Solving Proportions

Any fraction with the same numerator and denominator is equal to 1. If you multiply any number by 1, the number remains the same. So, $\frac{4}{8} \times \frac{2}{2} = \frac{8}{16}$. The equation $\frac{4}{8} = \frac{8}{16}$ is called a proportion because the two fractions are equal. A proportion is a mathematical equation that says two ratios are equal. Here are some other examples of proportions:

$$\frac{4}{8} = \frac{5}{10} \qquad \frac{2}{3} = \frac{40}{60} \qquad \frac{24}{3} = \frac{8}{1}$$

You can see that proportions typically have four numbers: two numerators and two denominators. Many practical problems involve proportions. Often, you will know three of the numbers in a proportion and need to find the fourth.

Example 1
During a storm, snow is falling at a rate of 1 inch every 45 minutes. At this rate, how long will it take for 4 inches of snow to fall?

We can use a proportion to answer this question. First, express the rate as a ratio.
$$\frac{1 \text{ inch}}{45 \text{ minutes}}$$

We need to find the time in minutes x it will take for 4 inches of snow to fall. Write the ratio.
$$\frac{4 \text{ inches}}{x \text{ minutes}}$$

Set the two ratios equal to one another.
$$\frac{1 \text{ inch}}{45 \text{ minutes}} = \frac{4 \text{ inches}}{x \text{ minutes}}$$

Solving the proportion means finding the value for x that makes the two rates equal. What number was 1 multiplied by to get 4? Since we multiplied the numerator by 4, we need to multiply the denominator by 4 as well.
$$\frac{1 \text{ inch}}{45 \text{ minutes}} \times \frac{4}{4} = \frac{1 \times 4 \text{ inches}}{45 \times 4 \text{ minutes}} \text{ or } \frac{4 \text{ inches}}{180 \text{ minutes}}$$

The value of x that makes the rates equal is 180 minutes.

<u>Example 2</u>

How would you solve the proportion $\dfrac{36}{120} = \dfrac{3}{x}$?

Notice that the ratio with the x in the denominator has a smaller numerator than the ratio on the right hand side. Use division to find the missing value.

36 divided by what number equals 3? $36 \div 12 = 3$

$$\frac{36}{120} = \frac{36 \div 12}{120 \div 12} \text{ or } \frac{3}{10}$$

So, $x = 10$.

Exercises
Solve each proportion.

1) $\dfrac{3}{7} = \dfrac{12}{x}$

2) $\dfrac{60}{x} = \dfrac{12}{7}$

3) $\dfrac{40}{x} = \dfrac{200}{70}$

4) $\dfrac{27}{90} = \dfrac{x}{11}$

5) Suppose that during basketball season, you made 18 out of your first 24 free throws. At this write, how many of your next 60 free throws would you make? Write and solve a proportion.

Turn on the HP 39gs and press the APLET key. Look for the HP Aplet **Proportions** (you may have to scroll). See your teacher if you don't have the Aplet. Once you have **Proportions**, highlight it and press the START menu key. Read the starting note. Press the VIEWS key and choose **Solve Proportion**.   Now you can practice solving proportions following the method of either example 1 or example 2.