

# SKILL 1: Ratios

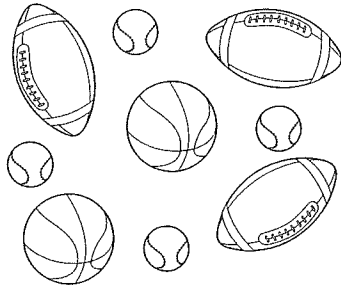
Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 1: Ratios

A ratio is a comparison of two quantities.

The ratio of footballs to basketballs shown at the right is  $\frac{3}{2}$ . This ratio can also be written as 3 : 2 and 3 to 2.



### Example

Give the ratio comparing the number of baseballs to the total number of balls shown.

Four out of nine balls shown are baseballs. The ratio of baseballs to balls shown can be written as 4 to 9, 4 : 9, or  $\frac{4}{9}$ .

### Guided Practice

Use the letters in the box.

A	C	C	C	L	
L	L	L	L	L	O
O	O	R	R	R	R
R	R				

- How many letters are there in all? 17
- How many letters are Rs? 5
- How many letters are Os? 3
- Give the ratio of Rs to Os.  $\frac{5}{3}$
- Give the ratio of Os to Rs.  $\frac{3}{5}$
- Give the ratio of Rs to all letters in three ways.  $\frac{5}{17}$ ,  $\frac{5}{17}$ ,  $5 : 17$

In a group of students, 35 are right-handed and 6 are left-handed.

- Give the ratio of right-handers to left-handers.  $\frac{35}{6}$
- Give the ratio of right-handers to left-handers.  $\frac{6}{35}$
- Give the ratio of left-handers to right-handers.  $\frac{35}{6}$
- Give the ratio of right-handers to all students.  $\frac{41}{6}$
- Give the ratio of left-handers to all students.  $\frac{41}{6}$

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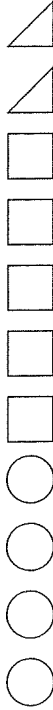
## SKILL 1: Practice

The students at Monroe School are divided into three teams as shown at the right. Write the ratio that makes each comparison.

	Team A	Team B	Team C
Girls	50	72	65
Boys	57	49	58

- Girls to boys on Team A  $\frac{57}{50}$
- Boys on Team A to Boys on Team C  $\frac{58}{121}$
- Team B students to Team A students  $\frac{107}{107}$

Use the figures pictured. Give each ratio.

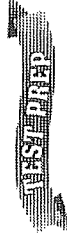


- Squares to circles  $\frac{5}{4}$
- Circles to triangles  $\frac{4}{2}$
- Triangles to squares  $\frac{2}{5}$
- Triangles to all figures  $\frac{11}{55}$

8. Write the ratio of circles to squares in three ways.  $\frac{4}{5}$ ,  $4 : 5$ ,  $4 \text{ to } 5$

Last season, the Yorktown football team won 6 games, lost 3 games and tied 1 game. Tell what each ratio compares.

- 6 to 3 Games won to games lost
- 3 to 10 Games lost to total games played
- 7 to 3 Games won or tied to games lost



12. Give the ratio of Os to Xs.

O O X X O X O

Skill 1

- |          |               |   |               |
|----------|---------------|---|---------------|
| A        | $\frac{3}{5}$ | C | $\frac{5}{8}$ |
| <b>B</b> | $\frac{3}{3}$ | D | $\frac{3}{8}$ |

13. Last year 6 out of 8 days were sunny. Which ratio does not compare sunny days to total days?

Skill 1

- |   |        |          |               |
|---|--------|----------|---------------|
| F | 6 to 8 | H        | $\frac{6}{8}$ |
| G | 6 : 8  | <b>J</b> | 6 to 14       |

# SKILL 2: Equal Ratios

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 2: Equal Ratios

The picture can be used to show equal ratios that compare squares to circles. Just as with fractions, ratios can be written in simplest form.  $\frac{2}{3}$  is in simplest form.

You can find ratios equal to a given ratio by multiplying or dividing both quantities of a ratio by the same nonzero number.

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squares =  $\frac{8}{12} = \frac{2}{3}$       circles =  $\frac{6}{9} = \frac{2}{3}$

### Example 1

Use multiplication to find four ratios equal to the ratio 1 inch to 5 miles.

Inches	1	2	3	4	5
Miles	5	10	15	20	25

$1 \times 2$     $1 \times 3$     $1 \times 4$     $1 \times 5$   
 $5 \times 2$     $5 \times 3$     $5 \times 4$     $5 \times 5$

### Example 2

Use multiplication or division to find five ratios equal to the ratio 36 students to 24 adults.

Students	36	72	18	3	108	6
Adults	24	48	12	2	72	4

$36 \times 2$     $36 \div 2$     $36 \div 12$     $36 \times 3$     $36 \div 6$   
 $24 \times 2$     $24 \div 2$     $24 \div 12$     $24 \times 3$     $24 \div 6$

### Guided Practice

1. Nine pounds of trail mix costs \$15. Find two equal ratios.

$$\frac{9}{15} = \frac{9 \times 2}{15 \times 2} = \frac{18}{30}$$

$$\frac{9}{15} = \frac{9 \div 3}{15 \div 3} = \frac{3}{5}$$

For each ratio given, find three equal ratios. Sample ratios are given.

2.  $\frac{2 \text{ miles}}{8 \text{ minutes}} = \frac{1 \text{ mi}}{4 \text{ min}}$ ,  $\frac{2 \frac{3}{4}}{6 \frac{9}{12}}$ ,  $\frac{4 \text{ min}}{16 \text{ min}}$ ,  $\frac{24 \text{ min}}{24 \text{ min}}$
3. 1 student = 10 pencils, 15 pencils = 3 students
4. 5 pencils = \$2.50, 24 hits = 36 hits, 1.25 dollars = 6 hits, 100 at bats = 150 at bats
5. 12 hits = 25 at bats, 100 at bats = 150 at bats

## SKILL 2: Practice

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

Complete each table to show equal ratios.

1.

Tablespoons cocoa	3	6	9	12	15	18	21
Ounces milk	8	16	24	32	40	48	56

2.

Stickers	50	25	10	5	2	1
Dollars	10.00	5.00	2.00	1.00	0.50	0.20

Find three ratios equal to the given ratio. Sample ratios are given for 3-10.

3.  $\frac{3 \text{ picture postcards}}{75 \text{ cents}} = \frac{1}{2} = \frac{\$0.50}{2} = \frac{4 \text{ picture postcards}}{\$1.00}$
4.  $\frac{3 \text{ wins}}{6 \text{ games}} = \frac{1}{2} = \frac{2}{4} = \frac{30 \text{ wins}}{60 \text{ games}}$
5.  $\frac{55 \text{ miles}}{1 \text{ hour}} = \frac{110}{2} = \frac{165}{3} = \frac{220 \text{ mi}}{4 \text{ h}}$
6.  $\frac{28 \text{ days}}{4 \text{ weeks}} = \frac{7}{1} = \frac{14}{2} = \frac{21 \text{ d}}{3 \text{ wk}}$
7.  $\frac{12 \text{ inches}}{1 \text{ foot}} = \frac{24}{2} = \frac{36}{3} = \frac{48 \text{ in.}}{4 \text{ ft}}$
8.  $\frac{100 \text{ senators}}{50 \text{ states}} = \frac{2}{1} = \frac{4}{2} = \frac{50 \text{ senators}}{25 \text{ states}}$

Alaska has about 110 people per 100 square miles. Answer each question.

9. Is this more or less than 1 person per square mile? More  
 $\frac{220}{200'} = \frac{1,100}{1,000}$
10. Write two ratios equal to the ratio  $\frac{110}{100}$ .



11. Which ratio is not equal to  $\frac{10}{15}$ ?

- (A)  $\frac{5}{2}$       (C)  $\frac{20}{30}$       (H)  $\frac{5}{3}$   
 (B)  $\frac{2}{3}$       (D)  $\frac{50}{75}$       (J)  $\frac{5}{8}$

12. A team lost 3 games and won 5 games. Which ratio compares wins to losses?

- (F)  $3:5$       (G)  $\frac{3}{5}$       (H)  $\frac{5}{3}$       (J)  $\frac{5}{8}$

# SKILL 3: Rates and Unit Rates

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 3: Rates and Unit Rates

A ratio that compares quantities that have two different units is called a rate. A unit rate compares a quantity with one unit of the other quantity. Two examples of unit rates are \$.25 per ounce ( $\frac{\$.25}{1 \text{ oz}}$ ) and 55 miles per hour ( $\frac{55 \text{ mi}}{1 \text{ h}}$ ).

### Example 1

Is the ratio  $\frac{700 \text{ words}}{3 \text{ pages}}$  a rate? Is it a unit rate?

The ratio is a rate because the units, words and pages, are different. It is *not* a unit rate because the comparison is not to 1 page.

### Example 2

Find three rates equal to  $\frac{\$.3}{6 \text{ caramel apples}}$ . Find the unit rate.

Make a table of equal ratios.

