

## 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.

$$\frac{16}{12} \longrightarrow \boxed{\frac{4}{3}}$$

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

$$12 + 16 = 28 \text{ all}$$

$$\frac{12}{28} \longrightarrow \boxed{\frac{3}{7}}$$

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

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

$$\frac{18}{14} \longrightarrow \boxed{\frac{9}{7}}$$

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

$$18 + 14 = 32 \quad \text{all}$$

$$\frac{14}{32} \longrightarrow \boxed{\frac{7}{16}}$$

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

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

do NOT cross-cancel with proportions

cross-multiply

$$bc = ad$$

Solve each proportion.

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

$$7 \cdot w = 35 \cdot 4$$

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

$$\boxed{w = 20}$$

4.  $\frac{9}{2} = \frac{m}{12}$

$$2 \cdot m = 9 \cdot 12$$

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

$$\boxed{m = 54}$$

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

$$9 \cdot z = 54 \cdot 5$$

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

$$\boxed{z = 30}$$

Write the sentence as a proportion & solve.

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

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

$$8 \cdot x = 3 \cdot 32$$

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

$$x = 12$$

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

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

$$18 \cdot d = 12 \cdot 27$$

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

$$d = 18$$

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?

$$\frac{30 \text{ tomatoes}}{12 \text{ pints}} \sim \frac{x \text{ tomatoes}}{4 \text{ pints}}$$

$$12 \cdot x = 30 \cdot 4$$

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

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

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.

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

$$2 \cdot x = 5.5 \cdot 7$$

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

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

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.

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

$$5 \cdot x = 2 \cdot 25$$

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

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

Let's try a few that look slightly different.

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

$$42 \cdot 4w = 12 \cdot 56$$

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

$$w = 4$$

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

$$13(k-4) = 5 \cdot 39$$

$$13k - 52 = 195$$

$$\begin{array}{r} 13k - 52 = 195 \\ +52 \quad +52 \\ \hline 13k = 247 \\ 13 \quad 13 \\ \hline k = 19 \end{array}$$

Let's try a few that look slightly different.

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

$$90(6+n) = 60 \cdot 15$$

$$\begin{array}{r} +540 + 90n = 900 \\ -540 \quad -540 \\ \hline 90n = 360 \\ \frac{90n}{90} = \frac{360}{90} \\ n = 4 \end{array}$$

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

$$1.2 \cdot n = 1.1 \cdot 3.6$$

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

$$n = 3.3$$

Let's try a few that look slightly different.

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

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

$$5k - 40 = -7 - k$$

$$+1k \quad \quad \quad +1k$$


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$$6k - 40 = -7$$

$$+40 \quad \quad \quad +40$$


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$$\frac{6k}{6} = \frac{33}{6}$$

$$k = 5.5$$

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

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

$$12m + 24 = 7m + 7$$

$$-7m \quad \quad \quad -7m$$


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$$5m + 24 = 7$$

$$-24 \quad \quad \quad -24$$


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

$$m = -3.4$$

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.

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

$$1x = 600 \cdot 1.6$$

$$\frac{1x}{1} = \frac{960}{1}$$

$$x = 960 \text{ ft}$$