Ratios & Proportional Relationships

A **ratio** compares two numbers. You can write a ratio using the word *to*, using a colon (:), or using fraction form.

Example: A softball pitcher strikes out four batters for every one batter that she walks out. What is the ratio of strikeouts to walks?

Always write the numbers in the ratio in the same order in which they appear in the question. Therefore, this answer can be written 4 to 1   4:1   4/1

Ratios are similar to fractions and can be simplified by reducing to lowest terms. However, there are some fraction rules that ratios do not follow. Do not change a ratio that is an improper fraction to a mixed number. Also, if a ratio in fraction form has a denominator of 1, do not write it as a whole number. Leave it in fraction form.

Another important difference is in the use of labels. The terms in a fraction have the same unit labels: 5/6 of a pie means 5 slices out of 6 slices. Ratios may have different labels: *The sale advertised 6 cans for $1, a 6:1 ratio*. (HiSet Exam Prep, 3rd ed.)

A **proportion** is two ratios that are set equal to each other. Usually the ratios in proportions are written in fraction form. An example of a proportion is $\frac{2}{x}=\frac{5}{10}$. To solve a proportion, you need to **cross-multiply.** The **Cross-Multiplication Theorem**, which allows us to solve proportions using this method, states that if $a,b,c,$ and d are real numbers, with $b\neq0$ and $d\neq0$ and if $\frac{a}{b}=\frac{c}{d}$, then $ad=bc$. Cross-multiplying allows us to get rid of the fractions in our equation. The Cross-Multiplication Theorem has several sub-theorems, called **corollaries.** (ck12.org)

*You may already be using proportions in your everyday life. For example, have you ever doubled a recipe? 2 c. flour/1 batch = 4c. flour/2 batches You've used proportions!