The unit rate compares the cost in dollars to 1 apple.

Cost in dollars	3	6	1	0.50
Apples	6	12	2	1

Three rates equal to  $\frac{\$.3}{6 \text{ caramel apples}}$  are  $\frac{\$.6}{12}$ ,  $\frac{\$.1}{2}$ , and  $\frac{\$.50}{1}$ .

The unit rate,  $\frac{\$.50}{1 \text{ apple}}$ , may be written as \$.50 per apple. This is an example of a unit price because it shows the price of one unit of the item.

### Guided Practice

Is the ratio a rate? Write yes or no and tell why.

1. 5 circles to 2 circles No The units are the same.  
 2. 365 days per year Yes The units are different.

Is the rate a unit rate? Write yes or no.

3. 20 students No 5 groups No 250 calories No 3 servings  
 5. 25 miles per gallon. Yes 36 inches No 3 feet  
 7. 12 eggs in a dozen Yes 8 ounces in a cup Yes  
 9.  $\frac{\$.90}{1 \text{ h}}$  Yes 10.  $\frac{\$.850}{1 \text{ h}}$  for each person Yes  
 11.  $\frac{\$.85.00}{1 \text{ h}}$  for 10 people No 12. 1 book every 2 weeks No  
 Ratio, Proportion, and Percent 5

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## SKILL 3: Practice

Is the ratio a rate? Write yes or no.

1. 5 gallons in 10 minutes Yes 2. 3 teaspoons to 1 teaspoon No  
 3. 20 quarters in \$5 Yes 4. 1 car wash every 15 minutes Yes  
 5. 3 daisies for \$1.00 Yes 6. \$20 out of every \$50 No

Is the rate a unit rate? Write yes or no. If not, write the rate as a unit rate.

7. 3 weeks per year Yes  
 8. \$4.50 for 2 pounds No, \$2.25 per pound  
 9. \$10 for 5 books No, \$2 for each book  
 10. 15 minutes for each quarter Yes  
 11. 7.5¢ per ounce Yes  
 12.  $\frac{72 \text{ pages}}{6 \text{ days}}$  No, 12 pages per day

13. Every 3 days, Miguel has a total of 90 minutes of softball practice. Give three more rates that describe 90 minutes to 3 days.  
**Sample rates given:**  
 $\frac{180 \text{ min}}{6 \text{ days}}$ ,  $\frac{270 \text{ min}}{9 \text{ days}}$ ,  $\frac{30 \text{ min}}{1 \text{ day}}$

Which vehicle has a mileage rate equal to each of the following? Use the chart for exercises 14 through 17.

Vehicle Type	Gas Mileage
Compact car	30 mi/gal
Mid-sized car	25 mi/gal
Mini-van	20 mi/gal
Sport utility	15 mi/gal

14.  $\frac{100 \text{ mi}}{5 \text{ gal}}$  Mini-van  
 15.  $\frac{100 \text{ mi}}{4 \text{ gal}}$  Mid-sized car  
 16.  $\frac{60 \text{ mi}}{4 \text{ gal}}$  Sport utility  
 17.  $\frac{60 \text{ mi}}{2 \text{ gal}}$  Compact car



18. Which ratio is a unit rate?  
 A 2 mi in 3 h C \$7 to \$1  
 B 3 lb for \$2 D 30 mi per h  
 Skill 3  
 F  $\frac{36}{24}$  H  $\frac{6}{3}$   
 G  $\frac{3}{2}$  J  $\frac{3}{2}$

19. Which ratio is equal to  $\frac{24}{36}$ ?  
 Skill 2

# SKILL 4: Meaning of Proportion

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 4: Meaning of Proportion

Two equal ratios form a proportion. Both ratios in a proportion must use the same units. For example,  $\frac{1}{2} = \frac{3}{6}$  is a proportion.

### Example 1

Do  $\frac{4}{5}$  and  $\frac{12}{15}$  form a proportion?

$$\frac{4}{5} \stackrel{?}{=} \frac{12}{15} \quad \leftarrow 4 \times 3 = 12$$

Multiply both terms of one ratio by the same number and get the second ratio. Because the ratios are equal, they do form a proportion.

$$\frac{5}{5} \stackrel{?}{=} \frac{15}{15} \quad \leftarrow 5 \times 3 = 15$$

### Example 2

A grocery store sells three oranges for \$.49 and a bag of a dozen oranges for \$2.00. Are these price rates equal?

Make a table of equal ratios to find the cost of a dozen (12) oranges at the rate of 3 for \$.49.

3 oranges =  $\frac{12 \text{ oranges}}{\$1.96}$ , less than the \$2.00 for a bag of a dozen.

The prices are not equal rates. They do not form a proportion.

Oranges	3	6	9	12
Dollars	.49	.98	1.47	1.96

### Guided Practice

Do  $\frac{72}{24}$  and  $\frac{8}{3}$  form a proportion?

1. What do you divide 72 by to get 8? 9

2. What do you divide 24 by to get 3? 8

3. Do the ratios form a proportion? Why or why not?

**No. The ratios are not equal because you cannot divide both terms of  $\frac{72}{24}$  by the same number and get  $\frac{8}{3}$ .**

Do the ratios form a proportion? Write yes or no.

4.  $\frac{21}{3} \stackrel{?}{=} \frac{7}{1}$       5.  $\frac{4}{9} \stackrel{?}{=} \frac{16}{27}$       6.  $\frac{8}{9} \stackrel{?}{=} \frac{48}{54}$       7.  $\frac{30}{10} \stackrel{?}{=} \frac{5}{6}$

Yes      No      Yes      No

8.  $\frac{5 \text{ boys}}{4 \text{ girls}} = \frac{20 \text{ girls}}{25 \text{ boys}}$  is not true. Use this information to write a proportion.

**Sample proportions: 5 boys = 25 boys or 4 girls = 20 girls**  
**4 girls = 20 girls or 5 boys = 25 boys**

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 4: Practice

Do the ratios form a proportion? Write yes or no.

1.  $\frac{7}{15} \stackrel{?}{=} \frac{28}{60}$       2.  $\frac{24}{6} \stackrel{?}{=} \frac{12}{3}$       3.  $\frac{36}{42} \stackrel{?}{=} \frac{6}{8}$       4.  $\frac{13}{42} \stackrel{?}{=} \frac{16}{36}$

Yes      No

5.  $\frac{9}{10} \stackrel{?}{=} \frac{54}{60}$       6.  $\frac{64}{8} \stackrel{?}{=} \frac{8}{2}$       7.  $\frac{5}{9} \stackrel{?}{=} \frac{55}{90}$       8.  $\frac{33}{48} \stackrel{?}{=} \frac{11}{16}$

Yes      No

9.  $\frac{2}{78} \stackrel{?}{=} \frac{1}{39}$       10.  $\frac{15}{75} \stackrel{?}{=} \frac{1}{4}$       11.  $\frac{20}{25} \stackrel{?}{=} \frac{4}{5}$       12.  $\frac{0.5}{2} \stackrel{?}{=} \frac{1.0}{4}$

Yes      No

13. Complete the table of equal ratios for the Pep Club's Lemonade Sale.

Cups sold	450	225	150	45	30	10	5	1
Profit in dollars	90	45	30	9	6	2	1	.20

14. What does the ratio for 10 cups sold tell you?

The profit is \$2 on 10 cups.

Answers may vary for exercises 15 and 16.

15. Write a proportion that gives the unit rate for a cup of lemonade.

$$\frac{\$90}{450 \text{ cups}} = \frac{\$.20}{1 \text{ cup}}$$

16. Write a proportion that could be used to find the profit if 300 cups of lemonade are sold.

$$\text{Sample answer: } \frac{\$90}{450 \text{ cups}} = \frac{\$x}{300 \text{ cups}}$$



17. Which ratio forms a proportion with  $\frac{5}{6}$ ?

A  $\frac{6}{5}$       B  $\frac{20}{30}$       C  $\frac{20}{24}$       D  $\frac{24}{20}$

Skill 4

18. Which ratio is a unit rate?

F  $\frac{1\text{¢}}{10\text{¢}}$       G  $\frac{5\text{m}}{1\text{cm}}$       H  $\frac{1\text{cm}}{5\text{m}}$       J  $\frac{10\text{¢}}{1\text{¢}}$

Skill 3

# SKILL 5: Cross Products in Proportions

Student pages 9–10

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 5: Cross Products in Proportions

In a proportion, the cross products are equal. The cross products are the results of multiplying the numbers in the proportion as shown at the right. Since the cross products are equal, we know that  $\frac{5}{6} = \frac{15}{18}$ .

$$\begin{array}{r} 5 \times 18 = 90 \\ \times 6 = 18 \\ \hline 6 \times 15 = 90 \end{array}$$

### Example 1

Do the ratios form a proportion?

$$\begin{array}{l} \frac{3}{5} \neq \frac{12}{20} \\ 3 \times 20 = 60 \\ 5 \times 12 = 60 \end{array}$$

The cross products are equal, so  $\frac{3}{5} = \frac{12}{20}$ .

