**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 $0.25 per ounce (\frac{1}{4} \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.

\[
\begin{array}{ccc}
\text{Cost in dollars} & 3 & 6 & 1 \\
\text{Apples} & 6 & 12 & 2 & 1 \\
\end{array}
\]

\[
\begin{array}{c}
3 \times 2 & \frac{3}{3} & \frac{3}{6} \\
6 \times 2 & \frac{6}{3} & \frac{6}{6} \\
\end{array}
\]

Three rates equal to \( \frac{3 \$}{6 \text{ caramel apples}} \) are \( \frac{\$6}{12}, \frac{\$1}{2}, \) and \( \frac{\$0.50}{1} \).

The unit rate, \( \frac{\$0.50}{1 \text{ apple}} \), may be written as \$0.50 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
   - Yes or no: No
   - Why: Different units.

2. 365 days per year
   - Yes or no: Yes
   - Why: Same unit.

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

3. \( \frac{20 \text{ students}}{5 \text{ groups}} \)
   - Yes or no: No
   - Why: Different units.

4. \( \frac{250 \text{ calories}}{3 \text{ servings}} \)
   - Yes or no: Yes
   - Why: Same unit.

5. \( \frac{25 \text{ miles per gallon}}{} \)
   - Yes or no: Yes
   - Why: Same unit.

6. \( \frac{36 \text{ inches}}{3 \text{ feet}} \)
   - Yes or no: Yes
   - Why: Same unit.

7. \( \frac{12 \text{ eggs in a dozen}}{} \)
   - Yes or no: Yes
   - Why: Same unit.

8. \( \frac{8 \text{ ounces in a cup}}{} \)
   - Yes or no: Yes
   - Why: Same unit.

9. \( \frac{\$9.00}{1 \text{ h}} \)
   - Yes or no: Yes
   - Why: Same unit.

10. \( \frac{\$8.50 \text{ for each person}}{} \)
    - Yes or no: Yes
    - Why: Same unit.

11. \( \frac{\$85.00 \text{ for 10 people}}{} \)
    - Yes or no: Yes
    - Why: Same unit.

12. \( \frac{1 \text{ book every 2 weeks}}{} \)
    - Yes or no: Yes
    - Why: Same unit.
SKILL 3: Practice

Is the ratio a rate? Write yes or no.

1. 5 gallons in 10 minutes __________
2. 3 teaspoons to 1 teaspoon __________
3. 20 quarters in $5 __________
4. 1 car wash every 15 minutes __________
5. 3 daisies for $1.00 __________
6. $20 out of every $50 __________

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

7. 3 weeks per year __________
8. $4.50 for 2 pounds __________
9. $10 for 5 books __________
10. 15 minutes for each quarter __________
11. 7.5¢ per ounce __________
12. 72 pages \( \frac{1}{6} \) days __________

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. __________

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

<table>
<thead>
<tr>
<th>Vehicle Type</th>
<th>Gas Mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact car</td>
<td>30 mi/gal</td>
</tr>
<tr>
<td>Mid-sized car</td>
<td>25 mi/gal</td>
</tr>
<tr>
<td>Mini-van</td>
<td>20 mi/gal</td>
</tr>
<tr>
<td>Sport utility</td>
<td>15 mi/gal</td>
</tr>
</tbody>
</table>

14. \( \frac{100 \text{ mi}}{5 \text{ gal}} \) __________
15. \( \frac{100 \text{ mi}}{4 \text{ gal}} \) __________
16. \( \frac{60 \text{ mi}}{4 \text{ gal}} \) __________
17. \( \frac{60 \text{ mi}}{2 \text{ gal}} \) __________

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

19. Which ratio is equal to \( \frac{24}{36} \)? __________

F \( \frac{36}{24} \)  H \( \frac{6}{3} \)  G \( \frac{3}{2} \)  J \( \frac{2}{3} \)

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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?

\[
\frac{4}{5} \rightarrow 4 \times 3 = 12 \\
\frac{12}{15} \rightarrow 5 \times 3 = 15
\]

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.

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.

\[
\begin{array}{|c|c|c|c|c|}
\hline
\text{Oranges} & 3 & 6 & 9 & 12 \\
\hline
\text{Dollars} & .49 & .98 & 1.47 & 1.96 \\
\hline
\end{array}
\]

3 oranges \( \frac{.49}{$} \) = 12 oranges \( \frac{12 \times .49}{$1.96} \), less than the $2.00 for a bag of a dozen.

