Writing and Solving Proportions

Name: _____	Date: _____	Score: _____ / 17

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.

Cross products must match.

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.

_____

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Answer Keys

1) 8
2) 2
3) 9
4) 24
5) 8
6) 28
7) 5
8) 6
9) 12
10) 5
11) 12
12) 30
13) 3
14) 6
15) 6
16) $240\,mi$
17) $180\,ft$: 12 hours; in 10 hours: 150 feet.

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: $8 \times \left(-1\frac{3}{8}\right) =$ **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: $240 \times \left(-\frac{3}{8}\right) = -\$90$; after 5 days: $-\$450$; losing money.

Each share changes by $-\frac{3}{8}$ dollar per day, and there are 240 shares, so multiply: $240 \times \left(-\frac{3}{8}\right)$. 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) $-14\,ft$; (b) $-21\,ft$; time to $-63\,ft$: $36\,s$.

First convert the rate: $-1\frac{3}{4} = -\frac{7}{4}$ foot per second. For part (a), multiply by 8: $8 \times \left(-\frac{7}{4}\right) = -14$ feet. For part (b), multiply by 12: $12 \times \left(-\frac{7}{4}\right) = -21$ 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: $(-63) \div \left(-\frac{7}{4}\right) = 63 \times \frac{4}{7} = 36$ seconds. The negatives describe downward direction, while time itself stays positive.

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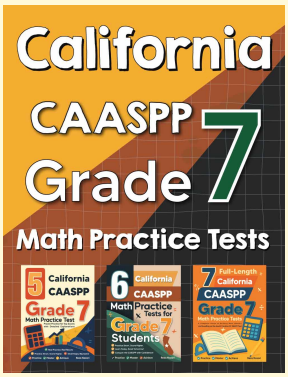

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