

## MASTERY TEST

If you know how to do these problems, you have learned your lesson!

51. A 6-ounce tube of toothpaste costs \$2.30. What is the unit price in cents per ounce? (Answer to one decimal place.)
52. A can of spray costs \$3.99 for 4 ounces. Another brand costs \$5.99 for 6 ounces. Which can is the better buy?
53. A student earned \$508.40 in a two-week period.
  - a. What was the rate of pay per week?
  - b. If the student worked 82 hours, what was the rate of pay per hour?
54. A 50-pound bag of Turf Supreme fertilizer covers 8000 square feet. To the nearest whole number, what is the rate of coverage in square feet per pound?
55. Mikisha traveled from Tampa to Miami, a distance of 280 miles, on one tank of gas. If her tank holds about 13 gallons of gas, what was her mile-per-gallon rate to the nearest whole number?
56. The school magazine offers you \$2600 to write a 1500-word article dealing with spring-break activities. To the nearest cent, what is the rate per word?

### 4.3

## WORD PROBLEMS INVOLVING PROPORTIONS

### To Succeed, Review How To . . .

Before starting this section you should know:

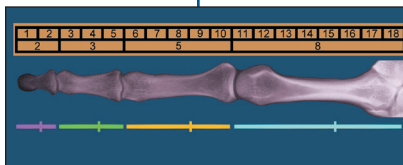
1. How to reduce a fraction to lowest terms. (pp. 122–124)
2. How to use the RSTUV method to solve word problems. (pp. 92, 175, 233)
3. How to solve a proportion. (p. 252)

### Objective

You should be able to:

- A** Solve word problems involving proportions.

### GETTING STARTED



The length of each line is *proportional* to the one above it. More precisely, each line is 1.61804 . . . longer than the previous one.



The *ratio* of your forearm length  $f$  to hand length  $h$  (measured from wrist to tip of middle finger) is written as  $\frac{f}{h}$  and equal to the ratio  $\frac{1.61804\dots}{1}$ .

We say that your forearm and hand are *proportional*. As you recall, an equality of ratios is called a *proportion*.

Here 
$$\frac{f}{h} = \frac{1.61804\dots}{1}$$

Now, suppose the length of your hand is 7 inches, what is the approximate length  $f$  of your forearm? You can find out by using the RSTUV procedure we have studied, but your answer should be about 11.3 inches. Does this work all the time? Find out for yourself. Measure the length  $h$  of your hand and predict the length  $f$  of your forearm. Is the prediction close to the actual length? Is  $\frac{f}{h}$  close to 1.61804...?

We shall practice using the RSTUV procedure in solving proportions next.

**A**

**Word Problems Involving Proportions**

**EXAMPLE 1 Rye grass coverage**

A pound of rye grass seed covers 120 square feet of lawn. How many pounds are needed to seed a lawn measuring 60 feet by 50 feet (3000 square feet)?

**SOLUTION** We use the RSTUV method discussed in Section 2.7.

**1. Read the problem.**

Read the problem and decide what it asks for. (We want to know how many pounds of seed are needed.)

**2. Select the unknown.**

Select a letter to represent the unknown. (Let  $p$  be the number of pounds needed.)

**3. Translate into an equation.**

Translate the problem into an equation. 1 pound seeds 120 square feet;  $p$  pounds seed 3000 square feet. Thus

$$\frac{1}{120} = \frac{p}{3000}$$

**4. Use the rules to solve.**

Use the rules studied to solve the equation.

$$\begin{aligned} 1 \cdot 3000 &= 120p && \text{Cross multiply.} \\ \frac{1 \cdot 3000}{120} &= p && \text{Divide both sides by 120.} \\ 25 &= p && \text{Simplify.} \end{aligned}$$

Thus 25 pounds are needed.

**5. Verify the answer.**

Verify your answer. If we substitute 25 for  $p$  in step 3, we have:

$$\frac{1}{120} = \frac{25}{3000}$$

Cross multiplying,  $1 \cdot 3000 = 120 \cdot 25$ , which is a true statement.

Thus, our answer is correct.

To make the work easier, we will shorten some of the steps in the next examples.

**EXAMPLE 2 Computer trouble**

Have you had trouble with a computer lately? A recent study indicated that 2 out of 5 families run into trouble with a computer in the course of a year. If 3000 families were surveyed, how many families would have run into trouble with the computer?

**SOLUTION**

**1. Read.**

Read the problem.

**2. Select unknown.**

Select  $f$  to represent the number of families that ran into trouble.

**3. Translate.**

Translate: Note that 3000 is the *total* number of families. Thus

$$\frac{2}{5} = \frac{f}{3000}$$

**PROBLEM 1**

A pound of Bahia grass seed covers 100 square feet of lawn. How many pounds are needed to seed a lawn measuring 90 feet by 50 feet (4500 square feet)?

