

Some thoughts to help you with Unit Conversions

Measurements usually have both a numerical component and a *unit*. Units are clearly important in establishing quantity. Would you rather have an ounce of gold or a ton of gold? Further evidence of the importance of units comes from the fate of the Mars Climate Orbiter (see <http://www.cnn.com/TECH/space/9909/30/mars.metric/>). Instead of entering into orbit around Mars, the Orbiter crashed into Mars because one of the project's teams was using metric units, while another was using English units.

To work with quantitative areas of science and medicine, you need to be comfortable doing unit conversions. The units in the measurements that you are converting will guide you through the conversion process, if you allow them to. An illustration of the approach is shown below.

Convert 48 feet into yards: $48 \text{ ft} \rightarrow ? \text{ yd}$

You must know the relationship between ft and yd. It is: $3 \text{ ft} = 1 \text{ yd}$

To make the ft unit disappear from the starting quantity, you will need to multiply by $1/\text{ft}$. To make the yd unit appear, you must multiply by yd. The overall action is therefore multiplying by yd/ft .

We now need to rearrange $3 \text{ ft} = 1 \text{ yd}$ to get the yd/ft relationship. To do this, divide both sides by 3ft:

$$1/3 \text{ ft} \times 3 \text{ ft} = 1 \text{ yd} \times 1/3 \text{ ft}$$

$$1 = 1 \text{ yd}/3 \text{ ft} \quad \begin{array}{l} \text{(1 yd = 3 ft by definition, so it's exact!)} \\ \text{(What does that mean re. sig. fig.?)} \end{array}$$

Back to the 48 ft conversion. **Because you can multiply anything by one without changing its value**, and because $1 = 1 \text{ yd}/3 \text{ ft}$, we can do the following:

$$48 \text{ ft} \times 1 \text{ yd}/3 \text{ ft} = 48 \text{ ft yd}/3 \text{ ft}$$

ft cancel out and you are left with: $48 \text{ yd}/3 = 12 \text{ yd}$

Comment in closing: Because you are always multiplying by a ratio equivalent to one, this is sometimes referred to as the *unit factor conversion method*. *Unit* in this case refers to "one," as in *unitary*.