = 7c$.

- 4 How much will the cheerleading squad earn if they wash 25 cars?

$t = 7c$ Write the equation.

$t = 7 \cdot 25$ Replace c with 25.

$t = 175$ Multiply.

The cheerleading squad will earn \$175 for washing 25 cars.

CHECK Your Progress

BALD EAGLE While in normal flight, a bald eagle flies at an average speed of 30 miles per hour.

- Make a table to show the relationship between the total distance d that a bald eagle can travel in h hours.
- Write an equation to find the total distance d that a bald eagle can travel in h hours while in normal flight.
- How many miles can a bald eagle travel in 2 hours?



Real-World Link

Bald eagles can dive at speeds up to 200 miles per hour.

Source: sandiegozoo.org

Real-World EXAMPLE

5 JET SKIING The cost of renting a jet ski at a local marina is shown in the table. Write a sentence and an equation to describe the data. Then find the total cost of renting a jet ski for 6 hours.

Number of Hours, h	Total Cost (\$), t
1	10
2	20
3	30
4	40

The cost of renting a jet ski is \$10 for each hour. The total cost t is \$10 times the number of hours h . Therefore, $t = 10h$. Use this equation to find the total cost t of renting a jet ski for 6 hours.

$t = 10h$ Write the equation.

$t = 10 \cdot 6$ or 60 Replace h with 6. Multiply.

The total cost of renting a jet ski for 6 hours is \$60.

CHECK Your Progress

e. **FITNESS** A fitness center charges the amount shown in the table for using the facility. Write a sentence and an equation to describe the data. Then find the total cost of using the fitness center for 12 months.

Number of Months, m	Total Fee (\$), t
1	25
2	50
3	75
4	100

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CHECK Your Understanding

Example 1 (p. 309) Write an equation to represent the function displayed in each table.

1.

Input, x	0	1	2	3	4
Output, y	0	4	8	12	16

2.

Input, x	1	2	3	4	5
Output, y	8	16	24	32	40

Examples 2–4 (p. 310) **LUNCH** Use the following information for Exercises 3–5.

The school cafeteria sells lunch passes that allow a student can purchase any number of lunches in advance for \$3 a lunch.

- Make a table to show the relationship between the number of lunches n and the total cost t .
- Write an equation to find t , the total cost in dollars for a lunch card with n lunches.
- If Lolita buys a lunch pass for 20 lunches, how much will it cost?

Example 5 (p. 311) **6. CARNIVAL** The general admission to a local carnival is shown in the table. Write a sentence and an equation to describe the data. Then find the total cost of admission for 7 people.

Number of People, n	Total Admission (\$), t
1	4
2	8
3	12
4	16

Exercises

HOMework HELP

For Exercises	See Examples
7–10	1
11, 14	2
12, 15	3
13, 16	4
17, 18	5

Write an equation to represent the function displayed in each table.

7.

Input, x	1	2	3	4	5
Output, y	6	12	18	24	30

8.

Input, x	0	1	2	3	4
Output, y	0	11	22	33	44

9.

Input, x	0	1	2	3	4
Output, y	0	15	30	45	60

10.

Input, x	1	2	3	4	5
Output, y	10	20	30	40	50

VIDEO GAMES Use the following information for Exercises 11–13.

In a video game, each player earns 15 points for each coin they collect.

- Make a table to show the relationship between the number of coins collected c and the total points p .
- Write an equation to find p , the total points for collecting c coins.
- How many points will a player earn if she collects 21 coins?

ELEPHANTS Use the following information for Exercises 14–16.

An African elephant eats at a rate of 400 pounds of vegetation each day.

- Make a table to show the relationship between the number of pounds v an African elephant eats in days d .
- Write an equation to find v , the number of pounds of vegetation an African elephant eats in d days.
- How many pounds of vegetation does an African elephant eat in 5 days?

17. **ENTERTAINMENT** The disc jockey hired for the spring dance charges the amount shown in the table. Write a sentence and an equation to describe the data. At this rate, how much will it cost to hire the disc jockey for 5 hours?

Number of Hours, h	Total Charge (\$), t
1	35
2	70
3	105

18. **FOOD** A catering service provides the table shown as a guide to help its customers decide how many pans of lasagna to order for events. Write a sentence and an equation to describe the data. At this rate, how many people would 8 pans of lasagna serve?