**Web It**

For an extensive lesson reviewing ratio and proportion and then covering applications of proportion, see link 4-3-1 at the Bello website at [mhhe.com/bello](http://mhhe.com/bello).

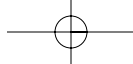
To review proportions, try link 4-3-2.

**PROBLEM 2**

If a study revealed that 2 out of 5 families run into trouble with a computer and it is known that 300 families had trouble with the computer, how many families were surveyed?

**Answers**

1. 45 pounds      2. 750



**4. Use cross products.**

Use cross products:

$$2 \cdot 3000 = 5f$$

$$\frac{2 \cdot 3000}{5} = f \quad \text{Divide by 5.}$$

$$\frac{6000}{5} = f \quad \text{Multiply.}$$

$$1200 = f \quad \text{Divide.}$$

That is, 1200 families ran into trouble.

**5. Verify.**

Verification is left for you.

**EXAMPLE 3 Protein in diet**

Do you have enough protein in your diet? Females are supposed to have 44 grams every day. If 2 tablespoons of peanut butter provide 8 grams of protein, how many tablespoons does a female need to have 44 grams of protein?

**SOLUTION**

**1. Read.**

Read the problem.

**2. Select unknown.**

Select  $t$  to be the number of tablespoons needed.

**3. Translate.**

Translate: 2 tablespoons provide 8 grams;  $t$  tablespoons provide 44 grams.

$$\frac{2}{8} = \frac{t}{44}$$

**4. Use cross products.**

Use cross products:

$$2 \cdot 44 = 8t$$

$$\frac{2 \cdot 44}{8} = t \quad \text{Divide both sides by 8.}$$

$$\frac{88}{8} = t \quad \text{Multiply.}$$

$$11 = t \quad \text{Divide.}$$

Thus 11 tablespoons of peanut butter are needed to obtain 44 grams of protein.

**5. Verify.**

Verification is left for you.

**EXAMPLE 4 Buying stocks**

The cost of 50 shares of 3M (MMM) stock is \$106.25. How many shares can you buy with \$425?

**SOLUTION**

**1. Read.**

Read the problem.

**2. Select unknown.**

Select  $n$  to be the number of shares you can buy with \$425.

**3. Translate.**

Translate: 50 shares cost \$106.25,  $n$  shares cost \$425. Thus

$$\frac{50}{106.25} = \frac{n}{425}$$

**PROBLEM 3**

Males need 56 grams of protein every day. If 2 tablespoons of peanut butter provide 8 grams of protein, how many tablespoons does a male need to have 56 grams of protein?

**PROBLEM 4**

The cost of 50 shares of Comp-U-Check is \$137.50. How many shares can you buy with \$1100?

**Answers**

3. 14 tablespoons      4. 400

**4. Use cross products.**

Use cross products:

$$50 \cdot 425 = 106.25n$$

$$\frac{50 \cdot 425}{106.25} = n \quad \text{Divide both sides by 106.25.}$$

$$\frac{21,250}{106.25} = n \quad \text{Multiply.}$$

$$200 = n \quad \text{Divide.}$$

Thus 200 shares can be bought with \$425.

**5. Verify.**

Verification is left for you.

Proportions are used in medicine for calculating dosages. Suppose you know the adult dose for a certain medicine. How can you find the dose suitable for children? “The only rule based on scientific principles and the one which should be used” is Clark’s Rule.

The rule states that the ratio of the weight of the child  $W_c$  to the average weight of an adult  $W_a$  is proportional to the children’s dose  $c$  divided by the adult dose  $a$ , that is,

Clark’s Rule  $\frac{W_c}{W_a} = \frac{c}{a}$

Source: Texas Health Science Technology Education.

We use this rule in the next example.

**EXAMPLE 5 Children’s dose of antibiotics**

The dose of antibiotics for a 150-pound adult is 3 pills. What is the equivalent dose suitable for a child weighing 50 pounds?

**SOLUTION**

**1. Read the problem.**

Read the problem. We have to use Clark’s Rule.

**2. Select the unknown.**

The unknown is the dose of pills for a child; call it  $c$ .

**3. Translate the problem into an equation or inequality.**

According to Clark’s Rule,

$$\frac{W_c}{W_a} = \frac{c}{a}$$

$W_c$  (the weight of the child) = 50

$W_a$  (the weight of the adult) = 150

$a$  (the adult dose) = 3 pills

**4. Use the rules we have studied to solve the equation.**

Substitute these values into the equation:

$$\frac{50}{150} = \frac{c}{3}$$

$$3 \cdot 50 = 150c \quad \text{Cross multiply.}$$

$$150 = 150c \quad \text{Multiply 3 by 50.}$$

$$1 = c \quad \text{Divide by 150.}$$

Thus, the dose of antibiotics for a 50-pound child is 1 pill.

