

Oct 16 Homework: Pages 30-33 ALL + Review A on pages 39-42

A proportion is a name we give to a statement that two ratios are equal. It can be written in two ways:

- two equal fractions,  $\frac{a}{b} = \frac{c}{d}$

or,

- using a colon,  $a:b = c:d$

When two ratios are equal, then the cross products of the ratios are equal.

That is, for the proportion,  $a:b = c:d$ ,  $a \times d = b \times c$

$$\frac{3}{5} = \frac{21}{35}$$

A proportion is simply a statement that two ratios are equal. It can be written in two ways: as two equal fractions  $a/b = c/d$ ; or using a colon,  $a:b = c:d$ . The following proportion is read as "twenty is to twenty-five as four is to five."

$$\frac{20}{25} = \frac{4}{5}$$

In problems involving proportions, we can use cross products to test whether two ratios are equal and form a proportion. To find the cross products of a proportion, we multiply the outer terms, called the extremes, and the middle terms, called the means.

Here, 20 and 5 are the extremes, and 25 and 4 are the means. Since the cross products are both equal to one hundred, we know that these ratios are equal and that this is a true proportion.

$$\frac{20}{25} = \frac{4}{5} \quad \text{cross products: } 20 \times 5 = 25 \times 4$$
$$100 = 100$$

We can also use cross products to find a missing term in a proportion. Here's an example. In a horror movie featuring a giant beetle, the beetle appeared to be 50 feet long. However, a model was used for the beetle that was really only 20 inches long. A 30-inch tall model building was also used in the movie. How tall did the building seem in the movie?

First, write the proportion, using a letter to stand for the missing term. We find the cross products by multiplying 20 times  $x$ , and 50 times 30. Then divide to find  $x$ . Study this step closely, because this is a technique we will use often in algebra. We are trying to get our unknown number,  $x$ , on the left side of the equation, all by itself. Since  $x$  is multiplied by 20, we can use the "inverse" of multiplying, which is dividing, to get rid of the 20. We can divide both sides of the equation by the same number, without changing the meaning of the equation. When we divide both sides by 20, we find that the building will appear to be 75 feet tall.

Step 1: Write the proportion

$$\frac{20 \text{ inches}}{50 \text{ feet}} = \frac{30 \text{ inches}}{x}$$

Step 2: Multiply to find the cross products

$$20 \text{ in.} \times x = 50 \text{ ft.} \times 30 \text{ in.}$$

Step 3: Divide to find X

$$\begin{aligned} \frac{20 \text{ in.} \times x}{20 \text{ in.}} &= \frac{50 \text{ ft.} \times 30 \text{ in.}}{20 \text{ in.}} \\ \cancel{20 \text{ in.}} \times x &= \frac{50 \text{ ft.} \times \cancel{30 \text{ in.}}}{\cancel{20 \text{ in.}}} \\ X &= 75 \text{ ft.} \end{aligned}$$

Note that we're using the inverse of multiplying by 20-that is, dividing by 20, to get x alone on one side.

Find whether each of the following statements is a proportion:

$$\frac{2}{3} = \frac{6}{9} \quad \text{Use cross products to verify: } 2 \times 9 = 3 \times 6$$

$18 = 18$  Yes, its a proportion.

$$\begin{aligned} 10:5 &= 40:20 \\ 200 &= 200 \end{aligned} \quad \text{Use cross products to verify: } 10 \times 20 = 5 \times 40$$

Yes, its a proportion.

$$\frac{4}{3} \neq \frac{20}{18} \quad \text{Use cross products to verify: } 4 \times 18 = 3 \times 20$$

$72 \neq 60$  No, not a proportion.

What value of n will make this a proportion?

$$\frac{6}{15} = \frac{n}{25}$$

$15 \times n = 6 \times 25$   
 $15 \times n = 150$   
 $n = 150 \div 15$   
 $n = 10$