### Example 2

Do the ratios form a proportion?

$$\begin{array}{l} \frac{40}{60} \neq \frac{8}{10} \\ 40 \times 10 = 400 \\ 60 \times 8 = 480 \end{array}$$

The cross products are not equal, so  $\frac{40}{60} \neq \frac{8}{10}$ . (Recall that the symbol  $\neq$  means *is not equal to*.)

### Guided Practice

Use the cross products to decide whether the ratios form a proportion. Write = or  $\neq$ .

$$\begin{array}{l} 1. \frac{4}{5} \neq \frac{2}{3} \\ 4 \times 3 = 12 \\ 5 \times 2 = 10 \\ \frac{4}{5} \neq \frac{2}{3} \\ 2. \frac{10}{50} \neq \frac{2}{10} \\ 10 \times 10 = 100 \\ 50 \times 2 = 100 \\ \frac{10}{50} = \frac{2}{10} \\ 3. \frac{9}{12} \neq \frac{6}{8} \\ 9 \times 8 = 72 \\ 12 \times 6 = 72 \\ \frac{9}{12} = \frac{6}{8} \end{array}$$

Use the table at the right.

4. For which two teachers are the ratios of boys to girls equal?

Mr. Muñoz and Mrs. Bruno

Class Enrollment		
Teacher	Boys	Girls
Ms. Hong	14	16
Mr. Muñoz	18	12
Mrs. Bruno	12	8
Mr. Ryan	15	8

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 5: Practice

Do the ratios form a proportion? Write yes or no.

- $\frac{6}{12} \neq \frac{12}{14}$  NO
- $\frac{3}{20} \neq \frac{2}{10}$  NO
- $\frac{20}{12} \neq \frac{25}{15}$  YES
- $\frac{27}{6} \neq \frac{36}{8}$  YES
- $\frac{13}{11} \neq \frac{24}{20}$  NO
- $\frac{3}{4} \neq \frac{15}{20}$  YES
- $\frac{10}{4} \neq \frac{45}{20}$  NO
- $\frac{15}{10} \neq \frac{3}{2}$  YES
- $\frac{12}{24} \neq \frac{4}{32}$  YES
- $\frac{12}{20} \neq \frac{4}{7}$  NO
- $\frac{12}{20} \neq \frac{5}{22}$  NO
- $\frac{2}{7} \text{ tsp} \neq \frac{6}{21} \text{ gal}$  YES
- $\frac{12}{20} \text{ cm} \neq \frac{15}{25} \text{ cm}$  NO
- $\frac{\$14}{3} \neq \frac{\$84}{18} \text{ hr}$  YES
- $\frac{27}{\$21} \text{ lb} \neq \frac{14}{\$18}$  NO
- $\frac{15}{21} \text{ sec} \neq \frac{10}{15} \text{ in.}$  NO
- $\frac{6}{13} \text{ ft} \neq \frac{7}{14} \text{ gal}$  NO

Use the data given in the table.

19. Which two students ran at the same rate?

Joyce and Alan

20. Larry ran 200 meters in 16 seconds. Did he run 200 meters at the same rate that he ran 500 meters? NO

21. At the rate given for 10 meters, how long would it take Tanya to run 100 meters? 10 seconds

Runner	Distance	Time
Joyce	100 m	12 sec
Larry	500 m	55 sec
Tanya	10 m	1 sec
Alan	200 m	24 sec

22. What is the cross product for this proportion:  $\frac{8}{5} = \frac{24}{15}$ ?

- A 120  
 B 75  
 C 192  
 D 110

Skill 5

23. Which shows a true proportion? H

- F  $\frac{5}{7} = \frac{10}{15}$   
 H  $\frac{22}{6} = \frac{11}{2}$   
 G  $\frac{4}{3} = \frac{12}{16}$   
 J  $\frac{18}{12} = \frac{3}{2}$

Skill 4

# SKILL 6:

## Solving Proportions Using Cross Products

Student pages 11-12

Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_



### SKILL 6: Solving Proportions Using Cross Products

To solve a proportion, you must find the missing number that makes the proportion true. You can use cross products to find this missing value.

#### Example 1

Use cross products to find the missing number:  $\frac{\square}{21} = \frac{3}{7}$

$\square \times 7 = 21 \times 3$  If the proportion is true, its cross products must be equal.

$\square \times 7 = 63$  Multiply:  $21 \times 3 = 63$ .

$63 \div 7 = 9$  Use division to undo multiplication.

So, the value of the missing number is 9.

#### Example 2

Find the unit rate equal to \$12 for 4 pounds.

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

The unit rate is an equal ratio that compares the cost,  $n$  dollars, to one pound.

$12 \times 1 = 4 \times n$  Write the cross products.

$12 = 4 \times n$  Multiply:  $12 \times 1$ .

$\frac{12}{4} = \frac{4 \times n}{4}$  Use division to undo multiplication.

$3 = n$  So,  $\frac{12}{4} = \frac{3}{1}$ .

The unit rate, or unit price, is 3 dollars for 1 pound.

#### Guided Practice

Use cross products to solve each proportion.

- $\frac{2}{8} = \frac{1.5}{n}$
- $\frac{6}{10} = \frac{n}{12}$
- $\frac{5}{n} = \frac{36}{6 \times n}$
- $2 \times n = 8 \times 1.5$
- $6 \times 12 = 10 \times n$
- $6n = 180$
- $2 \times n = 12$
- $72 = 10n$
- $6n = 180$
- $n = 6$
- $n = 7.2$
- $n = 30$

4. Write a proportion to find the unit rate for 35 miles on 10 liters of gasoline.

miles  $\rightarrow \frac{35}{10}$   
liters  $\rightarrow \frac{n}{1}$

Write cross products.  $35 \times 1 = n \times 10$

Solve the proportion.  $n = 3.5$

Write the unit rate. **The unit rate is 3.5 miles per liter of gasoline.**

Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

### SKILL 6: Practice

Solve each proportion.

- $\frac{2}{8} = \frac{n}{20}$
- $\frac{15}{5} = \frac{6}{n}$
- $\frac{n}{4} = \frac{6}{3}$
- $2 \times 20 = n \times 8$
- $15 \times n = 5 \times 6$
- $n \times 3 = 4 \times 6$
- $40 = 8n$
- $15n = 30$
- $3n = 24$
- $n = 5$
- $n = 2$
- $n = 8$
- $\frac{4}{5} = \frac{8}{n}$
- $\frac{12}{8} = \frac{6}{n}$
- $\frac{n}{8} = \frac{4}{5}$
- $n = 10$
- $\frac{4}{15} = \frac{2}{6}$
- $\frac{n}{15} = \frac{2}{6}$
- $\frac{n}{8} = \frac{20}{40}$
- $\frac{n}{15} = \frac{2}{6}$
- $n = 5$
- $\frac{2}{n} = \frac{8}{4}$
- $\frac{n}{8} = \frac{20}{40}$
- $\frac{n}{8} = \frac{4}{5}$
- $\frac{n}{9} = \frac{2}{3}$
- $\frac{30}{3} = \frac{n}{2}$
- $\frac{2}{7} = \frac{n}{4}$
- $n = 1$
- $\frac{3}{7} = \frac{12}{n}$
- $\frac{n}{9} = \frac{2}{3}$
- $n = 28$
- $n = 10$

Find the unit price.

- \$1.20 for 24 ounces of juice. \$0.05 per ounce
- \$12 for 8 pounds of peanuts. \$1.50 per pound
- 4 quarts of milk cost \$3.88. \$0.97 per quart



19. Find  $n$ :  $\frac{3}{9} = \frac{n}{4}$

- A 1.3      C 3  
 B 12      D 6.75

Skill 6

20. Give the ratio of As to all letters.  
 A B C A A C C

Skill 1

- F  $\frac{8}{3}$       H  $\frac{3}{8}$   
 G  $\frac{3}{5}$       J  $\frac{5}{3}$

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# SKILL 7: PROBLEM SOLVING: Solving Proportions

Student pages 13-14

Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_



## SKILL 7: PROBLEM SOLVING: Solving Proportions

### Example

Ron found that a dripping faucet filled 4 cups every hour. At this rate, how many cups of water would drip from the faucet in one day?



Read Each hour, 4 cups of water drip from the faucet.

Plan One ratio is  $\frac{4 \text{ cups}}{1 \text{ h}}$ . So, two equal ratios that form a proportion are  $\frac{4 \text{ cups}}{1 \text{ hour}}$  and  $\frac{x \text{ cups}}{24 \text{ hours}}$ .

$$\begin{array}{l} \text{cups} \rightarrow 4 \\ \text{hours} \rightarrow 1 \end{array} = \frac{n}{24}$$

Solve Find the cross products.

$$4 \times 24 = 1 \times n$$

$$96 = n$$

So, in one day, 96 cups of water would drip from the faucet.

Look Back 4 cups per hour is 40 cups in 10 hours, or 80 cups in 20 hours. The answer makes sense.

