

# Proportions



## Getting the Idea

A **proportion** is an equation that shows that two ratios are equivalent. For example,  $\frac{1}{2} = \frac{5}{10}$  is a proportion. In a true proportion, the ratios must be equivalent.

To solve a proportion, you can use **cross multiplication** to solve for the unknown quantity. To cross multiply, multiply the numerator of one ratio by the denominator of the other ratio. For example:

$$\frac{a}{50} = \frac{3}{5}$$

$$a \times 5 = 50 \times 3 \quad \text{Write the factors for the cross products.}$$

$$5a = 150 \quad \text{Multiply to find the cross products.}$$

$$a = 30 \quad \text{Divide to solve for } a.$$

## Example 1

Solve the proportion.

$$\frac{8}{12} = \frac{6}{x}$$

**Strategy** Cross multiply to solve for  $x$ .

### Step 1

Write the factors for the cross products.

$$\frac{8}{12} = \frac{6}{x}$$

$$8 \times x = 12 \times 6$$

### Step 2

Multiply to find the cross products.

$$8 \times x = 12 \times 6$$

$$8x = 72$$

### Step 3

Divide to solve for  $x$ .

$$8x = 72$$

$$\frac{8x}{8} = \frac{72}{8}$$

$$x = 9$$

**Solution** The solution is  $x = 9$ .

Some proportions may include decimals and fractions.

## Example 2

What value of  $y$  makes this proportion true?

$$\frac{0.4}{y} = \frac{3.4}{10.2}$$

**Strategy**     **Cross multiply to solve for  $y$ .**

**Step 1**     Write the factors for the cross products.

$$\begin{aligned}\frac{0.4}{y} &= \frac{3.4}{10.2} \\ 3.4 \times y &= 0.4 \times 10.2\end{aligned}$$

**Step 2**     Multiply to find the cross products.

$$\begin{aligned}3.4 \times y &= 0.4 \times 10.2 \\ 3.4y &= 4.08\end{aligned}$$

**Step 3**     Divide to solve for  $y$ .

$$\begin{aligned}3.4y &= 4.08 \\ \frac{3.4y}{3.4} &= \frac{4.08}{3.4} \\ y &= 1.2\end{aligned}$$

**Solution**     **Substituting the decimal 1.2 for  $y$  makes this proportion true.**

## Example 3

What value of  $n$  makes this proportion true?

$$\frac{\frac{3}{4}}{\frac{5}{6}} = \frac{1}{n}$$

**Strategy**     **Cross multiply to solve for  $n$ .**

**Step 1**     Write the factors for the cross products.

$$\begin{aligned}\frac{\frac{3}{4}}{\frac{5}{6}} &= \frac{1}{n} \\ \frac{3}{4} \times n &= \frac{5}{6} \times \frac{1}{2}\end{aligned}$$

**Step 2**     Multiply to find the cross products.

$$\begin{aligned}\frac{3}{4} \times n &= \frac{5}{6} \times \frac{1}{2} \\ \frac{3}{4}n &= \frac{5}{12}\end{aligned}$$

**Step 3**Solve for  $n$ .Multiply both sides by the reciprocal of  $\frac{3}{4}$ .

$$\frac{3}{4}n = \frac{5}{12}$$

$$\frac{4}{3} \times \frac{3}{4}n = \frac{5}{12} \times \frac{4}{3}$$

$$n = \frac{20}{36} = \frac{5}{9}$$

**Solution** Substituting the fraction  $\frac{5}{9}$  for  $n$  makes this proportion true.**Coached Example**What value of  $x$  makes this proportion true?

$$\frac{72}{90} = \frac{x}{25}$$

To cross multiply, multiply the \_\_\_\_\_ of each fraction by the \_\_\_\_\_ of the other fraction.

Write the factors for the cross products.

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}}$$

Multiply to find the cross products.