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

Guided Practice

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

1. What do you divide 72 by to get 8? __   
2. What do you divide 24 by to get 3? __   
3. Do the ratios form a proportion? Why or why not?

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

4. $\frac{21}{3} \div \frac{7}{1}$  
5. $\frac{4}{9} \div \frac{2}{16}$  
6. $\frac{8}{9} \div \frac{2}{48}$  
7. $\frac{30}{10} \div \frac{5}{6}$  
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.
Do the ratios form a proportion? Write yes or no.

1. \( \frac{7}{15} \) \( \frac{28}{60} \)
2. \( \frac{24}{6} \) \( \frac{12}{3} \)
3. \( \frac{36}{42} \) \( \frac{6}{8} \)
4. \( \frac{6}{13} \) \( \frac{18}{36} \)

5. \( \frac{9}{10} \) \( \frac{54}{60} \)
6. \( \frac{64}{8} \) \( \frac{8}{2} \)
7. \( \frac{5}{9} \) \( \frac{55}{90} \)
8. \( \frac{33}{48} \) \( \frac{11}{16} \)

9. \( \frac{2}{78} \) \( \frac{1}{39} \)
10. \( \frac{15}{75} \) \( \frac{2}{4} \)
11. \( \frac{20}{25} \) \( \frac{4}{5} \)
12. \( \frac{0.5}{2} \) \( \frac{1.0}{4} \)

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

<table>
<thead>
<tr>
<th>Cups sold</th>
<th>450</th>
<th></th>
<th></th>
<th>10</th>
<th>5</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Profit in dollars</td>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

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

A. \( \frac{6}{5} \)
B. \( \frac{20}{30} \)
C. \( \frac{20}{24} \)
D. \( \frac{24}{20} \)

18. Which ratio is a unit rate?

F. \( \frac{1¢}{10¢} \)
G. \( \frac{5 \text{ m}}{1 \text{ cm}} \)
H. \( \frac{1 \text{ cm}}{5 \text{ m}} \)
J. \( \frac{10¢}{1¢} \)

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 \( \frac{5}{6} = \frac{15}{18} \).

**Example 1**

Do the ratios form a proportion?

\[
\begin{align*}
3 \div & 12 \\
5 \div & 20 \\
3 \times 20 & = 60 \\
5 \times 12 & = 60
\end{align*}
\]

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

**Example 2**

Do the ratios form a proportion?

\[
\begin{align*}
40 \div & 8 \\
60 \div & 10 \\
40 \times 10 & = 400 \\
60 \times 8 & = 480
\end{align*}
\]

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 \( \neq \).

1. \( \frac{4}{5} \div \frac{2}{3} \)

\[
\begin{align*}
4 \times 3 & = 12 \\
5 \times 2 & = 10
\end{align*}
\]

2. \( \frac{10}{50} \div \frac{2}{10} \)

\[
\begin{align*}
10 \times 10 & = 100 \\
50 \times 2 & = 100
\end{align*}
\]

3. \( \frac{9}{12} \div \frac{6}{8} \)

\[
\begin{align*}
9 \times 8 & = 72 \\
12 \times 6 & = 72
\end{align*}
\]

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

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ms. Hong</td>
<td>14</td>
<td>16</td>
</tr>
<tr>
<td>Mr. Muñoz</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>Mrs. Bruno</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Mr. Ryan</td>
<td>15</td>
<td>8</td>
</tr>
</tbody>
</table>

Section A: Ratio and Proportion
**SKILL 5: Practice**

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

1. \(\frac{6}{12} = \frac{2}{14}\) __________
2. \(\frac{3}{20} = \frac{2}{10}\) __________
3. \(\frac{20}{12} = \frac{25}{15}\) __________
4. \(\frac{27}{6} = \frac{36}{8}\) __________
5. \(\frac{13}{11} = \frac{24}{20}\) __________
6. \(\frac{3}{4} = \frac{15}{20}\) __________
7. \(\frac{10}{4} = \frac{45}{20}\) __________
8. \(\frac{15}{10} = \frac{3}{2}\) __________
9. \(\frac{12}{21} = \frac{16}{28}\) __________
10. \(\frac{3}{24} = \frac{4}{32}\) __________
11. \(\frac{12}{20} = \frac{4}{7}\) __________
12. \(\frac{2}{9} = \frac{5}{22}\) __________
13. \(\frac{2}{7} \text{ tsp} = \frac{6}{21} \text{ gal}\) __________
14. \(\frac{12}{20} \text{ cm} = \frac{15}{25} \text{ cm}\) __________
15. \(\frac{14}{3} \text{ hr} = \frac{84}{18} \text{ hr}\) __________
16. \(\frac{27}{21} \text{ lb} = \frac{14}{18} \text{ lb}\) __________
17. \(\frac{15}{21} \text{ sec} = \frac{10}{15} \text{ in.}\) __________
18. \(\frac{6}{13} \text{ gal} = \frac{7}{14} \text{ gal}\) __________

Use the data given in the table.