### Guided Practice

- How many quarts is 96 cups of water?
  - How many cups are there in one quart? 4 cups
  - Write a proportion.
 
$$\begin{array}{l} \text{cups} \rightarrow \frac{4}{1} = \frac{96}{n} \\ \text{quarts} \rightarrow \frac{1}{1} = \frac{n}{n} \end{array}$$
  - Find the missing value in the proportion. 24 quarts
- Lea found she walked 10 feet in 6 steps. At this rate, how many steps would she need to walk one mile? (There are 5,280 feet in a mile.)
  - Write a proportion you can use to find the answer.
 
$$\frac{10}{6} = \frac{n}{5,280}$$
  - How many steps would Lea need to walk one mile? 3,168 steps

Name \_\_\_\_\_

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### SKILL 7: Practice

Use a proportion to find each missing number.

- 91 days = 13 weeks
- 9 dozen items = 108 items
- 2400 minutes = 40 hours
- 3 tons = 6,000 pounds

Solve each problem.

- Kurt gets an \$800 paycheck every 2 weeks. At this rate, how much does he earn in 1 year (52 weeks)? \$20,800
- A newborn baby's heart beats about 7 times every 3 seconds. At this rate, how many times does a baby's heart beat in 60 seconds? 140 heartbeats
- During a test, 3 out of 100 cars selected at random were found to be defective. Use this ratio to estimate the number of defective cars if 1,500 cars are tested. 45 cars

- At Super Stores a 12-exposure roll of film costs \$2.34 and a 20-exposure roll costs \$3.80. Which roll of film costs less per exposure? 20-exposure roll

Sample answers:

120 days per year  
9,000 days

- Sleeping 8 hours a day is the same as sleeping about 10 days a month.
  - About how many days is this per year?
  - About how many days in this in a 75-year lifetime?



- Four quarts of water weighs about 8 pounds. About how much does 2 quarts of water weigh?
 

Skill 7

A 1 lb      C 16 lb  
B 4 lb      D 2 lb
- Which ratio is not equal to  $\frac{3}{15}$ ?
 

Skill 2

F  $\frac{6}{30}$       H  $\frac{1}{5}$   
G  $\frac{30}{150}$       J  $\frac{45}{9}$

# SKILL 8: Similar Figures

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



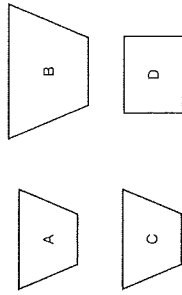
## SKILL 8: Similar Figures

Similar figures are the same shape but not necessarily the same size.

Congruent figures are the same size and the same shape.

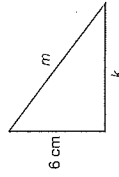
Polygons A, B, and C are all similar, but only polygons A and C are congruent.

In similar figures, matching angles have the same measure, and matching sides are proportional.



### Example

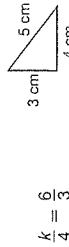
The two triangles are similar. Find the length of side  $k$ .



The triangles are similar, so the corresponding sides are proportional.

Write a proportion using corresponding sides.

The side that corresponds to  $k$  has a length of 4 cm.



Another pair of corresponding sides has lengths of 6 cm and 3 cm.

Find cross products to solve the proportion.

Divide to undo multiplication.

Side  $k$  measures 8 cm.

$$\frac{k}{4} = \frac{6}{3}$$

$$3 \times k = 24$$

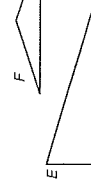
$$\frac{3 \times k}{3} = \frac{24}{3}$$

$$k = 8$$

### Guided Practice

Find a pair of triangles that appear to be:

1. Congruent G and H
2. Similar E and H; E and G; G and H



Use the similar triangles in the Example. Find the length of side  $m$ .

3. Find the length of the side that corresponds to side  $m$ . 5 cm

4. Find another pair of corresponding sides. 6 cm and 3 cm or 8 cm and 4 cm

5. Write a proportion using corresponding sides.  $\frac{6}{3} = \frac{m}{5}$  or  $\frac{8}{4} = \frac{m}{5}$

6. Solve to find the length of side  $m$ . 10 cm

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 8: Practice

Tell whether the figures appear to be congruent, similar, or neither.

1. neither congruent similar
2. congruent similar
3. congruent similar

The polygons in each exercise are similar. Find the missing lengths.

4.  $a = \underline{16 \text{ in.}}$   
 $b = \underline{12 \text{ in.}}$   
 $c = \underline{16 \text{ in.}}$
5.  $m = \underline{5 \text{ ft}}$   
 $n = \underline{7 \text{ ft}}$

6.  $r = \underline{7.8 \text{ cm}}$   
 $s = \underline{3 \text{ cm}}$   
 $t = \underline{7.2 \text{ cm}}$
7.  $x = \underline{12 \text{ m}}$   
 $y = \underline{7.5 \text{ m}}$   
 $z = \underline{12 \text{ m}}$

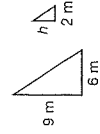
8. The sizes of rectangular screens are given in the table. Which screens are similar in size?

Screen	Dimensions
Hand TV	2 in. by 3 in.
Computer	12 in. by 15 in.
TV	15 in. by 21 in.
Movie	20 ft by 28 ft

### TV screen and movie screen



9. The triangles are similar. Find the length of  $h$ .



- A 3 m  
 B 9 m  
 C 6 m  
 D 27 m

10. Solve for  $d$ :  $\frac{d}{3.5} = \frac{10}{7}$

- F 3.5  
G 7  
 H 5  
J



# SKILL 9: PROBLEM SOLVING: Scale Drawings

Student pages 17–18

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 9: PROBLEM SOLVING: Scale Drawings

A scale drawing is used to illustrate something that is too large or too small to show the actual size. The scale is the ratio of a length in the drawing to the actual length it represents. If the units are the same, they may be omitted from the scale. For example, 1 cm : 4 cm may be written as 1 : 4 or  $\frac{1}{4}$ .

### Example

Find the actual height of the motorcycle.

**Read** What information do you know? The scale of the drawing is 1 in. = 3 ft. The height of the motorcycle in the drawing is 1.5 in.

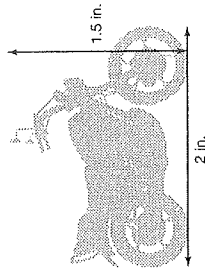
**Plan** What proportion can you write?

$$\begin{array}{l} \text{scale} \rightarrow \frac{1}{3} = \frac{1.5}{x} \\ \text{actual} \rightarrow \frac{1}{3} = \frac{x}{4.5} \end{array}$$

**Solve** Find the cross product.

The actual height of the motorcycle is 4.5 feet.

**Look Back** Check to see that your answer makes sense. If 1 inch on the drawing represents 3 feet, then 1.5 inches would represent 3 feet plus half of 3 feet (1.5 feet), or a total of 4.5 feet. The answer makes sense.



### Guided Practice

- Find the actual length of the motorcycle represented in the drawing.
  - How many inches long is the motorcycle in the drawing? 2 in.  
 $\frac{1}{3} = \frac{2}{x}$
  - Write a proportion you can use to find the length in feet. 1 in. = 40 ft
  - What is the actual length of the motorcycle? 6 ft
- A house is 60 feet long. Find the length of the house in a scale drawing for each scale given.
  - 1 in. = 15 ft 4 in.
  - 1 in. = 40 ft 1 1/2 in.
  - 1 in. = 16 ft 3.75 in.
  - 1 in. = 300 ft 0.2 in.

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Section A: Ratio and Proportion

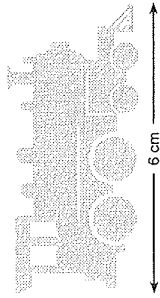
Ratio, Proportion, and Percent 17

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## SKILL 9: Practice

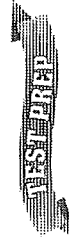
Find the actual length of the locomotive for each scale.

- 1 cm = 1 m 6 m
- 1 cm = 0.7 m 4.2 m
- 2 cm = 1 m 3 m



Solve each problem.

- Sammy created a model of a frontier fort. He used a scale of 1 in. to 2 ft. The walls of his model were 9 inches tall. How tall were the walls of the actual frontier fort? 18 ft
- An artist makes a scale model of a sculpture of a child. She uses a scale of 1 in. = 6 in. The actual sculpture will be 48 inches tall. What is the height of the scale model? 8 in.
- In Barry's classroom, the scale on the globe is 1 cm : 250 km. Barry used a tape measure. He found that it was about 40 centimeters from Dallas to Singapore. Find the estimate of the air distance between Dallas and Singapore. 10,000 km
- On a scale drawing, the width of a room is 6 in. and its length is 9 in. The actual length of the room is 18 ft. What is the actual width of the room? 12 ft

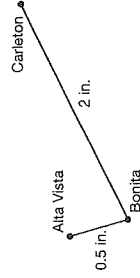


- Find the length of the hex nut in a drawing that was made using a scale of 8 : 3. The actual length of the hex nut is 1.5 cm.
 

