

# 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

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



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