19. Which two students ran at the same rate?

20. Larry ran 200 meters in 16 seconds. Did he run 200 meters at the same rate that he ran 500 meters?

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

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

**TEST PREP**

23. Which shows a true proportion?

<table>
<thead>
<tr>
<th>Runner</th>
<th>Distance</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joyce</td>
<td>100 m</td>
<td>12 sec</td>
</tr>
<tr>
<td>Larry</td>
<td>500 m</td>
<td>55 sec</td>
</tr>
<tr>
<td>Tanya</td>
<td>10 m</td>
<td>1 sec</td>
</tr>
<tr>
<td>Alan</td>
<td>200 m</td>
<td>24 sec</td>
</tr>
</tbody>
</table>

A 120  B 75  C 192  D 110

**10 Ratio, Proportion, and Percent**

Section A: Ratio and Proportion
**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: \( \frac{21}{7} = \frac{3}{x} \)

\[ \square \times 7 = 21 \times 3 \]

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.

1. \[ \frac{2}{8} = \frac{1.5}{n} \]

\[ 2 \times n = \_ \times \_ \]

\[ \_ \times \_ = 10 \times n \]

\[ 6 \times n = \_ \times \_ \]

\[ n = \_ \]

2. \[ \frac{6}{10} = \frac{n}{12} \]

\[ 6 \times n = \_ \times \_ \]

\[ n = \_ \]

3. \[ \frac{5}{n} = \frac{6}{36} \]

\[ 5 \times \_ = \_ \times 36 \]

\[ \_ \times \_ = n \]

\[ n = \_ \]

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

\[ \text{miles} \rightarrow \square = n \]

\[ \text{liters} \rightarrow \square = 1 \]

Write cross products.

\[ \_ \times \_ = \_ \times \_ \]

Solve the proportion.

\[ n = \_ \]

Write the unit rate. ___________
**SKILL 6: Practice**

Solve each proportion.

1. \( \frac{2}{8} = \frac{n}{20} \)  
   \( \frac{2}{8} = \frac{15}{5} = \frac{6}{n} \)  
   \( \frac{n}{4} = \frac{6}{3} \)

2. \( \frac{4}{5} = \frac{8}{n} \)  
3. \( \frac{12}{8} = \frac{6}{n} \)  
4. \( \frac{8}{9} = \frac{n}{3} \)  
5. \( \frac{20}{8} = \frac{n}{2} \)  
6. \( \frac{n}{8} = \frac{3}{4} \)  
7. \( \frac{20}{8} = \frac{n}{2} \)

Find the unit price.

16. $1.20 for 24 ounces of juice. \( \frac{1.20}{24} \) per ounce

17. $12 for 8 pounds of peanuts. \( \frac{12}{8} \) per pound

18. 4 quarts of milk cost $3.88. \( \frac{3.88}{4} \) per quart

**TEST PREP**

19. Find \( n: \frac{3}{9} = \frac{4}{n} \)  
   \( A \ 1.3 \quad C \ 3 \)  
   \( B \ 12 \quad D \ 6.75 \)

20. Give the ratio of As to all letters.  
   \( A \ B \ B \ C \ A \ A \ C \ C \)  
   \( F \ \frac{8}{3} \quad H \ \frac{3}{8} \)  
   \( G \ \frac{5}{3} \quad J \ \frac{5}{3} \)
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 \(\frac{x\text{ cups}}{24\text{ hours}}\).

\[
\begin{align*}
\text{cups} & \rightarrow 4 \Rightarrow n \\
\text{hours} & \rightarrow 1 \Rightarrow 24
\end{align*}
\]

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

1. How many quarts is 96 cups of water?
   a. How many cups are there in one quart? 
   b. Write a proportion. 
      \[
      \begin{align*}
      \text{cups} & \rightarrow \square = \square \\
      \text{quarts} & \rightarrow \square
      \end{align*}
      \]
   c. Find the missing value in the proportion. 