**5. Verify the answer.**

To verify the answer, note that the ratio of the weight of the child to the weight of the adult is  $\frac{50}{150}$  or  $\frac{1}{3}$ . In the same manner, the ratio of pills taken by the child to pills taken by the adult is 1 to 3 or  $\frac{1}{3}$ .

**PROBLEM 5**

What is the dose for a child weighing 75 pounds?

**Answer**

5.  $1\frac{1}{2} = 1.5$  pills

Finally, we shall consider strength, not your algebra strength, but the strength of different animals! Elephants can carry up to 25% of their own weight on their backs, camels about 20%, and leaf-cutting ants about 3 times their own weight, but rhinoceros beetles can carry about 850 times their body weight. How strong is that? We shall see in the next problem.

Source: Data from edHelper.com.



**EXAMPLE 6** Rhinoceros beetle carrying load

A rhinoceros beetle weighs 30 grams and can carry 850 times its body weight, that is, 25,500 grams. If a person could carry proportionally as much as the rhinoceros beetle, how much could a 60-kilogram (kg) student carry?

**SOLUTION**

**1. Read the problem.**

We want to find how much a 60 kg student can carry.

**2. Select the unknown.**

Let  $W$  be the weight of the student. The ratio of body weight to carrying weight for the beetle is  $\frac{30}{25,500}$ . For the student the ratio is  $\frac{60}{W}$ .

**3. Translate the problem into an equation or inequality.**

We want the weights to be proportional, so

$$\frac{30}{25,500} = \frac{60}{W}$$

**4. Use the rules we have studied to solve the equation.**

Cross multiply:  $30W = 60 \cdot 25,500$

Divide by 30:  $W = 51,000$  kg

Since one kg is about 2.2 pounds, the 51,000 kg represents more than 100,000 pounds! Strong indeed.

**5. Verify the answer.**

If students could carry 850 times their weight (like the beetle), a 60-kg student could carry  $850 \cdot 60 = 51,000$  kg as stated.

**PROBLEM 6**

Proportionally, how much could a 90 kg football player carry?

**Answer**

6. 76,500 kg

**Exercises 4.3**

**A** In Problems 1–30, use the RSTUV procedure to solve.

1. *Lawn coverage* A pound of weed and feed covers 200 square feet. How many pounds are needed to cover a lawn measuring 60 feet by 50 feet (3000 square feet)?
2. *Fertilizing the lawn* A pound of fertilizer covers 250 square feet. How many pounds are needed to fertilize a lawn measuring 70 feet by 50 feet (3500 square feet)?
3. *Advancing stocks* On a recent day, 2 out of 5 stocks in the New York Stock Exchange (NYSE) advanced in price. If 1900 issues were traded, how many advanced in price?
4. *Declining stocks* On a recent day, 3 out of 5 stocks in the NYSE declined in price. If 1500 issues were traded, how many declined in price?

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5. *Male RDA of protein* The recommended daily allowance (RDA) of protein for males in the 15–18 age range is 56 grams per day. Two ounces of cheddar cheese contain 14 grams of protein. How many ounces of cheddar cheese are needed to provide 56 grams of protein?
7. *Buying stocks* Fifty shares of Titan Corp. stock cost \$112.50. How many shares can be bought with \$562.50?
9. *Showering for sleep* It has been estimated that a 10-minute shower is worth  $1\frac{1}{2}$  hours of sleep. Using this scale, how long do you have to shower to get 6 hours of sleep?
11. *Getting the votes* It has been estimated that for every 10 volunteers working in a political campaign, the candidate gets 100 votes on election day. A candidate has 770 volunteers. How many votes can this candidate expect to get on election day?
13. *The gulp of water* You can maintain your body fluid level by drinking four gulps of water every 20 minutes during prolonged exercise. How many gulps do you need for a 2-hour workout?
15. *Pages in a 6600-word paper* A full, double-spaced typewritten page will have about 330 words on it if typed using an elite typefont. How many pages would there be in a double-spaced 6600-word paper typed using an elite typefont?
17. A 1-point increase in interest rates adds \$2.3 billion a year to federal spending. If interest rates went up 2.5 points, how much would that add to federal spending?
19. *Growing mesquite grass* It takes 1725 pounds of water to grow 1 pound of mesquite grass (used for cattle feeding). How many pounds of water are needed to grow a 50-pound bale of mesquite grass?
6. *Protein RDA for children* The RDA of protein for children 7–10 is 30 grams per day. One cup of whole milk contains 8 grams of protein. How many cups of milk are needed to provide the 30 grams RDA?
8. *Buying Mega stocks* Three shares of Mega stock cost \$144.75. How many shares can be bought with \$1544?
10. *Opened and glanced-at mail* It has been estimated that 3 out of 4 pieces of mailed advertising are opened and glanced at. Using this scale, how many pieces of advertising should you send if you want 900 persons to open and glance at your ad?
12. *Waiter, Waiter!* To make sure your dinner party runs smoothly, you will need 3 waiters for every 20 guests. How many waiters should you hire for a party of 80?
14. *Pages in a 2000-word document* A full, double-spaced typewritten page will have about 250 words on it if typed using a pica typefont. How many pages would there be in a double-spaced 2000-word paper typed using a pica typefont?
16. *Inflation and spending* A writer for the *New York Times* estimates that a 1-point increase in the inflation rate will add \$1.3 billion to federal spending in the first year. If the inflation rate increases 3.5 points, how much money will be added to federal spending in the first year?
18. *Windows needed for the superinsulated house* A superinsulated home must have 12 square feet of windows for every 100 square feet of floor space. How many square feet of windows are needed for a superinsulated 1700-square-foot home?
20. *New plant and equipment spending* U.S. manufacturers spent \$150 billion on new plants and equipment but \$200 billion on mergers and acquisitions. Kohlberg, Kravis, and Roberts acquired Nabisco for about \$20 billion. How many billions should they expect to spend on new plants and equipment?