A 0.56 cm    C 4.5 cm  
B 4 cm        D 12 cm

Skill 9

- The actual distance between Alta Vista and Bonita is 16 miles. Use the map to find the actual distance between Bonita and Carleton.



- F 4 mi    H 32 mi  
G 8 mi    J 64 mi

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Section A: Ratio and Proportion

18 Ratio, Proportion, and Percent

# SKILL 10: Meaning of Percent

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



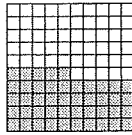
## SKILL 10: Meaning of Percent

A percent is a ratio that makes a comparison to 100. The meaning of percent is hundredths. So 80% is 80 hundredths, or  $\frac{80}{100}$ .

### Example 1

What percent (%) of the figure is shaded?  
45 out of 100 squares, or 45 hundredths of the squares are shaded.

$$\frac{45}{100} = 45\%, \text{ so } 45\% \text{ of the figure is shaded.}$$

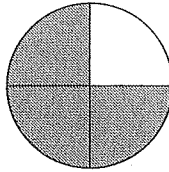


### Example 2

What percent of the circle is shaded?

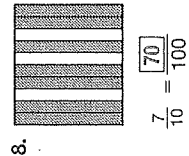
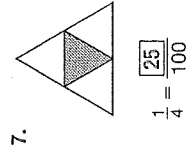
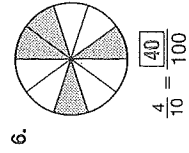
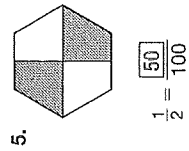
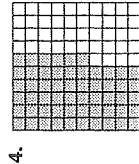
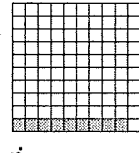
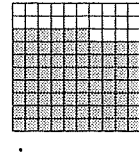
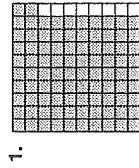
3 out of 4 of the sections of the circle are shaded. Find a ratio equal to  $\frac{3}{4}$  with a denominator of 100. Then write the percent.

$$\frac{3}{4} = \frac{3 \times 25}{4 \times 25} = \frac{75}{100} = 75\%, \text{ so } 75\% \text{ of the circle is shaded.}$$



### Guided Practice

Give the percent of each figure that is shaded.



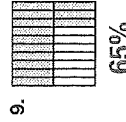
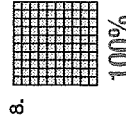
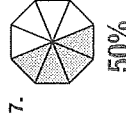
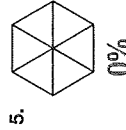
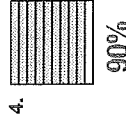
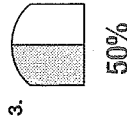
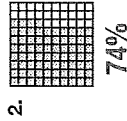
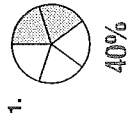
Name \_\_\_\_\_

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## SKILL 10: Practice

What percent of the figure is shaded?

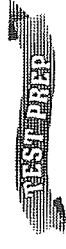
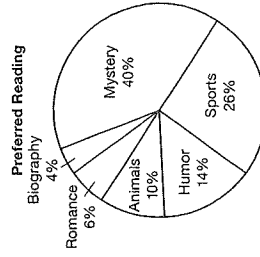


Solve each problem using the circle graph.

10. What percent of the preferred reading is humor or mystery books? 54%

11. What types of books together represent 90% of the preferred reading? Mystery, Sports, Humor, and Animals or Mystery, Sports, Humor, and Biography

12. What percent is represented by the entire circle? 100%



13. What percent of the figure is shaded?  
A 0.4  
B  $\frac{2}{5}$   
C 40%  
D 60%



Skill 10

14. Jo saves \$6 out of every \$15 she earns. How much does she save out of \$100 earned?  
F \$40  
G \$90  
H \$25  
J \$250

Skill 7

# SKILL 11: Fractions, Decimals, Percent

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 11: Fractions, Decimals, Percent

Fractions, decimals, and percents all describe parts of a whole.

- To convert a fraction to a percent, write an equal fraction with a denominator of 100. You might want to use a proportion to do this.
- To convert a decimal to a percent, multiply the decimal by 100 and write the percent symbol. Remember, to multiply by 100, you can simply move the decimal point two places to the right.

### Example 1

Write 15% as a fraction in simplest form and as a decimal.

$$\text{Fraction: } 15\% = \frac{15}{100} \div 5 = \frac{3}{20} \quad \text{Decimal: } 15\% = \frac{15}{100} = 0.15$$

### Example 2

Write  $\frac{1}{6}$  as a percent. Round to the nearest tenth.

$$\text{Write a proportion using } \frac{1}{6} \text{ and a fraction with a denominator of } 100.$$

$$6x = 100$$

$$\text{Divide both sides by } 6.$$

$$x \approx 16.7$$

So,  $\frac{1}{6} \approx 16.7\%$   6x means 6 times x  
Recall that the symbol  $\approx$  means is approximately equal to.

### Guided Practice

Write each percent as a fraction in simplest form and as a decimal.

$$1. 67\% = \frac{67}{100}; 0.67 \quad 2. 8\% = \frac{8}{100}; 0.08$$

Write each decimal as a percent.

$$3. 0.6 = 60\% \quad 4. 0.59 = 59\% \quad 5. 0.231 = 23.1\%$$

Solve each proportion. Then write the percent.

$$6. \frac{7}{10} = \frac{x}{100} \quad 7. \frac{5}{8} = \frac{x}{100} \quad 8. \frac{2}{3} = \frac{x}{100}$$

$$x = 70 \quad x = 62.5 \quad x \approx 66.7$$

$$\frac{7}{10} = 70\% \quad \frac{5}{8} = 62.5\% \quad \frac{2}{3} \approx 66.7\%$$

Section B: Percent

Ratio, Proportion, and Percent 23

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 11: Practice

Convert each percent to a fraction in lowest terms and to a decimal.

1. 80%      Fraction:  $\frac{4}{5}$       Decimal: 0.8
2. 25%      Fraction:  $\frac{1}{4}$       Decimal: 0.25
3. 3%      Fraction:  $\frac{3}{100}$       Decimal: 0.03
4. 75%      Fraction:  $\frac{3}{4}$       Decimal: 0.75
5. 16%      Fraction:  $\frac{4}{25}$       Decimal: 0.16
6. 94%      Fraction:  $\frac{47}{50}$       Decimal: 0.94

Convert each fraction or decimal to a percent. Round to the nearest tenth of a percent if necessary.

7.  $\frac{3}{10}$       30%
8.  $\frac{37}{50}$       74%
9.  $\frac{18}{20}$       90%
10.  $\frac{1}{2}$       50%
11.  $\frac{4}{5}$       80%
12.  $\frac{93}{100}$       93%
13. 0.43      43%
14. 0.01      1%
15. 0.74      74%
16.  $\frac{4}{9}$       44.4%
17.  $\frac{1}{8}$       12.5%
18.  $\frac{23.5}{100}$       23.5%

The table at the right shows what part of her allowance each girl saves.

Savings Rate	
Lindy	$\frac{1}{5}$
Sonia	16%
Annie	0.25
Gena	20%
Mari	$\frac{1}{10}$

19. Who saves the greatest percent of her allowance? Annie
20. Who saves the smallest percent of her allowance? Mari
21. Which girls save the same percent? Lindy and Gena



22. Write 0.347 as a percent. Skill 11
- A 34.7%       C 3.47%       F  $\frac{1 \text{ ride}}{\$10}$
- B 347%       D 0.00347%       G  $\frac{10 \text{ rides}}{\$1}$
- H \$1       J  $\frac{10 \text{ rides}}{\$10}$
23. Which shows a unit rate? Skill 3

24 Ratio, Proportion, and Percent

Section B: Percent

# SKILL 12:

## Finding a Percent of a Number

Student pages 25-26

Name \_\_\_\_\_

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### SKILL 12: Finding a Percent of a Number

To find a percent of a number, you can use a proportion, or you can write the percent as a decimal and multiply.

#### Example

Find 22% of 83.

#### Proportion Method

Write a proportion. Then find the cross products and solve for  $x$ .

$$\begin{array}{l} \text{part} \rightarrow x \quad 22 \leftarrow \text{Write the} \\ \text{whole} \rightarrow 83 \quad 100 \quad \text{percent as} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{a fraction} \\ \quad \quad \quad \quad \quad \quad \quad \quad \quad \quad \text{over 100.} \end{array}$$

$$\begin{array}{l} 100x = 1826 \\ x = 1826 \div 100 \\ x = 18.26 \\ 22\% \text{ of } 83 \text{ is } 18.26. \end{array}$$

#### Equation Method

Change the percent to a decimal and multiply.

$$\begin{array}{l} 22\% \text{ of } 83 = 0.22 \times 83 \\ = 18.26 \\ 22\% \text{ of } 83 \text{ is } 18.26. \end{array}$$

#### Guided Practice

Find 6% of 30 using the indicated method.

