

2.6 Write Ratios & Proportions

2.7 Solve Proportions Using Cross Products

A **ratio** uses division to compare two quantities.

$$a \text{ to } b \quad a : b \quad \frac{a}{b}$$

Each of the above is read "the ratio of a to b ."

Ratios should always be in **SIMPLEST FORM.**

1. A baseball team plays 12 home games and 16 away games.

- a) Find the ratio of away games to home games.

$$\frac{16 \div 4}{12 \div 4} = \boxed{\frac{4}{3}}$$

- b) Find the ratio of home games to all games played.

$$\frac{12 \div 4}{28 \div 4} = \boxed{\frac{3}{7}}$$

2. There are 18 ninth graders and 14 tenth graders in a class.

a) Find the ratio of ninth graders to tenth graders.

$$\frac{18 \div 2}{14 \div 2} = \boxed{\frac{9}{7}}$$

b) Find the ratio of tenth graders to all students.

$$\frac{14 \div 2}{32 \div 2} = \boxed{\frac{7}{16}}$$

A **proportion** is an equation that states that two ratios are equivalent.

$$\frac{a}{b} = \frac{c}{d} \text{ where } b \neq 0, d \neq 0$$

cross-multiply

Solve each proportion

3. ~~$\frac{w}{35} = \frac{4}{7}$~~

$$\frac{7w}{7} = \frac{140}{7}$$

$$\boxed{w = 20}$$

4. ~~$\frac{9}{z} = \frac{m}{12}$~~

$$\frac{2m}{2} = \frac{108}{2}$$

$$\boxed{m = 54}$$

5. ~~$\frac{z}{54} = \frac{5}{9}$~~

$$\frac{9z}{9} = \frac{270}{9}$$

$$\boxed{z = 30}$$

Write the sentence as a proportion & solve.

6. 3 is to 8 as x is to 32.

$$\frac{3}{8} = \frac{x}{32}$$

$$\frac{8x}{8} = \frac{96}{8}$$

$$x = 12$$

7. 12 is to 18 as d is to 27.

$$\frac{12}{18} = \frac{d}{27}$$

$$\frac{18d}{18} = \frac{324}{18}$$

$$x = 18$$

There are different ways to set up proportions when solving word problems.

8. A recipe for salsa calls for 30 tomatoes to make 12 pints of salsa. How many tomatoes are needed to make 4 pints of salsa?

$$\frac{30 \text{ tom.}}{12 \text{ pints}} = \frac{x}{4 \text{ pints}}$$

$$\frac{12 \text{ pints}}{30 \text{ tom.}} = \frac{4 \text{ pints}}{x}$$

$$\frac{12 \text{ pints}}{4 \text{ pints}} = \frac{30 \text{ tom.}}{x}$$

$$\frac{12x}{12} = \frac{120}{12}$$

$$x = 10 \text{ tomatoes}$$

9. A backpacker in the Appalachian Mountains hikes 5.5 miles in 2 hours. If the hiking rate remains the same, how far will the backpacker hike in 7 hours? Solve using a proportion.

$$\frac{5.5 \text{ miles}}{2 \text{ hr}} = \frac{x}{7 \text{ hr}}$$

$$\frac{2x}{2} = \frac{38.5}{2}$$

$$x = 19.25 \text{ miles}$$

10. When two full moons appear in the same month, the second full moon is called a blue moon. On average, 2 blue moons occur every 5 years. Find the number of blue moons that are likely to occur in the next 25 years using a proportion.

$$\frac{2 \text{ blue moons}}{5 \text{ yrs}} = \frac{x}{25 \text{ yrs}}$$

$$\frac{5x}{5} = \frac{50}{5}$$

$$x = 10 \text{ blue moons}$$

Let's try a few that look slightly different.

11. $\frac{12}{42} = \frac{4w}{56}$

$$\frac{168w}{168} = \frac{672}{168}$$

$$w = 4$$

12. $\frac{5}{13} = \frac{k-4}{39}$

$$13(k-4) = 195$$

$$13k - 52 = 195$$

$$\begin{array}{r} 13k - 52 = 195 \\ +52 \quad +52 \\ \hline 13k = 247 \end{array}$$

$$\frac{13k}{13} = \frac{247}{13}$$

$$k = 19$$

Let's try a few that look slightly different.

13. $\frac{6+n}{60} = \frac{15}{90}$

$$90(6+n) = 900$$

$$540 + 90n = 900$$

$$\begin{array}{r} 540 + 90n = 900 \\ -540 \quad -540 \\ \hline 90n = 360 \end{array}$$

$$\frac{90n}{90} = \frac{360}{90}$$

$$n = 4$$

14. $\frac{1.1}{1.2} = \frac{n}{3.6}$

$$\frac{1.2n}{1.2} = \frac{3.96}{1.2}$$

$$n = 3.3$$

Let's try a few that look slightly different.

15. $\frac{k-8}{7+k} = \frac{-1}{5}$

$$-1(7+k) = 5(k-8)$$

$$\begin{array}{r} -7 - k = 5k - 40 \\ +k \quad +k \\ \hline -7 = 6k - 40 \\ +40 \quad +40 \\ \hline 33 = 6k \\ \frac{33}{6} = \frac{6k}{6} \\ \frac{11}{2} = k \end{array}$$

$\frac{11}{2} = k$

16. $\frac{m+1}{4} = \frac{3m+6}{7}$

$$4(3m+6) = 7(m+1)$$

$$\begin{array}{r} 12m + 24 = 7m + 7 \\ -7m \quad -7m \\ \hline 5m + 24 = 7 \\ -24 \quad -24 \\ \hline 5m = -17 \\ \frac{5m}{5} = \frac{-17}{5} \\ m = -\frac{17}{5} \end{array}$$

$m = -\frac{17}{5}$

17. The ship model kits sold at a hobby store have a scale of 1 ft: 600 ft. A completed model of the Queen Elizabeth II is 1.6 feet long. Estimate to the nearest foot the actual length of the Queen Elizabeth II.

$$\frac{\text{model } 1 \text{ ft}}{\text{real } 600 \text{ ft}} = \frac{1.6 \text{ ft}}{x}$$

$x = 960 \text{ ft}$