

# Writing and Solving Proportions

Name: \_\_\_\_\_

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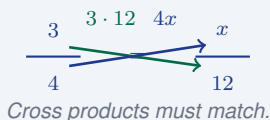
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A **proportion** is an equation that says two ratios are equal—and solving one means finding the missing value that keeps the comparison perfectly balanced. The go-to method is **cross multiplication**, which turns the proportion into a simpler equation you already know how to handle. You will use this skill everywhere: doubling a recipe, reading a map, comparing prices, and solving science problems. Master proportions and you have a tool that works in almost any situation where one quantity changes alongside another!

## Key Concepts & Quick Review

**Cross-multiplication:**  $\frac{a}{b} = \frac{c}{d} \Rightarrow a \cdot d = b \cdot c$ . **Example:**  $\frac{3}{4} = \frac{x}{12} \Rightarrow 3 \cdot 12 = 4x \Rightarrow 36 = 4x \Rightarrow x = 9$ .

**Check:** substitute back — both ratios must simplify to the same value. Always label units to avoid mixing up which quantity goes in the numerator.



## Examples

① Solve the proportion:  $\frac{5}{8} = \frac{x}{40}$ .

**Think It Through:** Cross-multiply to remove the fractions:  $5 \times 40 = 8 \times x$ , so  $200 = 8x$ . Now divide both sides by 8 to isolate the variable:  $x = 25$ . It is always smart to check by substituting the answer back in. Since  $\frac{25}{40}$  simplifies to  $\frac{5}{8}$ , the solution is correct.

**Answer:**  $x = 25$

② A nurse gives 150 mg of medicine for every 50 kg of body weight. How many milligrams should be given to a patient who weighs 80 kg?

**Think It Through:** Put the units in the same order on both sides: milligrams over kilograms. That gives  $\frac{150}{50} = \frac{x}{80}$ . Cross-multiply to get  $150 \times 80 = 50x$ , or  $12,000 = 50x$ . Then divide by 50 and find  $x = 240$ . So a patient weighing 80 kg should receive 240 mg. Keeping the units lined up helps avoid setting up the proportion backward.

**Answer:** 240 mg



**Practice Problems**

Solve each proportion for the unknown variable.

1.  $\frac{x}{6} = \frac{4}{3}$  \_\_\_\_\_

2.  $\frac{5}{x} = \frac{10}{4}$  \_\_\_\_\_

3.  $\frac{3}{7} = \frac{x}{21}$  \_\_\_\_\_

4.  $\frac{x}{9} = \frac{8}{3}$  \_\_\_\_\_

5.  $\frac{6}{x} = \frac{9}{12}$  \_\_\_\_\_

6.  $\frac{4}{5} = \frac{x}{35}$  \_\_\_\_\_

7.  $\frac{7}{x} = \frac{14}{10}$  \_\_\_\_\_

8.  $\frac{x}{15} = \frac{2}{5}$  \_\_\_\_\_

9.  $\frac{9}{12} = \frac{x}{16}$  \_\_\_\_\_

10.  $\frac{3}{x} = \frac{12}{20}$  \_\_\_\_\_

11.  $\frac{x}{8} = \frac{9}{6}$  \_\_\_\_\_

12.  $\frac{5}{6} = \frac{25}{x}$  \_\_\_\_\_

13.  $\frac{11}{x} = \frac{22}{6}$  \_\_\_\_\_

14.  $\frac{x}{14} = \frac{3}{7}$  \_\_\_\_\_

15.  $\frac{4}{x} = \frac{16}{24}$  \_\_\_\_\_

**Study Tips**

-  Set up both ratios with the **same units in the same position**: if one ratio is miles over hours, the other must also be miles over hours.
-  After solving, always **check your answer** by substituting back and confirming both ratios are equal.
-  When cross-multiplying produces large numbers, look for **common factors** to simplify before multiplying — it saves time.

**Word Problems**

16. A car uses  $\frac{3}{4}$  gal of gas to travel 15 mi. Write a proportion and solve to find how many miles the car can travel on a full 12-gallon tank. \_\_\_\_\_

17. A construction crew lays 45 feet of pipe in 3 hours. Working at the same rate, write and solve a proportion to find how long it will take to lay 180 feet of pipe. Then find how many feet they can lay in a 10-hour workday. \_\_\_\_\_



## Answer Keys

- |  |  |
|--|--|
| <p>1) 8<br/>2) 2<br/>3) 9<br/>4) 24<br/>5) 8<br/>6) 28<br/>7) 5<br/>8) 6<br/>9) 12</p> | <p>10) 5<br/>11) 12<br/>12) 30<br/>13) 3<br/>14) 6<br/>15) 6<br/>16) 240 <i>mi</i><br/>17) 180 <i>ft</i>: 12 hours; in 10 hours: 150 feet.</p> |
|--|--|

### Step-by-Step Explanations

**Strategy:** For Multiplying Integers and Rational Numbers, multiply magnitudes first and use sign rules only after the size is clear. Finish integer-multiplication work with units, signs, or labels whenever the problem needs them.

**Practice 1:**  $(-3) \times \frac{2}{5} =$  **Answer:**  $-\frac{6}{5}$

In the first example, multiply 3 by  $\frac{2}{5}$  for the size, then attach the negative sign from the single negative factor.

**Practice 15:**  $8 \times (-1\frac{3}{8}) =$  **Answer:** -11

Toward the end, change the mixed number to  $\frac{11}{8}$ ; multiplying by 8 cancels neatly, and the negative sign stays with the answer.

**Word-problem notes:**

**16. Answer:** Per day:  $240 \times (-\frac{3}{8}) = -\$90$ ; after 5 days:  $-\$450$ ; losing money.

Each share changes by  $-\frac{3}{8}$  dollar per day, and there are 240 shares, so multiply:  $240 \times (-\frac{3}{8})$ . The negative sign means the change is a loss. Simplify the numbers:  $240 \div 8 = 30$ , so the daily change is  $30 \times (-3) = -90$ . That means the investor loses \$90 each day. Over 5 days, multiply again:  $5 \times (-90) = -450$ . The portfolio is losing money, not gaining it.

**17. Answer:** (a)  $-14 \text{ ft}$ ; (b)  $-21 \text{ ft}$ ; time to  $-63 \text{ ft}$ :  $36 \text{ s}$ .

First convert the rate:  $-1\frac{3}{4} = -\frac{7}{4}$  foot per second. For part (a), multiply by 8:  $8 \times (-\frac{7}{4}) = -14$  feet.

For part (b), multiply by 12:  $12 \times (-\frac{7}{4}) = -21$  feet. To reach a depth of  $-63$  feet, divide the total depth change by the rate. Since both values are negative, the time is positive:  $(-63) \div (-\frac{7}{4}) = 63 \times \frac{4}{7} = 36$  seconds. The negatives describe downward direction, while time itself stays positive.



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