1. Write a proportion.

$$\begin{array}{l} \frac{x}{30} = \frac{6}{100} \\ 100x = 180 \\ x = 1.8 \\ 6\% \text{ of } 30 = 1.8 \end{array}$$

2. Write an equation.

$$\begin{array}{l} 6\% \text{ of } 30 = 0.06 \times 30 \\ = 1.8 \\ 6\% \text{ of } 30 = 1.8 \end{array}$$

Find the percent of each number.

- 25% of 84  
 $0.25 \times 84 = 21$   
25% of 84 = 21
- 60% of 45  
 $0.6 \times 45 = 27$   
60% of 45 = 27
- 10% of 7  
 $0.1 \times 7 = 0.7$   
10% of 7 = 0.7
- 4.2% of 50  
 $0.042 \times 50 = 2.1$   
4.2% of 50 = 2.1
- 91% of 37  
 $0.91 \times 37 = 33.67$   
91% of 37 = 33.67
- 75% of 160  
 $0.75 \times 160 = 120$   
75% of 160 = 120

Section B: Percent

Ratio, Proportion, and Percent 25

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### SKILL 12: Practice

Find the percent of each number.

- 50% of 66 = 33
- 25% of 72 = 18
- 40% of 180 = 72
- $33\frac{1}{3}\%$  of 123 = 41
- 54% of 120 = 64.8
- 0% of 14 = 0
- 22% of 96 = 21.12
- 4% of 180 = 7.2
- 100% of 180 = 180
- 19.2% of 50 = 9.6
- 31.4% of 20 = 6.28
- 8.8% of 700 = 61.6
- 3.8% of 145 = 5.51
- 45% of 75 = 33.75
- 98.5% of 150 = 147.75
- 75% of 360 = 270
- 1.2% of 200 = 2.4
- 20% of 65 = 13

Solve each problem. Try to find a pattern.

- 10% of 37 = 3.7  
37% of 10 = 3.7
- 78% of 50 = 39  
50% of 78 = 39
- 28% of 25 = 7  
25% of 28 = 7
- 47% of 40 = 18.8  
40% of 47 = 18.8

Solve.

- Of the 50 students in Class A, 48% are boys.  
How many of the students are boys? 24 boys
- The basketball team won 68% of the 25 games played. How many games did the team win? 17 games



25. Find 25% of 120.

- A 300  
B 3  
C 480  
D 30

Skill 12

26. Which is the cross product of  $\frac{4}{12} = \frac{5}{18}$ ?

- F 24  
G 42  
H 216  
J 72

Skill 5

# SKILL 13: Using Mental Math to Find a Percent of a Number

Student pages 27-28

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 13: Using Mental Math to Find a Percent of a Number

Some fraction, decimal, and percent conversions that are frequently used are shown in the table.

You can use these percents to find others.

$$3 \times 25\% = 75\%, \text{ so } 75\% = 3 \times \frac{1}{4} = \frac{3}{4}.$$

### Example 1

Find 25% of 28.

Think:  $25\% = \frac{1}{4}$ .  $\frac{1}{4} \times 28 = \frac{28}{4} = 7$ ,  
so 25% of 28 = 7.

### Example 2

Find 60% of 80.

Think:  $10\% \times 80 = \frac{1}{10} \times 80 = 8$ . Since 60% is  $6 \times 10\%$ , multiply the result by 6.  
 $6 \times 8 = 48$ , so 60% of 80 = 48.

### Example 3

Find  $33\frac{1}{3}\%$  of 240.

Think:  $33\frac{1}{3}\% = \frac{1}{3}$ .  $\frac{1}{3} \times 240 = \frac{240}{3} = 80$ , so  $33\frac{1}{3}\%$  of 240 = 80.

## Guided Practice

Use mental math to find each percent.

- Find 50% of 300.  
Think:  $50\% = \frac{1}{2}$ .  $\frac{1}{2} \times 300 = 150$ , so 50% of 300 = 150.
- Find  $12\frac{1}{2}\%$  of 24.  
Think:  $12\frac{1}{2}\% = \frac{1}{8}$ .  $\frac{1}{8} \times 24 = 3$ , so  $12\frac{1}{2}\%$  of 24 = 3.
- Find  $33\frac{1}{3}\%$  of 15.  
Think:  $33\frac{1}{3}\% = \frac{1}{3}$ .  $\frac{1}{3} \times 15 = 5$ , so  $33\frac{1}{3}\%$  of 15 = 5.
- Find 87% of 10.  
Think: 87% of 10 = 10% of 87 = 8.7.
- 20% of 45 = 9      6.  $66\frac{2}{3}\%$  of 90 = 60      7. 10% of 53 = 5.3
- 75% of 16 = 12      9. 100% of 93 = 93      10. 44% of 50 = 22

Section B: Percent

Ratio, Proportion, and Percent 27

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 13: Practice

Use mental math to find each percent of 400.

- 50% 200      2. 25% 100      3.  $37\frac{1}{2}\%$  150      4. 5% 20
- 1% 4      6. 20% 80      7. 80% 320      8. 30% 120

Use mental math to find each percent.

- 50% of 420 = 210      10. 75% of 80 60      11. 10% of 57 5.7
- 83% of 10 = 8.3      13.  $33\frac{1}{3}\%$  of 48 16      14. 100% of 35 35
- $12\frac{1}{2}\%$  of 40 = 5      16. 20% of 500 100      17.  $66\frac{2}{3}\%$  of 120 80
- 42% of 50 = 21      19. 50% of 1,800 900      20. 32% of 25 8

Solve each problem, using mental math.

- A 20% down payment is required on the purchase of a new car. What is the amount of the down payment needed to buy a \$21,000 car? \$4,200
- Jason has a 25% discount coupon for an amusement park ticket. How much will he save on a ticket that normally costs \$32? \$8
- Marvin earned \$800 one summer. He saved 75% of his earnings. How much money did Marvin save? \$600
- Eighty percent of the 300 students at Taft School ride the school bus. How many students is this? 240 students
- Mabelle's food bill at a restaurant was \$20. She decided to leave a 15% tip. How much tip did she leave? \$3.00



- Find 40% of 30. Skill 13  
A 6      C 75      F 44      H 44%  
B 12      D 120      G 0.44%      J 11%
- Write  $\frac{11}{25}$  as a percent. Skill 11

28 Ratio, Proportion, and Percent

Section B: Percent

# SKILL 14: Estimating Percents

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 14: Estimating Percents

To estimate the percent of a number, think of numbers that are close to those given but more convenient to use.

### Example 1

Estimate 87.2% of 300.

Think: 87.2% is close to 90%, so find 90% of 300.

$$90\% \times 300 = \frac{9}{10} \times 300 = 270.$$

87.2% of 300 is about 270.

### Example 2

Estimate 27% of 41.

Think: 27% is close to 25% and 41 is close to 40, so find 25% of 40.

$$25\% \times 40 = \frac{1}{4} \times 40 = 10$$

27% of 41 is about 10.

### Guided Practice

Estimate. Show what numbers you used. Sample responses given.

- 19% of 48  
↓ ↓  
20% of 50  
 $\frac{1}{5} \times 50 = 10$      $0.6 \times 100 = 60$      $\frac{3}{4} \times 28 = 21$
- 61.5% of 98  
↓ ↓  
60% of 100  
 $\frac{1}{5} \times 50 = 10$      $0.6 \times 100 = 60$      $\frac{3}{4} \times 28 = 21$
- 76% of 27  
↓ ↓  
75% of 28  
 $\frac{3}{4} \times 28 = 21$
- 97% of 325  
↓ ↓  
100% of 325  
 $1 \times 325 = 325$      $0.02 \times 500 = 10$      $\frac{1}{3} \times 18 = 6$
- 2.2% of 517  
↓ ↓  
2% of 500  
6.32% of 18  
↓ ↓  
33% of 18  
 $\frac{1}{3} \times 18 = 6$

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

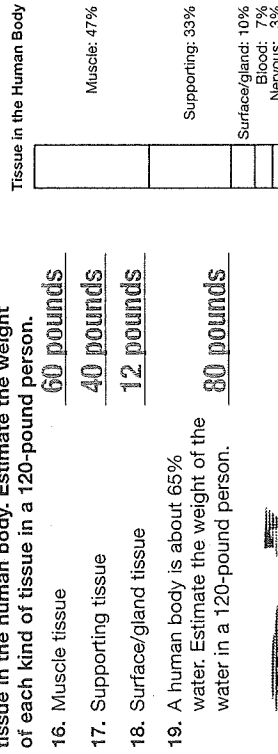
## SKILL 14: Practice

Estimate each percent. Show what numbers you used.