2. 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.)
   a. Write a proportion you can use to find the answer.
      \[
      \begin{align*}
      \text{steps} & \rightarrow \square = \square \\
      \text{feet} & \rightarrow \square
      \end{align*}
      \]
   b. How many steps would Lea need to walk one mile? 

Section A: Ratio and Proportion
**SKILL 7: Practice**

Use a proportion to find each missing number.

1. 91 days = _____ weeks
2. 9 dozen items = _____ items
3. 2400 minutes = _____ hours
4. 3 tons = _____ pounds

**Solve each problem.**

5. Kurt gets an $800 paycheck every 2 weeks. At this rate, how much does he earn in 1 year (52 weeks)?

6. 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?

7. 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.

8. 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?

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

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

   |   |   |
   | A | 1 lb | C | 16 lb |
   | B | 4 lb | D | 2 lb |

11. Which ratio is not equal to $\frac{3}{15}$?

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

14 Ratio, Proportion, and Percent
**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.  
\[
3 \times k = 24
\]

Divide to undo multiplication.

\[
k = \frac{24}{3} = 8
\]

Side \( k \) measures 8 cm.

**Guided Practice**

Find a pair of triangles that appear to be:

1. Congruent __________

2. Similar ________________

Use the similar triangles in the Example. Find the length of side \( m \).

3. Find the length of the side that corresponds to side \( m \). __________

4. Find another pair of corresponding sides. ____________________________

5. Write a proportion using corresponding sides. __________________________

6. Solve to find the length of side \( m \). __________

Section A: Ratio and Proportion
Tell whether the figures appear to be congruent, similar, or neither.

1. □ □
2. △ △
3. □ □

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

4. 
\[ \begin{align*}
9 \text{ in.} & \quad 12 \text{ in.} \\
12 \text{ in.} & \quad a & \quad c \\
b & \quad & \\
\end{align*} \]

\[ a = \quad \quad \quad b = \quad \quad \quad c = \quad \]

5. 
\[ \begin{align*}
9 \text{ ft} & \quad 10 \text{ ft} \\
18 \text{ ft} & \quad 14 \text{ ft} \\
m & \quad n & \quad \\
\end{align*} \]

\[ m = \quad \quad \quad n = \quad \quad \quad \]

6. 
\[ \begin{align*}
6.5 \text{ cm} & \quad 6 \text{ cm} \\
2.5 \text{ cm} & \quad r & \quad s \\
5 \text{ cm} & \quad 6 \text{ cm} & \quad t \\
\end{align*} \]

\[ r = \quad \quad \quad s = \quad \quad \quad t = \quad \]

7. 
\[ \begin{align*}
2.5 \text{ m} & \quad 4 \text{ m} & \quad 2.5 \text{ m} & \quad 7.5 \text{ m} \\
4 \text{ m} & \quad x & \quad y \\
\end{align*} \]

\[ x = \quad \quad \quad y = \quad \quad \quad z = \quad \]

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

<table>
<thead>
<tr>
<th>Screen</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand TV</td>
<td>2 in. by 3 in.</td>
</tr>
<tr>
<td>Computer</td>
<td>12 in. by 15 in.</td>
</tr>
<tr>
<td>TV</td>
<td>15 in. by 21 in.</td>
</tr>
<tr>
<td>Movie</td>
<td>20 ft by 28 ft</td>
</tr>
</tbody>
</table>

9. The triangles are similar. Find the length of \( h \).

\[ \begin{align*}
9 \text{ m} & \quad 6 \text{ m} \\
2 \text{ m} & \quad h \\
\end{align*} \]

\[ A \ 3 \text{ m} \quad C \ 6 \text{ m} \quad B \ 9 \text{ m} \quad D \ 27 \text{ m} \]

10. Solve for \( d \): \[ \frac{d}{3.5} = \frac{10}{7} \]

\[ F \ 3.5 \quad H \ 5 \quad G \ 7 \quad J \ 0.5 \]
**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?

\[
\text{scale} \quad \rightarrow \quad 1 \quad 1.5 \\
\text{actual} \quad \rightarrow \quad 3 \quad x
\]

**Solve** Find the cross product.

\[ x = 4.5 \]

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**

1. Find the actual length of the motorcycle represented in the drawing.
   a. How many inches long is the motorcycle in the drawing? 
   b. Write a proportion you can use to find the length in feet.
   c. What is the actual length of the motorcycle?