The serving size for each of the pizzas shown is  $\frac{1}{4}$  of the pizza. Which one do you think has the least fat?



Source: California Project Lean.

21. *Pizza, pizza* Charley's pizza has 13 grams of fat per serving. How many grams of fat are in  $\frac{3}{4}$  of the pizza?
22. The Peppy pizza has 21 grams of fat per serving. How many grams of fat are in  $\frac{1}{2}$  of the pizza?
23. Garden Delight Pizza has 7 grams of fat per serving. How many grams of fat are in the whole pizza?
24. *Overweight Americans* 54 out of 100 Americans consider themselves overweight. If there are 290 million Americans, how many consider themselves overweight?
25. *Global Internet population* In 2004, 175 million people in the United States were part of the global Internet population. If the 175 million people represent  $\frac{1}{4}$  of the global Internet population, how many people are there in the global Internet population?

- 26. Leaf-cutting ant loads** A leaf-cutting ant weighing 1.5 grams can carry a leaf weighing 4.5 grams. If a person could proportionally carry as much weight, how much could a 60 kg student carry?
- 27. Making nail polish remover** The formula for an acetone (nail polish remover) molecule is  $C_3H_6O$ . This means that for every 3 carbon (C) atoms, there are 6 hydrogen (H) atoms and one oxygen (O) atom in the molecule. How many carbon atoms must combine with 720 hydrogen atoms to form acetone molecules?
- 28. Polish remover** Referring to Problem 27, how many oxygen atoms are needed to combine with 660 hydrogen atoms to form acetone molecules?
- 29. Map distances to scale** The scale in a map is 1 inch = 20 miles. What is the actual distance between two towns that are 3.5 inches apart on the map?
- 30. Map Spacing** Two towns are 300 miles apart. If the scale on the map is 1 inch = 20 miles, how far apart are the towns on the map?

## SKILL CHECKER

Try the *Skill Checker Exercises* so you'll be ready for the next section.

Round 245.92

- 31.** to the nearest tenth.
- 32.** to the nearest unit.
- 33.** to the nearest ten.
- 34.** to the nearest hundred.

## USING YOUR KNOWLEDGE

Have you seen scientists or bird lovers banding or tagging animals? This procedure is used to estimate the size of wildlife populations. Here is how it works. First, a number of animals are captured, tagged, and released. Later, a different group is captured, and the ratio of tagged animals to the number of animals captured is determined. From this ratio the size of the population can be estimated. For example, a research team tagged 60 birds for identification. Later, they captured 240 birds and found 15 tagged. Can they estimate the number  $n$  of birds in the population? They know that the ratio of tagged birds to the total number of birds is 15 to 240. They also know that this ratio was 60 to  $n$ . Thus

$$\frac{\text{Number tagged}}{\text{Total number}} = \frac{\text{Number tagged}}{\text{Total number}}$$

$$\frac{15}{240} = \frac{60}{n}$$

Solving the proportion they obtain  $n = 960$ .

Follow this procedure to solve Problems 35 and 36.

- 35.** Researchers in the Vienna Woods tagged 300 birds. In a later sample they found that 12 out of 980 birds were tagged. About how many birds were there in the Vienna Woods?
- 36.** In Muddy Lake 600 fish were tagged. Later, 12 out of 480 fish were found to be tagged. About how many fish were in Muddy Lake?

## WRITE ON

- 37.** We solved proportions such as  $\frac{x}{2} = \frac{1}{2}$  by the method of cross products. Can you solve  $\frac{x}{2} = \frac{1}{2} + 1$  by using cross products? Explain.
- 38.** Clark's Rule helps you to find the suitable child's dose for a medicine based on the adult dose. Does the rule tell you how to administer the medicine? Explain.

