Study Guide and Intervention

Alg1 15.0

Ratios and Proportions

Ratios and Proportions A **ratio** is a comparison of two numbers by division. The ratio of x to y can be expressed as x to y, $x{:}y$ or $\dfrac{x}{y}$. Ratios are usually expressed in simplest form.

An equation stating that two ratios are equal is called a **proportion**. To determine whether two ratios form a proportion, express both ratios in simplest form or check cross products.

Example 1 Determine whether the ratios $\dfrac{24}{36}$ and $\dfrac{12}{18}$ form a proportion.

$\dfrac{24}{36} = \dfrac{2}{3}$ when expressed in simplest form.

$\dfrac{12}{18} = \dfrac{2}{3}$ when expressed in simplest form.

The ratios $\dfrac{24}{36}$ and $\dfrac{12}{18}$ form a proportion because they are equal when expressed in simplest form.

Example 2 Use cross products to determine whether $\dfrac{10}{18}$ and $\dfrac{25}{45}$ form a proportion.

$\dfrac{10}{18} \overset{?}{=} \dfrac{25}{45}$ Write the proportion.

$10(45) \overset{?}{=} 18(25)$ Cross products

$450 = 450$ Simplify.

The cross products are equal, so $\dfrac{10}{18} = \dfrac{25}{45}$. Since the ratios are equal, they form a proportion.

Exercises

Use cross products to determine whether each pair of ratios forms a proportion.

1. $\dfrac{1}{2}, \dfrac{16}{32}$

2. $\dfrac{5}{8}, \dfrac{10}{15}$

3. $\dfrac{10}{20}, \dfrac{25}{49}$

4. $\dfrac{25}{36}, \dfrac{15}{20}$

5. $\dfrac{12}{32}, \dfrac{3}{16}$

6. $\dfrac{4}{9}, \dfrac{12}{27}$

7. $\dfrac{0.1}{2}, \dfrac{5}{100}$

8. $\dfrac{15}{20}, \dfrac{9}{12}$

9. $\dfrac{14}{21}, \dfrac{20}{30}$

10. $2{:}3$, $20{:}30$

11. 5 to 9, 25 to 45

12. $\dfrac{72}{64}, \dfrac{9}{8}$

13. $5{:}5$, $30{:}20$

14. 18 to 24, 50 to 75

15. $100{:}75$, $44{:}33$

16. $\dfrac{0.05}{1}, \dfrac{1}{20}$

17. $\dfrac{1.5}{2}, \dfrac{6}{8}$

18. $\dfrac{0.1}{0.2}, \dfrac{0.45}{0.9}$

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Ratios and Proportions

Solve Proportions If a proportion involves a variable, you can use cross products to solve the proportion. In the proportion $\frac{x}{5} = \frac{10}{13}$, x and 13 are called **extremes.** They are the first and last terms of the proportion. 5 and 10 are called **means**. They are the middle terms of the proportion. In a proportion, the product of the extremes is equal to the product of the means.

Means-Extremes Property of Proportions	For any numbers a, b, c, and d, if $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

Example Solve $\frac{x}{5} = \frac{10}{13}$.

$\frac{x}{5} = \frac{10}{13}$ Original proportion

$13(x) = 5(10)$ Cross products

$13x = 50$ Simplify.

$\frac{13x}{13} = \frac{50}{13}$ Divide each side by 13.

$x = 3\frac{11}{13}$ Simplify.

Exercises

Solve each proportion.

1. $\frac{-3}{x} = \frac{2}{8}$

2. $\frac{1}{t} = \frac{5}{3}$

3. $\frac{0.1}{2} = \frac{0.5}{x}$

4. $\frac{x + 1}{4} = \frac{3}{4}$

5. $\frac{4}{6} = \frac{8}{x}$

6. $\frac{x}{21} = \frac{3}{63}$

7. $\frac{9}{y + 1} = \frac{18}{54}$

8. $\frac{3}{d} = \frac{18}{3}$

9. $\frac{5}{8} = \frac{p}{24}$

10. $\frac{4}{b - 2} = \frac{4}{12}$

11. $\frac{1.5}{x} = \frac{12}{x}$

12. $\frac{3 + y}{4} = \frac{-y}{8}$

13. $\frac{a - 8}{12} = \frac{15}{3}$

14. $\frac{12}{k} = \frac{24}{k}$

15. $\frac{2 + w}{6} = \frac{12}{9}$

Use a proportion to solve each problem.

16. MODELS To make a model of the Guadeloupe River bed, Hermie used 1 inch of clay for 5 miles of the river's actual length. His model river was 50 inches long. How long is the Guadeloupe River?

17. EDUCATION Josh finished 24 math problems in one hour. At that rate, how many hours will it take him to complete 72 problems?