Sample responses

- 24.5% of 80  
 $\frac{1}{4} \times 80 = 20$
- 30% of 19.7  
 $0.3 \times 20 = 6$
- 22% of 44.7 given.  
 $\frac{1}{5} \times 45 = 9$
- 61% of 15  
 $\frac{3}{5} \times 15 = 9$
- 41% of 81.2  
 $0.4 \times 80 = 32$
- 47% of 89  
 $\frac{1}{2} \times 90 = 45$
- 9% of 82.3  
 $0.1 \times 80 = 8$
- 71% of 21  
 $\frac{7}{10} \times 20 = 14$
- 76% of 17  
 $\frac{3}{4} \times 16 = 12$
- 13% of 16  
 $\frac{1}{8} \times 16 = 2$
- 17% of 195  
 $0.2 \times 200 = 40$
- 34% of 46  
 $\frac{1}{3} \times 45 = 15$
- 85% of 603  
 $0.9 \times 600 = 540$
- 67% of 64  
 $\frac{2}{3} \times 66 = 44$
- 4.3% of 600  
\_\_\_\_\_  $\times 600 = 24$

The chart shows the percent of each type of tissue in the human body. Estimate the weight of each kind of tissue in a 120-pound person.



- Muscle tissue  
60 pounds
- Supporting tissue  
40 pounds
- Surface/gland tissue  
12 pounds
- A human body is about 65% water. Estimate the weight of the water in a 120-pound person.  
80 pounds



20. Which is the best estimate for 41% of 79?  
A 28    C 200  
**B** 32    D 16

Skill 14

F 52  
G 0.52

Skill 12

21. Find 65% of 8.

**H** 5.2  
J 4.8

# SKILL 15: Percents Greater than 100 or Less Than 1

Student pages 31-32

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 15: Percents Greater Than 100 or Less Than 1

Mr. Lockwood's class at Kendall School is collecting aluminum cans to recycle. The goal is to collect 500 cans. So, 500 represents 100% of their goal. Percents can be less than 1% or greater than 100%.

### Example 1

On the first day, one student brought 3 cans. Write 3 out of 500 as a percent.

$$\frac{3}{500} = \frac{3 \div 5}{500 \div 5} = \frac{0.6}{100} = 0.6\%$$

Read: 6 tenths percent.

0.6% is less than 1% of the goal.

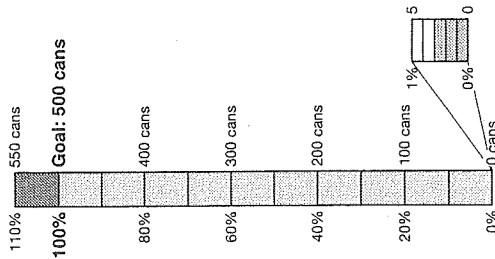
### Example 2

By the end of the second week, the students had collected 550 cans. Write 550 as a percent of 500.

$$\frac{550}{500} = \frac{550 \div 5}{500 \div 5} = \frac{110}{100} = 110\%$$

Read: one hundred ten percent

Notice that 110% is more than 100% of the goal.



### Guided Practice

Write each fraction, mixed number, or whole number as a percent.

- $\frac{2}{4} = \frac{2 \div 4}{4 \div 4} = \frac{0.5}{1} = 0.5\%$
- $2\frac{1}{2} = \frac{5}{2} = \frac{5 \times 50}{2 \times 50} = \frac{250}{100} = 250\%$
- $\frac{16}{500} = \frac{16 \div 5}{500 \div 5} = \frac{3.2}{100} = 3.2\%$
- $4 = \frac{4}{1} = \frac{4 \times 100}{1 \times 100} = \frac{400}{100} = 400\%$

Write each decimal as a percent. (Hint: When you multiply by 100, move the decimal point two places to the right.)

- $0.004 = 0.4\%$
- $2.09 = 209\%$
- $0.061 = 6.1\%$
- $3.57 = 357\%$

Write each percent as a decimal.

- $240\% = 240 \div 100 = 2.4$
- $0.3\% = 0.3 \div 100 = 0.003$

Find each percent.

- 0.9% of 120
- 225% of 40
- $0.009 \times 120 = 1.08$
- $2.25 \times 40 = 90$
- 0.2% of 134
- $0.002 \times 134 = 0.268$

Section B: Percent

Ratio, Proportion, and Percent 31

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 15: Practice

Write each percent as a decimal.

- 0.3% 0.003
- 215% 2.15
- 0.95% 0.0095
- 500% 5
- 0.7% 0.007
- 150% 1.5
- 625% 6.25
- 0.03% 0.0003

Write each decimal, fraction, mixed number, or whole number as a percent.

- $1\frac{1}{2}$  150%
- $3\frac{1}{5}$  320%
- $\frac{3}{200}$  1.5%
- $\frac{50}{1000}$  5%
- 1.82 182%
- 5.6 560%
- 0.008 0.8%
- 0.0012 0.12%
- 3 300%

Find each answer.

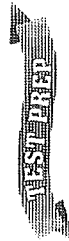
- 0.4% of 800 = 3.2
- 300% of 18 = 54
- 175% of 4 = 7
- 0.5% of 600 = 3

Solve each problem.

- Suppose the goal for Mr. Lockwood's class had been 250 cans. Then 550 cans would have been what percent of the goal? 220%
- Suppose the goal had been 1,000 cans. Then 550 cans would have been what percent of the goal? 55%

Fran said that 150% of the 30 students in Mr. Lockwood's class participated in the can-collecting activity. Is this possible? Explain.

**No, 150% is more than the entire class.**



- Find 180% of 300. **Skill 15**

- A 5.4  
B 54,000  
C 54  
D 540

- Which figures appear to be similar? **Skill 8**

- A  B  C  D   
F A and B  
G C and D  
H A and C  
J B and D

Section B: Percent

Ratio, Proportion, and Percent 32

# SKILL 16: PROBLEM SOLVING: Interest

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 16: PROBLEM SOLVING: Interest

When money is borrowed or invested, interest is paid or earned on the money. **Simple interest** is computed using the formula below. The **principal** is the amount of money borrowed or invested. The **rate** is the percent of interest per year. The length of time the money is borrowed or invested is expressed in years.

$$\text{Interest} = \text{Principal} \times \text{Rate} \times \text{Time}$$

$$I = p \times r \times t$$

### Example

The Math Club deposited \$288 in a savings account for 6 months. If the money earns simple interest at the rate of 8%, how much interest will the club receive after 6 months?

**Read** The principal is \$288, the rate is 8%, and the time is 6 months (0.5 year).

**Plan** Use the simple interest formula:  $I = p \times r \times t$ .

$$I = 288 \times 8\% \times 0.5$$

**Solve**  $I = 288 \times 0.08 \times 0.5$  Write the percent as a decimal or a fraction. Multiply.

$$I = 11.52$$

The Math Club will receive \$11.52 in interest.

**Look Back** Estimate the product:  $300 \times 0.1 \times 0.5 = 300 \times 0.05 = 15$ .

The answer makes sense.

### Guided Practice

1. Angie borrowed \$400 from her parents at 6.5% simple interest for 3 years. What is the total amount Angie must repay?

a. Give these values:  $p = \underline{\$400}$   $r = \underline{6.5\%}$   $t = \underline{3 \text{ yr}}$

b. Find the interest:  $I = p \times r \times t = \underline{\$400} \times \underline{0.065} \times \underline{3} = \underline{\$78}$

c. Angie will repay the principal plus interest. How much will she repay?  $\underline{\$400} + \underline{\$78} = \underline{\$478}$

2. Julian invested \$2,000 at 4% simple interest.

How much is his investment worth after  $1\frac{1}{2}$  years?

a. Simple interest:  $I = p \times r \times t = \underline{\$2,000} \times \underline{0.04} \times \underline{1.5} = \underline{\$120}$

b. Principal + Interest =  $\underline{\$2,000} + \underline{\$120} = \underline{\$2,120}$

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 16: Practice

Find the amount of the interest.

1.  $p = \$375$       2.  $p = \$1,000$

$r = 5\%$        $r = 10\%$

$t = 2$  years       $t = 2\frac{1}{2}$  years

$I = \underline{\$37.50}$        $I = \underline{\$250}$

3.  $p = \$400$

$r = 8.5\%$

$t = 6$  months

$I = \underline{\$17}$

Solve each problem.

4. Katie invested \$100 at 6% simple interest for  $1\frac{1}{2}$  years. How much interest did she earn? \_\_\_\_\_

5. Lou loaned Don \$500 at 10% simple interest for 1 year.

a. How much interest will Don pay? \$50

b. What is the total amount Don will repay? \$550

6. Find the simple interest earned

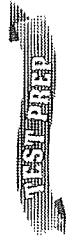
a. on \$300 invested at 5% for 4 years. \$60

b. on \$300 invested at 4% for 5 years. \$60

c. What do you notice about the answers to part a and part b? They are the same.

7. Fay invested \$750 at 8.5% simple interest. How much is her investment worth after 3 years? \$941.25

8. Steven's credit card company charges 18% simple interest. How much will he pay altogether if he has a balance of \$320 after one year? \$377.60



9. Find the simple interest earned on \$200 invested at 7% for 3 years. Skill 16

A \$420      C \$600

B \$42      D \$14

10. Solve:  $\frac{15}{36} = \frac{m}{54}$ .

F 810

G 42

Skill 6

H 22.5

J 129.6



# SKILL 17: Finding the Percent

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 17: Finding the Percent

You can write a percent proportion to find what percent one number is of another.