## MASTERY TEST

If you know how to do these problems, you have learned your lesson.

- 39.** According to Clark's Rule,  $\frac{W_c}{W_a} = \frac{c}{a}$ , where  $W_c$  is the weight of the child,  $W_a$  is the weight of the adult,  $a$  is the adult dose, and  $c$  is the child's dose. If the adult dose (150-pound person) of cough syrup is 6 teaspoons daily, what is a 50-pound child's dose?
- 40.** A leaf-cutting ant weighing 1.5 grams can carry a leaf weighing 3 grams. If a person could proportionally carry as much weight, how much could a 70 kg student carry?

41. Fifty shares of Mega Stock cost \$212.50. How many shares can you buy with \$850?
42. If a 120-pound woman needs 50 grams of protein a day and a 4-ounce serving of chicken provides 30 grams of protein, how many ounces of chicken are needed to provide the required 50 grams of protein?
43. Two out of three students at a college passed College Algebra with a C or better. If 600 students were taking College Algebra, how many passed with a C or better?
44. Perennial rye seed covers 250 square feet per pound. How many pounds are needed to seed a lawn measuring 50 feet by 100 feet (5000 square feet)?

## COLLABORATIVE LEARNING

There is a relationship between the numbers in the Fibonacci sequence, the so-called Golden Section numbers, and  $\frac{1}{89}$ . Here is some information you will need to do this activity:

The Fibonacci numbers are: 1, 1, 2, 3, 5, 8, 13, . . .

The Golden Section numbers are: 0.6180339887... and 1.6180339887...

$\frac{1}{89} = 0.01123595...$

Form three groups of students:

- GROUP 1.** Find the ratio of numbers *preceding* each other in the Fibonacci sequence and write them as decimals to six places. Here are some:

$$\frac{1}{1} = 1.000000$$

$$\frac{2}{1} = 2.000000$$

$$\frac{3}{2} = 1.500000$$

$$\frac{5}{3} = 1.666666$$

What number is the pattern approaching?

- GROUP 2.** Find the ratio of numbers *following* each other in the Fibonacci sequence and write them as decimals to six places. Here are some:

$$\frac{1}{1} = 1.000000$$

$$\frac{1}{2} = 0.500000$$

$$\frac{2}{3} = 0.666666$$

$$\frac{3}{5} = 0.600000$$

What number is the pattern approaching?

- GROUP 3.** Arrange the numbers in the Fibonacci sequence 1, 1, 2, 3, 5 . . . as decimals like this:

0.01

0.001

0.0002

0.00003

0.000005

Find the next 5 terms and the sum of the 10 terms obtained. What number is the pattern approaching?

Pick any *four* consecutive Fibonacci numbers, say, **1 2 3 5**



**GROUP 1.** Find the product of the *first* and *last* numbers,  $1 \times 5 = 5$  this time.  
**GROUP 2.** Find *twice* the product of the two middle numbers,  $2 \times (2 \times 3) = 12$ .  
**GROUP 3.** Get the answers from Groups 1 and 2 and square them.  
 $5^2 = 25$  and  $12^2 = 144$

**ALL GROUPS:** Make a conjecture about writing the sum of the two answers as a number squared. Repeat the process with four different consecutive Fibonacci numbers. Does the conjecture still work?

**Research Questions**

1. The *Human Side of Mathematics* at the beginning of this chapter mentions several names for Leonardo Fibonacci. Find at least two more names used for Fibonacci.
2. Find at least two different interpretations of the name Fibonacci.
3. Find the meaning of the word *bigollo* in Italian.
4. The *Human Side of Mathematics* mentions the *Liber Abaci*, a book written by Fibonacci. Find the titles of three other books he wrote and describe their contents.
5. The *Human Side of Mathematics* mentions “the rabbit problem.” State the problem and indicate how the Fibonacci sequence relates to it.
6. There are at least five more famous problems by Fibonacci in the *Liber Abaci*. State three of them.
7. In what year did Fibonacci die?
8. There is a set of numbers called the Golden Section numbers associated with the Fibonacci sequence. What are these numbers, and how are they associated with the Fibonacci sequence?

**Summary**

SECTION	ITEM	MEANING	EXAMPLE
4.1A	Ratio	A quotient of two numbers	The ratio 2 to 3 (also written as 2:3 or $\frac{2}{3}$ ).
4.1B	Proportion	An equation stating that two ratios are equal	$\frac{a}{b} = \frac{c}{d}$ is a proportion.
4.2	Rates	A ratio used to compare unlike quantities	$\frac{21 \text{ miles}}{3 \text{ gallons}}$
4.2B	Unit rate	A rate in which the denominator is 1	$\frac{28 \text{ miles}}{1 \text{ gallon}}$
4.3A	RSTUV	Method used to solve word problems (Read, Select a variable, Translate, Use algebra, Verify the answer)	

## Review Exercises

(If you need help with these exercises, look in the section indicated in brackets.)