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

Divide both sides by \_\_\_\_\_ to solve for  $x$ .

$$x = \underline{\hspace{2cm}}$$

Substituting the value \_\_\_\_\_ for  $x$  makes the proportion  $\frac{72}{90} = \frac{x}{25}$  true.



## Lesson Practice

Choose the correct answer.

1. What value of  $x$  makes this proportion true?

$$\frac{14}{20} = \frac{56}{x}$$

- A.  $x = 62$
- B.  $x = 70$
- C.  $x = 80$
- D.  $x = 100$

2. What value of  $d$  makes this proportion true?

$$\frac{6}{16} = \frac{d}{12}$$

- A.  $d = 3.2$
- B.  $d = 4.5$
- C.  $d = 8$
- D.  $d = 8.5$

3. What value of  $y$  makes this proportion true?

$$\frac{15}{35} = \frac{y}{224}$$

- A.  $y = 90$
- B.  $y = 93$
- C.  $y = 96$
- D.  $y = 99$

4. Which pair of ratios does **not** form a true proportion?

- A. 8:14 and 20:35
- B. 6 to 10 and 15 to 25
- C.  $\frac{9}{4}$  and  $\frac{36}{16}$
- D. 12:15 and 30:40

5. What value of  $n$  makes this proportion true?

$$\frac{8}{18} = \frac{n}{45}$$

- A.  $n = 16$
- B.  $n = 18$
- C.  $n = 20$
- D.  $n = 25$

6. What value of  $w$  makes this proportion true?

$$\frac{0.6}{1.6} = \frac{w}{1.2}$$

- A.  $w = 0.45$
- B.  $w = 0.8$
- C.  $w = 1.6$
- D.  $w = 3.2$

7. What value of  $k$  makes this proportion true?

$$\frac{k}{8.4} = \frac{6.8}{11.2}$$

- A.  $k = 1.6$   
 B.  $k = 2.8$   
 C.  $k = 4.4$   
 D.  $k = 5.1$

8. Solve this proportion.

$$\frac{2.1}{c} = \frac{1.5}{1.4}$$

- A.  $c = 0.6$   
 B.  $c = 1.96$   
 C.  $c = 2.25$   
 D.  $c = 2.94$

9. Gina wants to solve the following proportion.

$$\frac{a}{\frac{5}{8}} = \frac{\frac{3}{5}}{\frac{2}{3}}$$

- A. Explain how to solve the proportion.

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- B. Solve the proportion. Show your work.

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10. Select True or False for each statement.

- A. If  $\frac{x}{6} = \frac{8}{3}$ , then  $x = 14$ .       True     False  
 B. If  $\frac{2}{13} = \frac{8}{d}$ , then  $d = 52$ .       True     False  
 C. If  $\frac{z}{11} = \frac{11}{10}$ , then  $z = 10$ .       True     False  
 D. If  $\frac{7}{14} = \frac{b}{9}$ , then  $b = 4.5$ .       True     False  
 E. If  $\frac{3}{8} = \frac{6}{s}$ , then  $s = 16$ .       True     False

11. Write each ratio in the correct box.

$$\frac{16}{40}$$

$$\frac{36}{96}$$

$$\frac{8}{20}$$

$$\frac{42}{112}$$

$$\frac{38}{95}$$

$$\frac{27}{72}$$

Equal to $\frac{12}{32}$	Equal to $\frac{32}{80}$

12. Circle the number that makes the statement true.

The value  $f =$ 

0.45
0.55
0.65

 makes the proportion  $\frac{0.4}{f} = \frac{1.6}{1.8}$  true.

13. Which pair of ratios do **not** form a true proportion? Circle all that apply.

A. 20:5 and 4:2

B. 3 to 4 and 12 to 16

C.  $\frac{18}{8}$  and  $\frac{3}{2}$

D. 12 to 24 and 3 to 4

E. 6:9 and 3:2

F.  $\frac{8}{6}$  and  $\frac{4}{3}$