Number of Pans, p	Total Number Served, n
1	24
2	48
3	72

19. **RESEARCH** Use the Internet or another source to find the average amount of food that another animal eats per day. Then write an equation to find f , the amount of food the animal eats in d days.

Write an equation to represent the function displayed in each table.

20.

Input, x	2	4	6	8	10
Output, y	1	2	3	4	5

21.

Input, x	3	6	9	12	15
Output, y	1	2	3	4	5



Real-World Link . . .

An African elephant spends up to 16 hours each day searching for and feeding on vegetation in the form of grasses, tree limbs, tubers, fruits, vines, and shrubs.

Source: elephantcountryweb.com

EXTRAPRACTICE

See pages 677, 700.

Math  nigeSelf-Check Quiz at
tx.msmath1.com

22.  **FIND THE DATA** Refer to the Texas Data File on pages 16–19. Choose some data and write a real-world problem in which you would write an equation using two variables to represent a problem situation.

23. **WEATHER** Write an equation to find the total precipitation t in inches for Burbank in m months. How much precipitation does Burbank receive in 4 months? Compare this to the total precipitation in 4 months for Coronado.

City	Average Annual Precipitation (in.)
Burbank	12
Coronado	9
Pasadena	20


Source: weatherbase.com

H.O.T. Problems

24. **OPEN ENDED** Write about a real-world situation that can be represented by the equation $y = 5x$. Be sure to explain what the variables represent in the situation.

25. **CHALLENGE** Write an equation to represent the function in the table.

Input, x	6	8	10	12	14	16
Output, y	0	1	2	3	4	5

26.  **WRITING IN MATH** Choose an exercise from this lesson, and explain why the relationship is proportional.

 **TEST PRACTICE**

27. The table shows admission prices at a local zoo based on the number of guests.

Number of Guests, x	Total Admission (\$), y
1	7
2	14
3	21
4	28

Which equation can be used to find y , the total admission for x guests?

- A $x = 7y$ C $y = 7x$
 B $y = 7 + x$ D $x = 7 + y$

28. If the cost of snorkeling is \$5 for the equipment plus an additional \$7 for each hour that you snorkel, which equation represents c , the cost in dollars for snorkeling for h hours?

- F $c = 7h + 5$
 G $c = 5h + 7$
 H $c = 7(h + 5)$
 J $c = 5(h + 7)$

Spiral Review

29. Find the next two terms of the sequence 3, 11, 19, 27, ... (Lesson 6-6)
30. **MONEY** Maxine withdraws the same amount of money from her savings account each month. In March, her account balance was \$100. Her next monthly balances were \$85, \$70, and \$55. At this rate, what will her account balance be in September? (Lesson 6-5)

Graphing Calculator Lab

Graphing Proportional Relationships

Main IDEA

Graph proportional relationships.



Targeted TEKS 6.4

The student uses letters as variables in mathematical

expressions to describe how one quantity changes when a related quantity changes.

(A) Use tables and symbols to represent and describe proportional and other relationships such as those involving conversions, arithmetic sequences (with a constant rate of change), perimeter and area. 6.5 The student uses letters to represent an unknown in an equation. Also addresses TEKS 6.12(A).

ACTIVITY

CORN DOGS The corn dog was invented for the Texas State Fair in 1942. Suppose Booth A at a fair sells corn dogs for \$2 each while Booth B charges \$3 for each corn dog. Write and graph an equation representing the total cost y for selling x corn dogs.

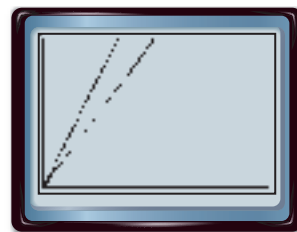
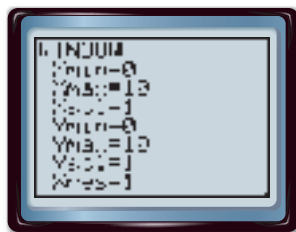
STEP 1 Write an equation to show the relationship between the number of corn dogs sold x and total cost y at each booth.

Booth A	Booth B
Total cost is \$2 per corn dog.	Total cost is \$3 per corn dog.
$y = 2x$	$y = 3x$

STEP 2 Press $\boxed{Y=}$ on your calculator and enter the expression $2x$ into Y1 and $3x$ into Y2.