- [4.1A] Express each ratio as a fraction in lowest terms:
  - 1 to 10
  - 2 to 10
  - 3 to 10
  - 4 to 10
  - 5 to 10
- [4.1A] The ratio of cars to people for different countries is given. Write each ratio as a fraction in reduced form.
  - Canada, 425 cars per 1000 persons
  - Belgium, 325 cars per 1000 persons
  - Austria, 300 cars per 1000 persons
  - Cyprus, 150 cars per 1000 persons
  - Taiwan, 40 cars per 1000 persons
- [4.1A] The approximate ratio of circumference (distance around) to diameter (distance across the top) of a soda can is given. Write this ratio as a fraction in reduced form.
  - 14.52 inches to 4.62 inches
  - 14.58 inches to 4.64 inches
  - 14.60 inches to 4.65 inches
  - 14.64 inches to 4.66 inches
  - 14.68 inches to 4.67 inches
- [4.1B] Write the following proportions as equations.
  - 3 is to 7 as 6 is to  $x$
  - 4 is to 7 as 12 is to  $x$
  - 5 is to 7 as  $x$  is to 21
  - 6 is to 7 as 33 is to  $x$
  - 7 is to 35 as 5 is to  $x$
- [4.1D] Solve the proportion:
 

<ol style="list-style-type: none"> <li><math>\frac{x}{4} = \frac{1}{2}</math></li> <li><math>\frac{x}{8} = \frac{1}{2}</math></li> <li><math>\frac{x}{12} = \frac{1}{2}</math></li> </ol>	<ol style="list-style-type: none"> <li><math>\frac{x}{6} = \frac{1}{2}</math></li> <li><math>\frac{x}{10} = \frac{1}{2}</math></li> </ol>
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- [4.1C] Determine if the following pairs of numbers are proportional.
  - 2, 3 and 4, 5
  - 8, 10 and 4, 5
  - 5, 6 and 12, 15
  - 12, 18 and 2, 3
  - 9, 12 and 3, 4
- [4.1D] Solve the proportion:
 

<ol style="list-style-type: none"> <li><math>\frac{2}{x} = \frac{2}{5}</math></li> <li><math>\frac{6}{x} = \frac{2}{5}</math></li> <li><math>\frac{12}{x} = \frac{2}{5}</math></li> </ol>	<ol style="list-style-type: none"> <li><math>\frac{4}{x} = \frac{2}{5}</math></li> <li><math>\frac{10}{x} = \frac{2}{5}</math></li> </ol>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	-------------------------------------------------------------------------------------------------------------------------------------------
- [4.1D] Solve the proportion:
 

<ol style="list-style-type: none"> <li><math>\frac{x}{4} = \frac{9}{2}</math></li> <li><math>\frac{x}{4} = \frac{9}{18}</math></li> <li><math>\frac{x}{4} = \frac{9}{6}</math></li> </ol>	<ol style="list-style-type: none"> <li><math>\frac{x}{4} = \frac{9}{12}</math></li> <li><math>\frac{x}{4} = \frac{9}{36}</math></li> </ol>
-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------------------------------------------
- [4.1D] Solve the proportion:
 

