

Proportions & Problem Solving

Ratios

A ratio is the quotient of two numbers or quantities, for example 3 problems out of

5 problems, $\frac{3 \text{ problems}}{5 \text{ problems}} \rightarrow \frac{3}{5}$. It is always written in order
top(first)
bottom(second).

The ratio is also written in simplest form, for example 10 discs to

15 discs is written as $\frac{10 \text{ discs}}{15 \text{ discs}} \xrightarrow{\text{cancel common "factors"}} \frac{2}{3}$.

Rates

Rate is a type of ratio comparing different units, 15 miles in 1 hour = $\frac{15 \text{ miles}}{1 \text{ hour}} = 15$

mph. Unlike ratios, the units for rates do not cancel as they are different.

Generally, we like the denominator to be 1 unit for rates, like **unit price** \rightarrow price per 1 unit (pound, ounces, pint, etc.), **mpg** \rightarrow miles per 1 gallon, **mph** \rightarrow miles per 1 hour, etc.

Proportions

When we have a ratio, or rate, on each side of an equals sign it is called a proportion, 1 inch is to 12 inches as 3 inches are to 36 inches \rightarrow

$\frac{1 \text{ inch}}{12 \text{ inches}} = \frac{3 \text{ inches}}{36 \text{ inches}}$. To solve a proportion, or to check if it is true, we can use the

"cross-product"(I prefer the term cross-multiply).

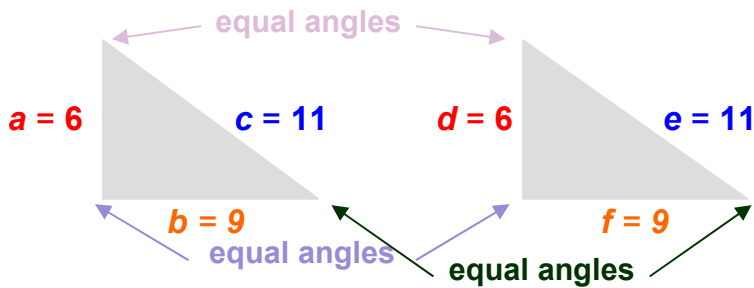
Examples:

$\frac{1 \text{ inch}}{12 \text{ inches}} = \frac{3 \text{ inches}}{36 \text{ inches}} \rightarrow 1 * 36 = 3 * 12 \rightarrow 36 = 36$, which is true.

$\frac{4}{x} = \frac{17}{10} \rightarrow \frac{4}{x} = \frac{17}{10} \rightarrow 4 * 10 = x * 17 \rightarrow 40 = 17x \rightarrow \frac{40}{17} = \frac{17x}{17} \rightarrow 2.35 = x$

Congruent Triangles

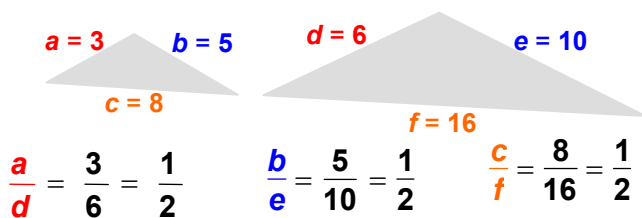
Two triangles are congruent when they have the same shape and the same size. Corresponding angles are equal, and corresponding sides are equal. We can check using Side - Angle - Side(SAS), Angle - Side - Angle(ASA), or Side - Side - Side(SSS); but **NOT** Angle - Angle - Angle. The order matters on SAS & ASA!



Similar Triangles

Two triangles are similar when they have the same shape but not necessarily the same size. In similar triangles, the measures of corresponding angles are equal and corresponding sides are in proportion.

Side a corresponds to side d , side b corresponds to side e , and side c corresponds to side f .



TIPS:

- 1) If you have 1 right triangle and are looking for the 3rd side, use the Pythagorean Theorem, which is covered later.
- 2) If you have 2 similar triangles and are looking for a side, use proportions.