

# Algebra 1A

## Lesson 3.6

### Solve Proportions Using Cross Products

#### Warm-Up

Solve.

(a)  $2 - x = 8$   
 $\begin{array}{r} -2 \quad -2 \\ -x = 6 \\ \hline -1 \quad -1 \\ x = -6 \end{array}$

(b)  $-6x - 6 + 4x = -x + 2$   
 $\begin{array}{r} -2x - 6 = -x + 2 \\ +2x \quad +2x \\ -6 = x + 2 \\ \hline -2 \quad -2 \\ x = -8 \end{array}$

(c)  $5x - (4x + 1) = -12$   
 $\begin{array}{r} 5x - 4x - 1 = -12 \\ x - 1 = -12 \\ \hline +1 \quad +1 \\ x = -11 \end{array}$

(d)  $-3(x - 2) = x$   
 $\begin{array}{r} -3x + 6 = x \\ +3x \quad +3x \\ 6 = 4x \\ \hline 4 \quad 4 \\ x = \frac{3}{2} \end{array}$

#### Cross Product Property

The cross products of a proportion are equal.

If  $\frac{a}{b} = \frac{c}{d}$  then  $ad = bc$

Example

$\frac{3}{4} = \frac{6}{8}$        $3 \cdot 8 = 24$   
 $4 \cdot 6 = 24$

$\frac{2}{4} = \frac{5}{10}$

$2 \cdot 10 = 20$   
 $4 \cdot 5 = 20$

#### Example 1. Use the Cross Product Property

Solve the proportions.

(a)  $\frac{4}{x} = \frac{12}{24}$   
 $\begin{array}{r} 12x = 96 \\ \hline 12 \quad 12 \\ x = 8 \end{array}$

(b)  $\frac{5m}{6} = \frac{10}{12}$   
 $\begin{array}{r} 60m = 60 \\ \hline 60 \quad 60 \\ m = 1 \end{array}$

#### Example 2. Solve a Proportion with an Expression

Solve.

(a)  $\frac{3}{x} = \frac{9}{x-4}$   
 $9x = 3(x-4)$   
 $9x = 3x - 12$   
 $\begin{array}{r} -3x \quad -3x \\ \hline 6x = -12 \\ \hline 6 \quad 6 \\ x = -2 \end{array}$

(b)  $\frac{x}{5} = \frac{x-6}{4}$   
 $5(x-6) = 4x$   
 $5x - 30 = 4x$   
 $\begin{array}{r} -5x \quad -5x \\ \hline -30 = -1x \\ \hline -1 \quad -1 \\ 30 = x \\ x = 30 \end{array}$

Try It!

(a)

$$\frac{4}{y} = \frac{24}{30}$$

$$\frac{24y}{24} = \frac{120}{24}$$

$$y = 5$$

(b)

$$\frac{8}{12} = \frac{t}{t+1}$$

$$8(t+1) = 12t$$

$$8t + 8 = 12t$$

$$-8t \quad -8t \quad t = 2$$

$$\frac{8}{7} = \frac{4t}{4}$$

(c)

$$\frac{24}{(5z+4)} = \frac{4}{z-1}$$

$$4(5z+4) = 24(z-1)$$

$$20z + 16 = 24z - 24$$

$$-20z \quad -20z$$

$$16 = 4z - 24$$

$$+24 \quad +24$$

$$\frac{40}{4} = \frac{4z}{4}$$

$$z = 10$$

**Example 3. Write and Solve a Proportion**

A recipe that makes 12 cookies calls for 2 cups of flour. How much flour would be needed to make 30 cookies?

$$\frac{12 \text{ cookies}}{2 \text{ cups flour}} = \frac{30 \text{ cookies}}{x \text{ cups flour}}$$

$$\frac{12x}{12} = \frac{60}{12}$$

$$x = 5$$

You need 5 cups of flour to make 30 cookies.

**Scale Drawings and Scale Models**

Scale Drawing - 2D DRAWING of an object in which the DIMENSIONS of the drawing are in proportion to the dimensions of the object

Scale Model - 3D MODEL of an object in which the dimensions of the model are in proportion to the dimensions of the object

**Example 4. Using the Scale on a Map**

A map has a scale of 1 in : 1500 ft.

(a) On the map, Saline and Ann Arbor are 17.25 inches apart. Find the distance between Saline and Ann Arbor in miles (1 mile = 5280 feet).

$$\frac{1 \text{ IN}}{1500 \text{ FT}} = \frac{17.25 \text{ IN}}{x \text{ FT}}$$

$$x = 25875 \text{ FT}$$

$$25875 \text{ FT} \times \frac{1 \text{ MI}}{5280 \text{ FT}} \approx 4.9 \text{ MILES}$$

SALINE AND AA ARE 4.9 MILES APART

(b) Saline and Milan are 13.75 inches apart on the map. Find the distance between Saline and Milan in miles.

$$\frac{1 \text{ IN}}{1500 \text{ FT}} = \frac{13.75 \text{ IN}}{x \text{ FT}}$$

$$x = 20625 \text{ FT}$$

$$20625 \text{ FT} \times \frac{1 \text{ MI}}{5280 \text{ FT}} \approx 3.9 \text{ MILES}$$

SALINE AND MILAN ARE 3.9 MILES APART

**Assignment:** Page 171 (4 - 30) even

**Review:**

Solve the equation if possible.

1.  $3x + 1 = 5x$

2.  $8 - 2y = 21 - 6y$

3.  $3n = (6 - n)(-3)$

4.  $\frac{1}{2}(14 + 8a) = 9a$

5.  $7 - 6d = 3(5 - 2d)$

6.  $-7(b + 1) = 5(b - 2)$