Section 7.1 - Proportions

Goals: solve proportions by cross-multiplying and write proportions to represent situations

Proportion: an equation stating that two ratios are equal
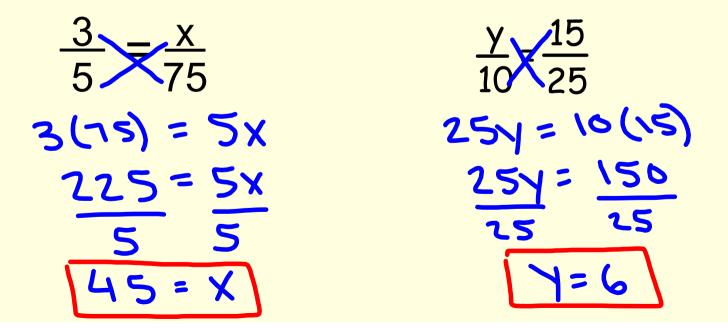
Example:
$$\frac{a}{b} = \frac{c}{d}$$

Proportions are used in many different situations...
- comparing rates
- comparing prices
- exchanging currency
- reading maps
- making scale models

Cross Products Property

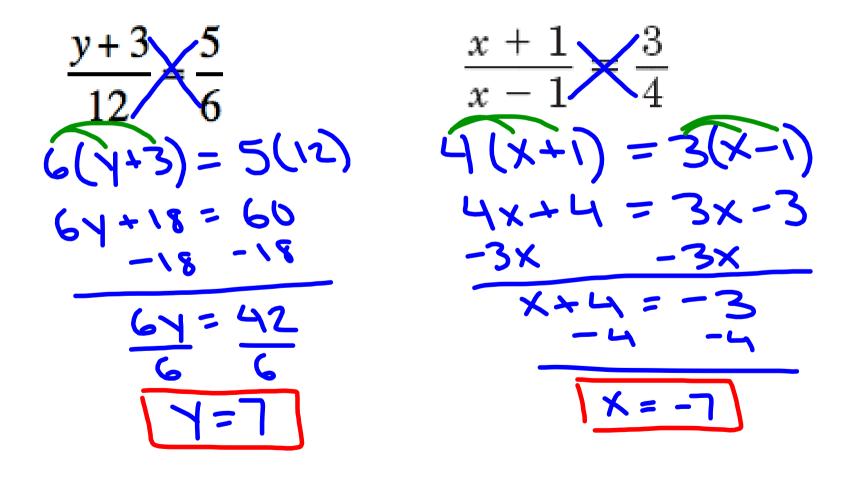If $\dfrac{a}{b} = \dfrac{c}{d}$, then $a \cdot d = b \cdot c$

Cross Multiplying

Solving a proportion means finding the value of the variable that makes the proportion true by finding the cross products.

$$\frac{3}{5} = \frac{x}{75}$$

$$3(75) = 5x$$

$$225 = 5x$$

$$\frac{225}{5} = \frac{5x}{5}$$

$$45 = x$$

$$\frac{y}{10} = \frac{15}{25}$$

$$25y = 10(15)$$

$$25y = 150$$

$$\frac{25y}{25} = \frac{150}{25}$$

$$y = 6$$

Proportions with the Distributive Property

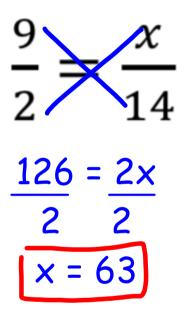- use the Distributive Property if one part of the proportion has two terms
- distribute to both terms when cross-mutliplying

$$\frac{y+3}{12} \times \frac{5}{6}$$

$$6(y+3) = 5(12)$$
$$6y + 18 = 60$$
$$\underline{-18 \quad -18}$$
$$\frac{6y}{6} = \frac{42}{6}$$
$$\boxed{y = 7}$$

$$\frac{x+1}{x-1} \times \frac{3}{4}$$

$$4(x+1) = 3(x-1)$$
$$4x + 4 = 3x - 3$$
$$\underline{-3x \qquad -3x}$$
$$x + 4 = -3$$
$$\underline{-4 \qquad -4}$$
$$\boxed{x = -7}$$

SOLVE EACH PROPORTION.

$$\frac{9}{2} = \frac{x}{14}$$

$$\frac{126}{2} = \frac{2x}{2}$$

$$x = 63$$

$$\frac{15}{m+1} = \frac{3}{m}$$

$$15m = 3m + 3$$

$$\underline{-3m \quad -3m}$$

$$\frac{12m}{12} = \frac{3}{12}$$

$$m = 0.25$$
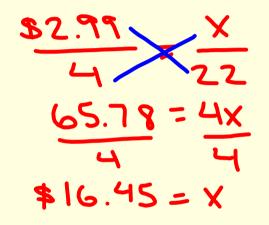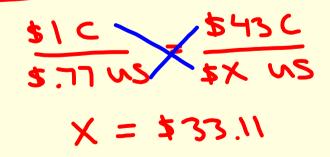
Write and Solve a Proportion

Hamburger patties are on sale for $2.99 for 4 burgers. You need 22 burgers for a cook-out. How much will you be spending?

$$\frac{\$2.99}{4} \times \frac{X}{22}$$

$$\frac{65.78}{4} = \frac{4x}{4}$$

$$\$16.45 = X$$

Currently, $1 Canadian = $0.77 US. If you buy a pair of shoes on vacation in Quebec that cost 43 Canadian dollars, how much did you spend in US dollars?
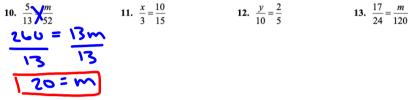
$$\frac{\$1\ C}{\$.77\ US} \times \frac{\$43\ C}{\$X\ US}$$
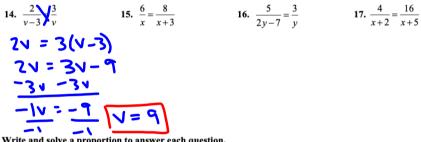
$$X = \$33.11$$

<u>USING PROPORTIONS</u>

Solve each proportion by cross multiplying. Show your work.

10. $\dfrac{5}{13} \diagdown \dfrac{m}{52}$

$$\dfrac{260}{13} = \dfrac{13m}{13}$$

$$\boxed{20 = m}$$

11. $\dfrac{x}{3} = \dfrac{10}{15}$

12. $\dfrac{y}{10} = \dfrac{2}{5}$

13. $\dfrac{17}{24} = \dfrac{m}{120}$

Solve each proportion by cross multiplying. Show your work.

14. $\dfrac{2}{v-3} \diagdown \dfrac{3}{v}$

$$2v = 3(v-3)$$
$$2v = 3v - 9$$
$$\underline{-3v \quad -3v}$$
$$\dfrac{-1v}{-1} = \dfrac{-9}{-1} \quad \boxed{v = 9}$$

15. $\dfrac{6}{x} = \dfrac{8}{x+3}$

16. $\dfrac{5}{2y-7} = \dfrac{3}{y}$

17. $\dfrac{4}{x+2} = \dfrac{16}{x+5}$

Write and solve a proportion to answer each question.

18. In a shipment of 400 parts, 14 are found to be defective. How many defective parts should be expected in a shipment of 1000?

$$\dfrac{400}{14} = \dfrac{1000}{x}$$

19. A piece of cable 8.5 cm long weights 52 grams. What will a 10-cm length of the same cable weigh?

20. You purchase a scale model of a train. The model states that the scale is 1 inch: 5.4 feet. If the model is 10 inches long, how long is the actual train?