STEP 3 Next, change the view of your graph by pressing \boxed{WINDOW} and entering the values shown below.

STEP 4 Finally, graph the equations by pressing \boxed{Graph} .



ANALYZE THE RESULTS

- MAKE A CONJECTURE** Which equation is represented by the steeper line? Explain. To check your conjecture, press \boxed{Trace} and then use $\boxed{\uparrow}$ and $\boxed{\downarrow}$ keys to switch between the two lines.
- Press $\boxed{2nd}$ $\boxed{[CALC]}$ $\boxed{1}$ and enter a value of 3. Switch between the two lines. What do the x - and y -values displayed represent?
- MAKE A CONJECTURE** Suppose Booth C sells corn dogs for \$2.50 each. How should the graph of this equation appear in relationship to the graphs of the other two equations? Explain. Check your answer by entering the appropriate equation into Y_3 , pressing \boxed{Graph} , and switching between the equations.

Study Guide and Review



Download Vocabulary Review from tx.msmath1.com

FOLDABLES

Study Organizer

GET READY to Study

Be sure the following Key Concepts are noted in your Foldable.

Ratio	Proportion	Function
Examples	Examples	Examples

Key Concepts

Ratios (Lessons 6-1 and 6-2)

- Ratios are a comparison of two quantities by division.
- Equivalent ratios express the same relationship between two quantities.
- To find an equivalent ratio, multiply or divide each quantity in the ratio by the same number.

Rates (Lesson 6-1)

- Rates are a ratio comparing two quantities with different kinds of units.
- A unit rate is a rate for one unit of a given quantity.

Proportions (Lessons 6-3 and 6-4)

- Proportions are equations stating that two ratios are equivalent.
- To solve a proportion, use either an equivalent fraction or a unit rate.

Sequences (Lesson 6-6)

- Sequences are a list of numbers in a specific order.
- Each number listed in a sequence is called a term.
- Each term of an arithmetic sequence is found by adding the same number to the previous term.
- Algebraic expressions can be used to describe a sequence.

Equations (Lesson 6-7)

- An equation can be used to represent a function.

Key Vocabulary

arithmetic sequence (p. 303)	ratio table (p. 282)
equivalent ratio (p. 282)	scaling (p. 283)
proportion (p. 289)	sequence (p. 303)
proportional (p. 289)	term (p. 303)
rate (p. 275)	unit rate (p. 275)
ratio (p. 274)	

Vocabulary Check

State whether each sentence is *true* or *false*. If *false*, replace the underlined word or number to make a true sentence.

1. A ratio is a comparison of two numbers by multiplication.
2. A rate is the ratio of two measurements that have different units.
3. Two quantities are said to be proportional if they have a constant ratio or rate.
4. A proportion is an equation stating that two ratios or rates are not equal.
5. Adding or subtracting two related quantities by the same number is called scaling.
6. A sequence is a list of numbers in a specific order.
7. In an arithmetic sequence, each term is found by multiplying the same number.
8. In a ratio table, the columns are filled with pairs of numbers that have the same term.

Lesson-by-Lesson Review

6-1 Ratios and Rates (pp. 274–279)

Write each ratio or rate as a fraction in simplest form.

9. 12 blue marbles out of 20 marbles
10. 9 goldfish out of 36 fish
11. 18 boys out of 21 students

Write each rate as a unit rate.

12. 3 inches of rain in 6 hours
13. 189 pounds of garbage in 12 weeks
14. 78 erasers in 3 packages
15. **DVDs** Rick has 12 action, 15 comedy, and 9 drama DVDs. Find the ratio of action DVDs to the total number of DVDs. Then explain its meaning.

Example 1 Write the ratio 30 sixth graders out of 45 students as a fraction in simplest form.

$$\frac{30}{45} = \frac{2}{3}$$

The GCF of 30 and 45 is 15.

Example 2 Write the rate 150 miles in 4 hours as a unit rate.

$$\frac{150 \text{ miles}}{4 \text{ hours}} = \frac{37.5 \text{ miles}}{1 \text{ hour}}$$

Divide the numerator and the denominator by 4 to get the denominator of 1.