2. A house is 60 feet long. Find the length of the house in a scale drawing for each scale given.
   a. 1 in. = 15 ft 
   b. 1 in. = 40 ft 
   c. 1 in. = 16 ft 
   d. 1 in. = 300 ft
SKILL 9: Practice

Find the actual length of the locomotive for each scale.

1. 1 cm = 1 m
2. 1 cm = 0.7 m
3. 2 cm = 1 m

Solve each problem.

4. 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?

5. 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?

6. 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.

7. 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?

TEST PREP

8. 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

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
Circle each correct answer.

1. The model of a building is 5 in. long. The scale is 2 in. = 15 ft. What is the actual length of the building?
   A 2.5 ft  
   B 6 ft  
   C 37.5 ft  
   D 30 ft  

2. Which shows a proportion?
   F $\frac{20}{32} = \frac{5}{8}$  
   H $\frac{6}{10} = \frac{5}{12}$  
   G $\frac{3}{4} = \frac{4}{3}$  
   J $\frac{15}{30} = \frac{1}{3}$  

3. Which ratio does not show 7 students to 10 adults?
   A $\frac{10}{7}$  
   B 7 to 10  
   C $\frac{7}{10}$  
   D 7 : 10  

4. During a test, 3 out of 200 television sets were found to be defective. About how many defective sets would you expect out of 4,000 television sets?
   F 266 sets  
   H 60 sets  
   G 20 sets  
   J 30 sets  

5. Solve: $\frac{6}{9} = \frac{x}{30}$.
   A 45  
   B 30  
   C 180  
   D 20  

6. Which is a unit rate?
   F 12 limes $\frac{\$1}{\$10}$  
   H $\frac{\$1}{\$10}$  
   G $\frac{2 \text{ L}}{\$1.19}$  
   J 8 tokens $\frac{\$10}{\$10}$  

7. Which figures appear to be similar?
   W X Y Z
   A W and Y  
   B X and Z  
   C X and Y  
   D W and Z  

8. Which ratio is equal to $\frac{5}{8}$?
   F $\frac{8}{3}$  
   H $\frac{16}{6}$  
   G $\frac{16}{40}$  
   J $\frac{45}{72}$  

9. The rectangles are similar. Find the length of side $r$.
   A 0.75 cm  
   B 5 $\frac{1}{3}$ cm  
   C 12 cm  
   D 24 cm  

10. Find the cross product: $\frac{3}{4.5} = \frac{6}{9}$.
    F 18  
    G 27  
    H 40.5  
    J 2  

11. Use the scale 3 in. to 10 ft to find the scale length of a car that is 17 ft long.
    A 2 in.  
    B 5.1 in.  
    C 56.6 in.  
    D 3.1 in.  

12. If 24 identical prints cost $5.04, how much does each print cost?
    F $\$0.21$  
    G $\$2.10$  
    H $\$120.96$  
    J $\$12$
Match each exercise with its answer by drawing a line from the exercise star to the answer star. Write the letter the line goes through on the blank beside the answer. You will name a famous person. The units are not given in the answers.

1. Solve: \( \frac{30}{50} = \frac{n}{5} \). * 
   I * 28 ___

2. Is $5 for 6 tickets a rate? * 
   * 72 ___

3. If 3 CDs cost $42, what do 2 CDs cost? * 
   M * 75 ___

4. Solve: \( \frac{12}{9} = \frac{m}{3} \). * 
   * 5/3 ___

5. 4 qt = 1 gal * 
   20 qt = ? gal * 
   A * 3 ___

6. Give the ratio of As to Bs: ABAABBAA: * 
   * 4 ___

7. Find the unit rate for 12 for $4. * 
   I * Yes ___

8. Find the cross product: * 
   \( \frac{4}{9} = \frac{8}{18} \). * 
   Y * 24 ___

9. Find \( n \). The triangles are similar. * 
   S * 3/1 ___

10. 25 mi in 2 h is the same as ? mi in 6 h. * 
    SM * No ___

11. Solve: \( \frac{5}{7} = \frac{6}{x} \). * 
    * 10 ___

12. A scale of 3 cm to 8 m is the same as 9 cm to ? m. * 
    A * 8.4 ___

13. Is \( \frac{3}{4} = \frac{8}{6} \) a proportion? * 
    * ___

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Name ________________________ Date ________________________ Class

Mixed Review for Section A

Ratio, Proportion, and Percent

Section A: Ratio and Proportion