<ol style="list-style-type: none"> <li><math>\frac{5}{7} = \frac{x}{7}</math></li> <li><math>\frac{5}{7} = \frac{x}{28}</math></li> <li><math>\frac{5}{7} = \frac{x}{42}</math></li> </ol>	<ol style="list-style-type: none"> <li><math>\frac{5}{7} = \frac{x}{14}</math></li> <li><math>\frac{5}{7} = \frac{x}{35}</math></li> </ol>
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- 11.** [4.1E] A worker in an assembly line takes 3 hours to produce 27 parts. At that rate how many parts can she produce in
- a. 1 hour?
  - b. 2 hours?
  - c. 4 hours?
  - d. 5 hours?
  - e. 6 hours?
- 12.** [4.2A] A famous writer was paid \$12,000 for an essay. What was her rate per word, if the essay had
- a. 2000 words?
  - b. 3000 words?
  - c. 4000 words?
  - d. 6000 words?
  - e. 8000 words?
- 13.** [4.2A] A student took a 400-mile car trip. To the nearest whole number, what was the miles-per-gallon rate if the amount of gas used was
- a. 18 gallons?
  - b. 19 gallons?
  - c. 20 gallons?
  - d. 21 gallons?
  - e. 22 gallons?
- 14.** [4.2A] A bag of fertilizer covers 5000 square feet of lawn. To the nearest whole number, what is the rate of coverage in square feet per pound if the bag contains
- a. 20 pounds of fertilizer?
  - b. 22 pounds of fertilizer?
  - c. 24 pounds of fertilizer?
  - d. 25 pounds of fertilizer?
  - e. 50 pounds of fertilizer?
- 15.** [4.2B] A jar of popcorn costs \$2.39. To the nearest cent, what is the unit price in cents per ounce if the jar contains
- a. 24 ounces?
  - b. 16 ounces?
  - c. 32 ounces?
  - d. 40 ounces?
  - e. 48 ounces?
- 16.** [4.2B] A 12-ounce bottle of generic popcorn oil sells for \$1.39. Which is the better buy if the brand X popcorn oil contains 24 ounces and costs
- a. \$2.75?
  - b. \$2.76?
  - c. \$2.77?
  - d. \$2.74?
  - e. \$2.79?
- 17.** [4.3A] A pound of grass seed covers 120 square feet of lawn. Find how many pounds are needed to seed a lawn measuring
- a. 60 feet by 30 feet (1800 square feet).
  - b. 70 feet by 30 feet (2100 square feet).
  - c. 90 feet by 24 feet (2160 square feet).
  - d. 60 feet by 45 feet (2700 square feet).
  - e. 50 feet by 60 feet (3000 square feet).
- 18.** [4.3A] A survey indicated that 3 out of 5 doctors used brand X aspirin. Find how many used brand X if
- a. 3000 doctors were surveyed.
  - b. 4000 doctors were surveyed.
  - c. 5000 doctors were surveyed.
  - d. 6000 doctors were surveyed.
  - e. 8000 doctors were surveyed.
- 19.** [4.3A] The RDA of protein for males is 56 grams per day. Find how many ounces of a certain product are needed to provide the 56 grams of protein if it is known that
- a. 3 ounces of the product provide 8 grams of protein.
  - b. 4 ounces of the product provide 8 grams of protein.
  - c. 5 ounces of the product provide 8 grams of protein.
  - d. 6 ounces of the product provide 8 grams of protein.
  - e. 7 ounces of the product provide 8 grams of protein.
- 20.** [4.3A] The cost of 50 shares of Fly-by-Night Airline is \$87.50. Find how many shares you can buy with
- a. \$350.
  - b. \$700.
  - c. \$612.50.
  - d. \$787.50.
  - e. \$1050.

## Practice Test 4

(Answers on page 277)

- Express each ratio as a fraction in lowest terms:  
a. 2 to 7      b. 3 to 18      c. 10 to 58
- The approximate ratio of circumference (distance around) to diameter (distance across the top) of a soda can is 15.55 in. to 4.95 in. Write this ratio as a fraction in reduced form.
- Write the following proportions.  
a. 2 is to 7 as 6 is to 21  
b. 5 is to 7 as 15 is to  $x$
- Solve the proportion  $\frac{x}{2} = \frac{5}{20}$ .
- Solve the proportion  $\frac{x}{8} = \frac{9}{12}$ .
- A worker in an assembly line takes 3 hours to produce 26 parts. At that rate how many parts can she produce in 9 hours?
- A student traveled 300 miles on 17 gallons of gas. What was the miles-per-gallon rate? (Round the answer to the nearest whole number.)
- A 30-ounce jar of popcorn costs \$2.49. What is the unit price in cents per ounce? (Answer to the nearest cent.)
- A pound of grass seed covers 120 square feet of lawn. How many pounds are needed to seed a lawn measuring 60 feet by 40 feet (2400 square feet)?
- The RDA of protein for males is 56 grams per day. Two ounces of a certain product provide 4 grams of protein. How many ounces of the product are needed to provide 56 grams of protein?
- The ratio of cars to people in Australia is 375 per 1000. Write this ratio as a fraction in reduced form.
- The male-to-female ratio in India is 54 to 46. Write this ratio as a fraction in reduced form.
- There is a law stating that the ratio of width to length for the American flag should be 10 to 19. A flag measured 40 by 78 feet. Are the pairs of numbers 10, 19 and 40, 78 proportional?
- Solve the proportion  $\frac{6}{x} = \frac{2}{5}$ .
- Solve the proportion  $\frac{5}{7} = \frac{x}{28}$ .
- A famous writer was paid \$12,000 for a 2000-word article. Find the rate per word.
- An 18-pound bag of lawn food covers 3000 square feet of lawn. To the nearest whole number, what is the rate of coverage in square feet per pound?
- A 12-ounce bottle of gourmet popcorn oil sells for \$1.39. The 24-ounce brand X bottle costs \$2.77. Which is the better buy?
- A survey indicated that 3 out of 7 doctors used brand X aspirin. If 2100 doctors were surveyed, how many used brand X?
- The cost of 50 shares of Fly-by-Night Airline is \$87.50. How many shares can you buy with \$875?