6-2 Ratio Tables (pp. 282–287)

For Exercises 16 and 17, use the ratio tables given to solve each problem.

16. **MONEY** Arthur bought 5 notebooks for \$3. How much will he spend on 10 notebooks?

Number of Notebooks	5	10
Money Spent (\$)	3	■

17. **TRUCKS** In a parking lot, 3 out of 8 vehicles were trucks. If there were 128 vehicles, how many were trucks?

Number of Trucks	3	■
Number of Vehicles	8	128

18. **TICKETS** Roman spent \$306 for 17 baseball tickets. Use a ratio table to determine how much each ticket costs.

Example 3 Boston received 6 inches of rain in 24 hours. If it rained at a constant rate, use a ratio table to determine how much rain Boston would receive in 48 hours.

Set up a ratio table. Label the rows with the two quantities being compared. Then fill in what is given.

Inches of Rain	6	■
Number of Hours	24	48

Use scaling to find the desired quantity.

Inches of Rain	6	12
Number of Hours	24	48

So, Boston would receive 12 inches of rain in 48 hours.

6-3 Proportions (pp. 289–293)

Determine if the quantities in each pair of ratios or rates are proportional. Explain your reasoning and express each proportional relationship as a proportion.

19. 220 ft to 25 in.; 88 ft to 10 in.
20. 14 girls to 21 boys; 21 girls to 34 boys
21. **JEWELRY** Stacey made 8 necklaces in 48 minutes. Nick made 4 necklaces in 24 minutes. Are these rates proportional? Explain your reasoning.

Example 4 Are the ratios 18 weeks to 3 years and 54 weeks to 10 years proportional? Explain your reasoning.

Find the unit ratio for each ratio.

$$\frac{18 \text{ weeks}}{3 \text{ years}} = \frac{6 \text{ weeks}}{1 \text{ year}} \quad \frac{54 \text{ weeks}}{10 \text{ years}} = \frac{5.4 \text{ weeks}}{1 \text{ year}}$$

Since the ratios do not share the same unit ratio, they are not equivalent. Therefore, they are not proportional.

6-4 Algebra: Solving Proportions (pp. 294–299)

Solve each proportion.

22. $\frac{7}{11} = \frac{m}{33}$
23. $\frac{3}{20} = \frac{15}{k}$
24. $\frac{8}{20} = \frac{9}{60}$
25. $\frac{25}{h} = \frac{5}{7}$
26. **SCHOOL** At Rio Middle School, the teacher to student ratio is 3 to 42. If 504 students are enrolled at the school, how many teachers are there?

Example 5 Solve the proportion

$$\frac{9}{12} = \frac{g}{4}$$

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

Since $12 \div 3 = 4$, divide the numerator and denominator by 3.

So, $g = 3$.

6-5 PSI: Look for a Pattern (pp. 301–302)

Solve by looking for a pattern.

27. **LAPS** Cheyenne ran 1 lap on day 1. She ran 2 laps on day 2, 4 laps on day 3, and 8 laps on day 4. If this pattern continues, how many laps will she run on day 7?
28. **BASEBALL** The table shows the scores at a baseball game. If the scoring pattern continues, how many runs will the Reds score in the 7th inning?

Inning	1	2	3	4	5	6	7
Cubs	0	1	2	4	0	1	3
Reds	4	3	2	0	4	3	■

Example 6 A display of cans is stacked in the shape of a pyramid. There are 2 cans in the top row, 4 in the second row, 8 in the third row, and so on. The display contains 7 rows. How many cans are in the display?

Make a table to see the pattern.

Row	1	2	3	4	5	6	7
Number of Cans	2	4	6	8	10	12	14

There are $2 + 4 + 6 + 8 + 10 + 12 + 14$ or 56 cans in the display.

6-6

Sequences and Expressions (pp. 303–308)

Use words and symbols to describe the value of each term as a function of its position. Then find the value of the sixteenth term in the sequence.

29.

Position	22	23	24	25	n
Value of Term	15	16	17	18	■

30.

Position	10	11	12	13	n
Value of Term	28	31	34	37	■

31. **BUSINESS** Jennifer earns \$12 for every dog she walks. Write an algebraic expression to find the amount of money she would earn for walking n number of dogs. Then find the amount of money she would earn for walking 45.

