

# Proportions and Cross Multiplication

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Quick Review

A **proportion** is an equation that says two ratios are equal, like  $\frac{2}{3} = \frac{8}{12}$ . When one number is missing, you can solve the proportion with **cross multiplication**: multiply each numerator by the *opposite* denominator and set the products equal. For  $\frac{x}{4} = \frac{6}{8}$  this gives  $8x = 4 \times 6$ . Then **divide** to find the unknown. Cross multiplication works because equal ratios always have equal “cross products.” Always check by plugging your answer back in.

◇ **Example:** Solve the proportion  $\frac{x}{4} = \frac{6}{8}$ .  
 ⇒ We have two equal ratios with one missing piece. Cross multiply: multiply  $x$  by 8 and multiply 4 by 6, then set them equal. That gives  $8x = 24$ . Now undo the multiplication by dividing both sides by 8:  $x = 24 \div 8 = 3$ . Check it:  $\frac{3}{4} = \frac{6}{8}$  because both simplify to the same ratio. Perfect.

**Answer:**  $x = 3$

## PRACTICE

Solve each proportion for the unknown.

- |                                  |       |                                    |       |
|----------------------------------|-------|------------------------------------|-------|
| 1. $\frac{x}{4} = \frac{6}{8}$   | _____ | 11. $\frac{7}{2} = \frac{21}{x}$   | _____ |
| 2. $\frac{x}{15} = \frac{5}{3}$  | _____ | 12. $\frac{x}{6} = \frac{10}{12}$  | _____ |
| 3. $\frac{x}{12} = \frac{3}{4}$  | _____ | 13. $\frac{9}{12} = \frac{x}{16}$  | _____ |
| 4. $\frac{2}{5} = \frac{x}{20}$  | _____ | 14. $\frac{x}{14} = \frac{2}{7}$   | _____ |
| 5. $\frac{3}{7} = \frac{x}{28}$  | _____ | 15. $\frac{8}{x} = \frac{2}{3}$    | _____ |
| 6. $\frac{x}{9} = \frac{4}{6}$   | _____ | 16. $\frac{5}{6} = \frac{15}{x}$   | _____ |
| 7. $\frac{5}{8} = \frac{x}{24}$  | _____ | 17. $\frac{x}{21} = \frac{4}{3}$   | _____ |
| 8. $\frac{x}{10} = \frac{9}{15}$ | _____ | 18. $\frac{10}{25} = \frac{x}{30}$ | _____ |
| 9. $\frac{4}{x} = \frac{8}{14}$  | _____ | 19. $\frac{7}{x} = \frac{14}{18}$  | _____ |
| 10. $\frac{6}{x} = \frac{3}{5}$  | _____ | 20. $\frac{x}{16} = \frac{15}{20}$ | _____ |

### Word Problems

- A recipe uses 3 eggs for every 2 cakes. How many eggs are needed for 8 cakes? Set up and solve a proportion. \_\_\_\_\_
- A map scale shows 1 inch represents 25 miles. How many miles do 4 inches represent? \_\_\_\_\_
- If 5 notebooks cost \$8, how much do 15 notebooks cost at the same rate? \_\_\_\_\_
- A car uses 4 gallons of gas to travel 96 miles. How many gallons are needed to travel 144 miles? \_\_\_\_\_



## Answer Keys

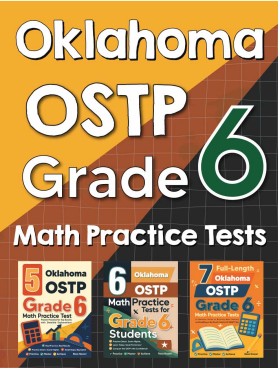
- |              |               |
|--------------|---------------|
| 1. $x = 3$   | 13. $x = 12$  |
| 2. $x = 25$  | 14. $x = 4$   |
| 3. $x = 9$   | 15. $x = 12$  |
| 4. $x = 8$   | 16. $x = 18$  |
| 5. $x = 12$  | 17. $x = 28$  |
| 6. $x = 6$   | 18. $x = 12$  |
| 7. $x = 15$  | 19. $x = 9$   |
| 8. $x = 6$   | 20. $x = 12$  |
| 9. $x = 7$   | 21. 12 eggs   |
| 10. $x = 10$ | 22. 100 miles |
| 11. $x = 6$  | 23. \$24      |
| 12. $x = 5$  | 24. 6 gallons |

### Step-by-Step Explanations

- |  |  |
|--|--|
| <p>1. Cross multiply: <math>8x = 24</math>, so <math>x = 24 \div 8 = 3</math>.</p> <p>2. Cross multiply: <math>3x = 75</math>, so <math>x = 75 \div 3 = 25</math>.</p> <p>3. Cross multiply: <math>4x = 36</math>, so <math>x = 36 \div 4 = 9</math>.</p> <p>4. Cross multiply: <math>5x = 40</math>, so <math>x = 40 \div 5 = 8</math>.</p> <p>5. Cross multiply: <math>7x = 84</math>, so <math>x = 84 \div 7 = 12</math>.</p> <p>6. Cross multiply: <math>6x = 36</math>, so <math>x = 36 \div 6 = 6</math>.</p> <p>7. Cross multiply: <math>8x = 120</math>, so <math>x = 120 \div 8 = 15</math>.</p> <p>8. Cross multiply: <math>15x = 90</math>, so <math>x = 90 \div 15 = 6</math>.</p> <p>9. Cross multiply: <math>8x = 56</math>, so <math>x = 56 \div 8 = 7</math>.</p> <p>10. Cross multiply: <math>3x = 30</math>, so <math>x = 30 \div 3 = 10</math>.</p> <p>11. Cross multiply: <math>7x = 42</math>, so <math>x = 42 \div 7 = 6</math>.</p> <p>12. Cross multiply: <math>12x = 60</math>, so <math>x = 60 \div 12 = 5</math>.</p> | <p>13. Cross multiply: <math>12x = 144</math>, so <math>x = 144 \div 12 = 12</math>.</p> <p>14. Cross multiply: <math>7x = 28</math>, so <math>x = 28 \div 7 = 4</math>.</p> <p>15. Cross multiply: <math>2x = 24</math>, so <math>x = 24 \div 2 = 12</math>.</p> <p>16. Cross multiply: <math>5x = 90</math>, so <math>x = 90 \div 5 = 18</math>.</p> <p>17. Cross multiply: <math>3x = 84</math>, so <math>x = 84 \div 3 = 28</math>.</p> <p>18. Cross multiply: <math>25x = 300</math>, so <math>x = 300 \div 25 = 12</math>.</p> <p>19. Cross multiply: <math>14x = 126</math>, so <math>x = 126 \div 14 = 9</math>.</p> <p>20. Cross multiply: <math>20x = 240</math>, so <math>x = 240 \div 20 = 12</math>.</p> <p>21. Write <math>\frac{3}{2} = \frac{x}{8}</math>. Cross multiply: <math>2x = 24</math>, so <math>x = 12</math> eggs.</p> <p>22. Write <math>\frac{1}{25} = \frac{4}{x}</math>. Cross multiply: <math>x = 25 \times 4 = 100</math> miles.</p> <p>23. Write <math>\frac{5}{8} = \frac{15}{x}</math>. Cross multiply: <math>5x = 120</math>, so <math>x = \\$24</math>.</p> <p>24. Write <math>\frac{4}{96} = \frac{x}{144}</math>. Cross multiply: <math>96x = 576</math>, so <math>x = 6</math> gallons.</p> |
|--|--|



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