

4-4

Solving Proportions

What You'll Learn

To solve proportions using unit rates, mental math, and cross products

Why Learn This?

You know the price of six oranges, but you want to buy eight. You can solve a proportion to find the total cost of the quantity that you want to buy.

You can use unit rates to solve a proportion. First find the unit rate. Then multiply to solve the problem.



Shopping Use the information above to find the cost in dollars of 8 oranges.

Solve the proportion $\frac{2.34 \text{ dollars}}{6 \text{ oranges}} = \frac{x \text{ dollars}}{8 \text{ oranges}}$.

Step 1 Find the unit price.

$$\frac{2.34 \text{ dollars}}{6 \text{ oranges}}$$

$$\$2.34 \div 6 \text{ oranges} \leftarrow \text{Divide to find the unit price.}$$

$$\$0.39/\text{orange}$$

Step 2 You know the cost of one orange. Multiply to find the cost of 8 oranges.

$$\$0.39 \cdot 8 = \$3.12 \leftarrow \text{Multiply the unit rate by the number of oranges.}$$

The cost of 8 oranges is \$3.12.



Examples

- ① **Using Unit Rates** The cost of 4 lightbulbs is \$3. Use the information to find the cost of 10 lightbulbs.

Step 1 Find the unit price.

$$\frac{3 \text{ dollars}}{4 \text{ lightbulbs}} = \$3 \div 4 \text{ lightbulbs} \leftarrow \text{Divide to find the unit price.}$$

$$\frac{\boxed{\$.75}}{\text{lightbulb}}$$

Step 2 You know the cost of one lightbulb. Multiply to find the cost of 10 lightbulbs.

$$\boxed{\$.75} \cdot \boxed{10} = \boxed{\$ 7.50} \leftarrow \text{Multiply the unit rate by the number of lightbulbs.}$$

The cost of 10 lightbulbs is $\boxed{\$ 7.50}$.

You can use mental math to solve some proportions. When a proportion involves a variable, you solve the proportion by finding the value of the variable.

EXAMPLE**Solving Using Mental Math****2****Algebra** Solve each proportion using mental math.

a. $\frac{z}{12} = \frac{21}{36}$

$$\frac{z}{12} = \frac{21}{36}$$

← Since $12 \times 3 = 36$, the common multiplier is 3.

$z = 7$

← Use mental math to find what number times 3 equals 21.

b. $\frac{8}{10} = \frac{n}{40}$

$$\frac{8}{10} = \frac{n}{40}$$

← Since $10 \times 4 = 40$, $8 \times 4 = n$.

$n = 32$

← Use mental math.

2 Solving Using Mental Math Solve each proportion using mental math.

a. $\frac{5}{c} = \frac{30}{42}$

$$\frac{5}{c} = \frac{30}{42}$$

← Since $5 \times \boxed{6} = 30$, the common multiplier is $\boxed{6}$.

$c = \boxed{7}$

← Use mental math to find what number times $\boxed{6}$ equals 42.

b. $\frac{9}{4} = \frac{72}{t}$

$$\frac{9}{4} = \frac{72}{t}$$

← Since $9 \times \boxed{8} = 72$, $4 \times \boxed{8} = t$.

$t = \boxed{32}$

← Use mental math.

Many proportions cannot easily be solved with mental math. In these situations, you can use cross products to solve a proportion.

EXAMPLE Solving Using Cross Products

3 Gridded Response Solve $\frac{25}{38} = \frac{15}{x}$ using cross products.

$$\frac{25}{38} = \frac{15}{x}$$

$$25x = 38(15) \quad \leftarrow \text{Write the cross products.}$$

$$25x = 570 \quad \leftarrow \text{Simplify.}$$

$$\frac{25x}{25} = \frac{570}{25} \quad \leftarrow \text{Divide each side by 25.}$$

$$x = 22.8 \quad \leftarrow \text{Simplify.}$$

2	2	.	8
.	.	.	.
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

E Solving Using Cross Products Solve $\frac{6}{8} = \frac{9}{a}$ using cross products.

$$\frac{6}{8} = \frac{9}{a}$$

$$6a = 8(9) \quad \leftarrow \text{Write the cross products.}$$

$$6a = 72 \quad \leftarrow \text{Simplify.}$$

$$\frac{6a}{6} = \frac{72}{6} \quad \leftarrow \text{Divide each side by } 6.$$

$$a = 12 \quad \leftarrow \text{Simplify.}$$

More Than One Way

Nature An oyster bed covers 36 m^2 . Your class studies 4 m^2 of the oyster bed. In those 4 m^2 you count 96 oysters. Predict the number of oysters in the entire bed.