Example 7 Use words and symbols to describe the value of each term as a function of its position. Then find the value of the ninth term in the sequence.

Position	5	6	7	8	n
Value of Term	20	24	28	32	■

Study the relationship between each position and the value of its term.

Position	Multiply by 4	Value of Term
5	5×4	20
6	6×4	24
7	7×4	28
8	8×4	32
n	$n \times 4$	$4n$

Notice that the value of each term is 4 times its position number.

$$4n = 4 \cdot 9 \quad \text{Replace } n \text{ with } 9.$$

$$= 36 \quad \text{Multiply.}$$

The value of ninth term in the sequence is 36.

6-7

Proportions and Equations (pp. 309–313)

Write an equation to represent the function displayed in each table.

32.

Input, x	1	2	3	4	5
Output, y	6	12	18	24	30

33.

Input, x	1	2	3	4	5
Output, y	7	14	21	28	35

34. **BOWLING** A bowling alley charges \$4 per game. Write an equation to find the total cost in dollars t for the number of games bowled n . Then find the total cost for 8 games bowled.

Example 8 Write an equation to represent the function displayed in the table.

Examine how the value of each input and output changes.

Input, x	1	2	3	4	5
Output, y	9	18	27	36	45

$+1 \quad +1 \quad +1 \quad +1$

 $+9 \quad +9 \quad +9 \quad +9$


Each output is equal to 9 times the input. So, the equation that represents the function is $y = 9x$.

Practice Test

Write each ratio as a fraction in simplest form.

- 12 red blocks out of 20 blocks
- 24 potato chips out of 144 chips
- 65 rotten apples out of 520 apples
- BIRDS** If a hummingbird flaps its wings 250 times in 5 seconds, how many times does a hummingbird flap its wings each second?

Write each rate as a unit rate.

- \$2 for 36 erasers
- 180 pages in 90 minutes
-  **TEST PRACTICE** Candace buys 12 cans of orange juice for \$6. At this rate, how much would she pay for 48 cans of orange juice?
A \$20
B \$22
C \$24
D \$30

Determine if the quantities in each pair of ratios or rates are proportional. Explain your reasoning and express each proportional relationship as a proportion.

- 32 pencils for \$8; 16 pencils for \$4
- 72 out of 90 students have siblings; 362 out of 450 students have siblings
- 524 Calories for 4 servings; 786 Calories for 6 servings

Solve each proportion.

- $\frac{4}{6} = \frac{x}{12}$
- $\frac{10}{p} = \frac{2}{8}$
- $\frac{n}{13} = \frac{8}{52}$
- $\frac{7}{13} = \frac{a}{52}$

- SEASONS** If 7 of the 28 students in a class prefer the winter months, predict how many would prefer the winter months in a school of 400 students.

- DISCOUNT** Ellie is using the following table to help her calculate the discount on baseball caps. Mr. Gomez would like to order 8 baseball caps. How much of a discount should Ellie give him?

Baseball caps	1	2	3
Discount (\$)	2	3	4

-  **TEST PRACTICE** Which expression was used to create the table?

Position, x	Value of Term
3	11
4	14
5	17
6	20
7	23
x	■

- F $x + 8$
G $2x + 3$
H $x - 8$
J $3x + 2$

READING For Exercises 18–20, use the following information.

Darnell reads an average of 2 hours each day.

- Make a table to show the relationship between the number of h hours Darnell spends reading in d days.
- Write an equation to find h , the number of hours Darnell spends reading in d days.
- On average, how many hours will Darnell spend reading in 12 days?



Read each question. Then fill in the correct answer on the answer document provided by your teacher or on a sheet of paper.

- Samantha's class was sorting books in the library. The class sorted 45 books in 90 minutes. If they continue sorting at this rate, how long will it take them to sort 120 books?
 - 5 h
 - $4\frac{1}{2}$ h
 - 4 h
 - $3\frac{1}{2}$ h
- The ratio of cats to dogs seen by a vet in a day is about 2 to 5. If a vet saw 40 animals in one day, about how many were dogs?