## Answers to Practice Test

ANSWER	IF YOU MISSED	REVIEW		
	QUESTION	SECTION	EXAMPLES	PAGE
1. a. $\frac{2}{7}$ b. $\frac{1}{6}$ c. $\frac{5}{29}$	1	4.1	1	249
2. $\frac{3}{8}$	2	4.1	2	249
3. $\frac{311}{99}$	3	4.1	3	249
4. $\frac{27}{23}$	4	4.1	4	249
5. a. $\frac{2}{7} = \frac{6}{21}$ b. $\frac{5}{7} = \frac{15}{x}$	5	4.1	5	250
6. No	6	4.1	6	251
7. $x = \frac{1}{2}$	7	4.1	7b	252
8. $x = 15$	8	4.1	7a	252
9. $x = 6$	9	4.1	7b	252
10. $x = 20$	10	4.1	7c	252
11. 78	11	4.1	8, 9	253
12. \$6	12	4.2	1	259
13. 18	13	4.2	2	259
14. 167	14	4.2	3	259
15. 8¢	15	4.2	5	260
16. The 24-oz bottle	16	4.2	6	261
17. 20 lb	17	4.3	1	266
18. 900	18	4.3	2	266
19. 28	19	4.3	3	267
20. 500	20	4.3	4	267

## Cumulative Review Chapters 1–4

1. Write nine thousand, eight hundred ten in standard form.
2. Write the prime factors of 56.
3. Multiply:  $2^3 \times 7 \times 4^0$
4. Simplify:  $25 \div 5 \cdot 5 + 7 - 3$
5. Classify  $\frac{9}{7}$  as proper or improper.
6. Write  $\frac{39}{4}$  as a mixed number.
7. Write  $7\frac{2}{3}$  as an improper fraction.
8. Multiply:  $\frac{1}{2} \cdot 3\frac{1}{7}$
9. Multiply:  $\left(\frac{3}{7}\right)^2 \cdot \frac{1}{9}$
10. Divide:  $\frac{8}{5} \div 2\frac{2}{7}$
11. Add:  $7\frac{2}{3} + 1\frac{3}{5}$
12. Subtract:  $5\frac{1}{4} - 1\frac{7}{8}$
13. Translate and solve:  $\frac{7}{9}$  less than a number  $c$  is  $\frac{1}{2}$ . What is  $c$ ?
14. Find a number such that  $\frac{11}{12}$  of it is  $7\frac{1}{10}$ .
15. Give the word name for 241.35.
16. Write 44.874 in expanded form.
17. Add:  $36.454 + 9.69$
18. Subtract:  $342.42 - 13.5$
19. Multiply:  $0.554 \cdot 0.15$
20. Divide:  $\frac{135}{0.27}$
21. Round 449.851 to the nearest ten.
22. Divide:  $10 \div 0.13$  (Round answer to two decimal digits.)
23. Write  $\frac{7}{12}$  as a decimal.
24. Write 0.15 as a reduced fraction.
25. Write  $0.\overline{84}$  as a reduced fraction.
26. What decimal part of 12 is 9?
27. Arrange in order of decreasing magnitude and write using the  $>$  sign:  $6.435 > 6.4\overline{35} > 6.4\overline{35}$
28. Insert  $=$ ,  $<$ , or  $>$  to make a true statement:  $0.89 \underline{\hspace{1cm}} \frac{7}{20}$
29. Solve for  $x$ :  $x + 2.5 = 6.5$
30. Solve for  $y$ :  $2.1 = 0.3y$
31. Solve for  $z$ :  $9 = \frac{z}{6.9}$
32. The ratio of cars to people in Australia is 420 to 1000. Write this ratio as a fraction in reduced form.
33. Write the following proportion: 6 is to 2 as 54 is to  $x$ .
34. There is a law stating that the ratio of width to length for the American flag should be 10 to 19. Is a flag measuring 50 by 97 feet of the correct ratio?
35. Solve the proportion:  $\frac{j}{5} = \frac{6}{150}$
36. Solve the proportion:  $\frac{20}{c} = \frac{4}{3}$
37. A worker in an assembly line takes 9 hours to produce 25 parts. At that rate how many parts can she produce in 36 hours?
38. A salesperson traveled 600 miles on 17 gallons of gas. How many miles per gallon did the salesperson get? (Round to the nearest whole number.)
39. A 24-ounce jar of peanut butter costs \$2.89. What is the unit price in cents per ounce? (Answer to the nearest cent.)
40. A pound of lawn food covers 120 square feet of lawn. How many pounds are needed to cover a lawn measuring 80 by 60 feet (4800 square feet)?
41. The protein RDA for males is 48 grams per day. Two ounces of a certain product provide 4 grams of protein. How many ounces of the product are needed to provide 48 grams of protein?
42. The cost of 80 shares of Fly-by-Night Airline is \$87.50. How many shares can you buy with \$875.00?