Carlos's Method

I will let x represent the number of oysters in the 36-m^2 bed.

$$\begin{array}{l} \text{oysters} \rightarrow \frac{96}{4} = \frac{x}{36} \leftarrow \text{oysters} \\ \text{area} \rightarrow \quad \quad \quad \leftarrow \text{area} \end{array} \quad \leftarrow \text{Write a proportion.}$$

$$96(36) = 4x \quad \leftarrow \text{Write the cross products.}$$

$$3,456 = 4x \quad \leftarrow \text{Simplify.}$$

$$\frac{3,456}{4} = \frac{4x}{4} \quad \leftarrow \text{Divide each side by 4.}$$

$$864 = x \quad \leftarrow \text{Simplify.}$$

There are about 864 oysters in the oyster bed.

Brianna's Method

Since $9 \cdot 4 \text{ m}^2 = 36 \text{ m}^2$, the entire bed is 9 times as large as the portion studied. So I know there should be about $9 \cdot 96$, or 864, oysters in the oyster bed.



Table talk - work out both of these problems.

Quick Check

1. a. Postcards cost \$2.45 for 5 cards. How much will 13 cards cost?

- b. Swimming goggles cost \$84.36 for 12. At this rate, how much will new goggles for 17 members of a swim team cost?

Table talk about each of these three problems.

2. Solve each proportion using mental math.

a. $\frac{3}{8} = \frac{b}{24}$

b. $\frac{m}{5} = \frac{16}{40}$

c. $\frac{15}{30} = \frac{5}{p}$

Table talk about each of these three problems.

3. Solve each proportion using cross products.

a. $\frac{12}{15} = \frac{x}{21}$

b. $\frac{16}{30} = \frac{d}{51}$

c. $\frac{20}{35} = \frac{110}{m}$

You have an assignment worksheet and time to begin working on it now.

Name _____ Class _____ Date _____

Practice 4-4

Solving Proportions

Use mental math to solve for each value of n .

1. $\frac{n}{14} = \frac{20}{35}$ _____

2. $\frac{9}{6} = \frac{21}{n}$ _____

3. $\frac{24}{n} = \frac{16}{10}$ _____

4. $\frac{3}{4} = \frac{n}{10}$ _____

Solve each proportion using cross products.

5. $\frac{k}{8} = \frac{14}{4}$
 $k =$ _____

6. $\frac{u}{3} = \frac{10}{5}$
 $u =$ _____

7. $\frac{14}{6} = \frac{d}{15}$
 $d =$ _____

8. $\frac{5}{1} = \frac{m}{4}$
 $m =$ _____

9. $\frac{36}{32} = \frac{n}{8}$
 $n =$ _____

10. $\frac{5}{30} = \frac{1}{x}$
 $x =$ _____

11. $\frac{t}{4} = \frac{5}{10}$
 $t =$ _____

12. $\frac{9}{2} = \frac{v}{4}$
 $v =$ _____

Solve.

13. A contractor estimates it will cost \$2,400 to build a deck to a customer's specifications. How much would it cost to build five similar decks?

14. A recipe requires 3 c of flour to make 27 dinner rolls. How much flour is needed to make 9 rolls?

Solve using a calculator, paper and pencil, or mental math.

15. Mandy runs 4 km in 18 min. She plans to run in a 15 km race. How long will it take her to complete the race?

16. Ken's new car can go 26 miles per gallon of gasoline. The car's gasoline tank holds 14 gal. How far will he be able to go on a full tank?

17. Eleanor can complete two skirts in 15 days. How long will it take her to complete eight skirts?

18. Three eggs are required to make two dozen muffins. How many eggs are needed to make 12 dozen muffins?