F 5	H 29
G 12	J 40
- Which statement about the mixed number $1\frac{5}{8}$ is true?
 - $1\frac{5}{8} > \frac{1}{2}$
 - $1\frac{5}{8} > 2$
 - $1 > 1\frac{5}{8}$
 - $1\frac{5}{8} < \frac{1}{4}$
- Mr. Lee's car odometer read 55,085.4 miles. After his trip, it read 56,002.8 miles. Choose the best estimate for the number of miles the car was driven on his trip.

F 100 miles	H 1,000 miles
G 150 miles	J 2,000 miles

- GRIDDABLE** When Shawnel held her cat and stepped onto a scale, the scale's display read 107.2 pounds. If Shawnel weighs 97.9 pounds, how many pounds does her cat weigh?
- David's time in a race was 9 minutes. Armando's time was two minutes less than Rachel's time, and Rachel's time was 4 minutes more than David's time. Which table could be used to find Armando's time?

A

Name	Time (min)
Armando	$9 - 4 + 2$
Rachel	$4 - 2$
David	9

B

Name	Time (min)
Armando	$4 - 2$
Rachel	$9 + 4$
David	9

C

Name	Time (min)
Armando	$9 + 4 - 2$
Rachel	$9 + 4$
David	9

D

Name	Time (min)
Armando	$4 + 2$
Rachel	$9 + 4$
David	9

- GRIDDABLE** Find the greatest common factor of 15, 20, and 25.
- At a concert, backstage passes were awarded to the person sitting in the seat numbered with the least common multiple of 9, 12, and 18. Find the number of the prizewinning seat.

F 3	H 36
G 12	J 45

9. Juanita was making a cake. She added $\frac{1}{4}$ cup of brown sugar, $1\frac{1}{3}$ cups of flour, and $\frac{3}{4}$ cup of flour. Which procedure can you use to find the total number of cups Juanita used?
- A Divide the sum of the whole numbers by the sum of the fractions, using a common denominator when necessary
- B Find the difference between the sum of the whole numbers and the sum of the fractions, using a common denominator when necessary
- C Multiply the sum of the whole numbers by the sum of the fractions, using a common denominator when necessary
- D Add the sum of the whole numbers and the sum of the fractions, using a common denominator when necessary
10. At a sports camp, there is 1 counselor for every 12 campers. If there are 156 campers attending the camp, which proportion can be used to find x , the number of counselors?
- F $\frac{x}{12} = \frac{1}{156}$
- G $\frac{12}{1} = \frac{x}{156}$
- H $\frac{1}{12} = \frac{x}{156}$
- J $\frac{x}{1} = \frac{12}{156}$

TEST-TAKING TIP

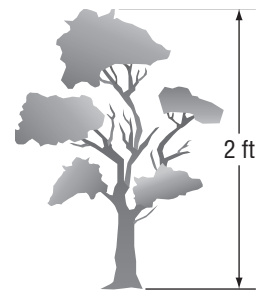
Question 10 When setting up a proportion, make sure the numerators and denominators in each ratio have the same units, respectively.

11. Which is the prime factorization of 252 using exponents?
- A $2^2 \cdot 7$
- B $2^2 \cdot 7 \cdot 9$
- C $2^2 \cdot 9$
- D $2 \cdot 7^2 \cdot 9$
12. On Monday, Ted ran $3\frac{1}{2}$ miles. Then on Wednesday he ran $1\frac{2}{3}$ miles and on Friday he ran $2\frac{1}{4}$ miles. Find the total number of miles Ted ran.
- F $6\frac{1}{2}$ miles
- G $7\frac{5}{12}$ miles
- H $7\frac{1}{2}$ miles
- J $8\frac{1}{12}$ miles

Pre-AP

Record your answers on a sheet of paper. Show your work.

13. Dante made a scale model of a tree. The actual tree is 32 feet tall, and the height of the model is 2 feet.



- a. Write a proportion that Dante could use to find the actual height that one foot on the drawing represents.
- b. How many actual feet does one foot on the model represent?
- c. Suppose a branch on the actual tree is 4 feet long. How long would this branch be on the model of the tree?

NEED EXTRA HELP?

If You Missed Question...	1	2	3	4	5	6	7	8	9	10	11	12	13
Go to Lesson...	6-1	6-4	4-6	3-4	3-5	5-6	4-1	4-5	1-4	6-4	1-3	5-6	6-4
For Help with Test Objective...	2	2	1	1	1	6	1	1	6	2	1	1	1