Unit 19 Proportions

1. A **proportion** exists when two ratios are equal.
2. Equal ratios are also equivalent fractions.
   A. Look at the proportion statement 2:6 = 3:9 or $\frac{2}{6} = \frac{3}{9}$.
   B. Reducing reveals these two ratios are equal and therefore in proportion.

$\frac{2}{6} = \frac{2 \div 2}{6 \div 2} = \frac{1}{3}$

$\frac{3}{9} = \frac{3 \div 3}{9 \div 3} = \frac{1}{3}$

Look at the proportion $\frac{2}{6} = \frac{3}{9}$

Note: 2 is $\frac{1}{3}$ of 6 and 3 is $\frac{1}{3}$ of 9.

3. When proportions are written as fractions, their cross products are equal. This **cross products rule** is often referred to as **cross multiplication**.

Note: Product means the result of multiplication.

$\frac{2}{6} = \frac{3}{9}$

$\frac{2}{6} \times \frac{3}{9}$

$2 \times 9 = 6 \times 3$

$18 = 18$

   A. Equality of cross products can be used to determine if ratios are equal and therefore, in proportion.

Example:

Are 3/4 and 9/12 in proportion?

$\frac{3}{4} \overset{?}{=} \frac{9}{12}$

$3 \times 12 \overset{?}{=} 4 \times 9$

Since $36 = 36$

These two ratios are in proportion.

Example:

Are 2/3 and 4/5 in proportion?

$\frac{2}{3} \overset{?}{=} \frac{4}{5}$

$2 \times 5 \overset{?}{=} 3 \times 4$

Since $10 < 12$

The two ratios are not in proportion.

   B. Cross products can be used to determine the larger of two fractions.
      1. When cross products are not equal, product size shows fraction size.
         a. If the first number is larger than the second number, the first fraction is larger.
         b. If the second number is larger than the first number, the second fraction is larger.
      2. As indicated by the arrows below, be sure to multiply down to the right and then up to the right.
      3. Example:
         Compare $\frac{5}{8}$ to $\frac{7}{12}$.

$\frac{5}{8} \; ? \; \frac{7}{12}$

$\frac{5}{8} \times \frac{7}{12}$

$5 \times 12 \; ? \; 8 \times 7$

Since $60 > 56$

5/8 is larger than 7/12