### Example

6 is what percent of 15?

Write a proportion. *Think:* 6 out of 15 is equal to what percent?

$$\frac{\text{part}}{\text{whole}} \rightarrow \frac{6}{15} = \frac{x}{100} \quad \leftarrow \text{Find the missing value.}$$

Write the cross products.

$$\begin{aligned} 15x &= 6 \times 100 \\ 15x &= 600 \\ x &= 600 \div 15 \\ x &= 40 \end{aligned}$$

Divide by 15.

$$\frac{6}{15} = \frac{40}{100}$$

So, 6 is 40% of 15.

### Guided Practice

Complete the steps to answer each question.

1. What percent of 20 is 7?

a. *Think:* 7 out of 20 is equal to what percent? Write a proportion:

$$\frac{x}{100} = \frac{7}{20}$$

b. Write the cross products.

$$20x = 700$$

c. Divide to undo the multiplication.

$$\begin{aligned} x &= 700 \div 20 \\ x &= 35 \\ 7 \text{ is } 35\% \text{ of } 20. \end{aligned}$$

2. 15 is what percent of 75?

a.  $\frac{15}{75}$  out of  $\frac{75}{75}$  = what percent? a.  $\frac{60}{75}$  out of  $\frac{25}{75}$  = what percent?

b.  $\frac{15}{75} = \frac{x}{100}$

c. 15 is 20 % of 75.

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 17: Practice

Find each answer.

- 20 is what percent of 25? 80%
- Find what percent 12 is of 16. 75%
- 21 is what percent of 35? 60%
- Find what percent 4 is of 80. 5%
- What percent of 88 is 66? 75%
- 15 is what percent of 50? 30%
- What percent of 300 is 450? 150%
- Find what percent 0.12 is of 48. 0.25%
- Find what percent 35 is of 20. 175%
- Find what percent 30 is of 15. 200%
- 10.4 is what percent of 40? 26%
- What percent of 20 is 16.6? 83%

Solve each problem. Use the table.

13. What percent of the 40 girls preferred the Prime Numbers? 30%

14. What percent of the 40 girls were undecided? 10%

15. Which group was the most popular? Square Roots

Favorite Music Groups (40 girls surveyed)	
Prime Numbers	12 girls
Acute Angles	$\frac{1}{4}$ of the girls
Square Roots	35% of the girls
Undecided	4 girls



16. 9 is what percent of 20? Skill 17

- A 22.2%    C 45  
 B 45%    D 4.5%

17. Find 60% of 92. Skill 12

- F  $153\frac{1}{3}$     H 552  
 G 5.52     J 55.2

# SKILL 18: Finding the Base

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 18: Finding the Base

Sometimes you will know the values for the part and the percent of a number. You can use a percent proportion to find the whole, or base number value.

### Example

20% of what number is 3?

Think: The value 3 is 20% of what base number?

Write a proportion. Think: 3 out of how many equals 20 out of 100?

$$\frac{\text{part}}{\text{whole}} \rightarrow \frac{3}{x} = \frac{20}{100}$$

Write the cross products.  
 $20x = 3 \times 100$   
 $20x = 300$

Divide by 20.  
 $x = 300 \div 20$   
 $x = 15$

20% of 15 is 3.

### Guided Practice

Complete the steps to find the base.

1. 54 is 90% of what number?  
 a. Think: 54 out of how many is equal to 90 out of 100?

b. Write a proportion.  
 $\frac{54}{x} = \frac{90}{100}$

c. Write the cross products.  
 $90x = 5,400$

d. Divide to undo the multiplication.  
 $x = \frac{60}{100}$   
 54 is 90% of 60.

2. 50% of what number is 37?

a. Think: 37 out of how many is equal to 50 out of 100?

b.  $\frac{37}{x} = \frac{50}{100}$

c.  $x = \frac{74}{100}$   
 50% of 74 is 37.

3. 45 is 225% of what number?

a. Think: 45 out of how many is equal to 225 out of 100?

b.  $\frac{45}{x} = \frac{225}{100}$

c.  $x = \frac{20}{100}$   
 45 is 225% of 20.

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 18: Practice

Find each base.

- 70% of what number is 35? 50
- 18% of what number is 81? 450
- 45% of what number is 27? 60
- 25% of what number is 19? 76
- 30% of what number is 27? 90
- 14 is 25% of what number? 56
- 104 is 5% of what number? 2,080
- 20% of what number is 14.4? 72
- 125% of what number is 15? 12
- 0.9 is 10% of what number? 9
- 33 $\frac{1}{3}$ % of what number is 36? 108
- 0.4% of what number is 8? 2,000
- 10 is 2.5% of what number? 400
- 22 is 12 $\frac{1}{2}$ % of what number? 176

Solve each problem.

- The members of the school band sold \$1,800 worth of fruit. This was 60% of their fundraising goal. How much was their goal? \$3,000
- Amy sells computer software. She earns 28% of her total sales in commission. If she earned \$1,897 in commissions last month, what were her total sales for the month? \$6,775
- Shing sold 13 computers this week. This was 4% of the computers in stock. How many computers were in stock? 325 computers



18. 12% of what number is 9?

- (A) 75 (B) 7.5 (C) 1.08 (D) 750

Skill 18

19. Write 0.003 as a percent.

- F 30% (G) 0.3% H 0.03% J 3%

Skill 15

# SKILL 19: PROBLEM SOLVING: Percent of Increase and Decrease

Student pages 41-42

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_



## SKILL 19: PROBLEM SOLVING: Percent of Increase and Decrease

To find the percent of increase, compare the amount of increase to the original amount

$$\frac{\text{amount of increase}}{\text{original amount}} = \frac{n}{100}$$

To find the percent of decrease, compare the amount of the decrease to the original amount.

$$\frac{\text{amount of decrease}}{\text{original amount}} = \frac{n}{100}$$

### Example

Last year the Luna family paid \$900 a month for rent. This year the rent increased to \$972 a month. By what percent did their rent increase from last year to this year?

**Read** The rent increased from \$900 to \$972.

**Plan** Subtract to find the amount of the increase:  $\$972 - \$900 = \$72$ . Write a proportion to find what percent \$72 is of \$900.

amount of increase  $\rightarrow \frac{72}{900} = \frac{n}{100}$   
 original amount  $\rightarrow \frac{900}{100}$   
**Solve** Find the cross products.  $900n = 7200$   
 Divide by 900.  $n = 8$

The percent of increase is 8%.

**Look Back** Is 8% of \$900 equal to \$72? Since  $0.08 \times 900 = 72$ , it checks.

### Guided Practice

1. The original price of a pair of jeans was \$30. The sale price is \$24. What is the percent of discount? (Discount is a decrease in price.)

a. Find the amount of the discount.  $\$30 - \$24 = \$6$   
 amount of decrease  $\rightarrow \frac{6}{30} = \frac{n}{100}$   
 original amount  $\rightarrow \frac{30}{100}$   
 the percent of discount.  $\rightarrow \frac{20\%}{100\%}$   
 c. Solve the proportion. What is the percent of discount?

2. Michael bought a baseball card for \$5. He later sold it for \$10. By what percent did the price of the card increase?

a. Write a proportion to find the percent of increase.  
 amount of increase  $\rightarrow \frac{5}{5} = \frac{n}{100}$   
 original amount  $\rightarrow \frac{5}{100}$   
 b. By what percent did the price of the card increase?  
 $100\%$

Name \_\_\_\_\_ Date \_\_\_\_\_ Class \_\_\_\_\_

## SKILL 19: Practice

Write increase or decrease for each change. Then find the percent of increase or decrease.

- from \$90 to \$117  
increase, 30%
- from \$98 to \$49  
decrease, 50%
- from \$45 to \$27  
decrease, 40%
- from \$72 to \$135  
increase, 87.5%
- from \$120 to \$150  
increase, 25%
- from \$200 to \$196  
decrease, 2%

Solve each problem.

- The enrollment at Polk Middle School grew from 440 students to 528 students. By what percent did enrollment grow?  
20%
- Between 1978 and 1997 the price of gasoline increased from about \$65 a gallon to about \$1.30. By what percent did the price of gasoline increase?  
100%
- A store marked down the price of a television from \$800 to \$600. What is the percent of decrease in price?  
25%
- The population of Liberty City decreased from 1,250 to 1,145. By what percent did the population go down?  
8.4%
- During a 20% discount sale, a pair of skates was marked down \$7. What was the original price of the skates?  
\$35
- After Hank studied for a test and got a good grade, his average increased from 85 to 91. To the nearest percent, by what percent did Hank increase his average?  
7%



- A \$12 tape is on sale for \$9. What is the percent of discount?  
 A 133%    C 25%    F 3 : 4  
 B 75%    D \$3    G  $\frac{3}{4}$   
 Skill 19
- Which does not show the ratio 3 applies to 4 oranges?  
 A  $\frac{4}{3}$     H  $\frac{4}{3}$   
 B  $\frac{3}{4}$     J 3 to 4  
 Skill 1