DIMENSIONAL ANALYSIS

(AKA TRAIN TRACKS)

The train track method is used to convert measurements from one unit to another unit, such as feet to meters. To start, take the initial measurement and write it down, then draw a long line underneath it and another, shorter, vertical line right after the measurement, as shown below.

12.56 feet

Next, take a ratio of one unit to another and put it in fraction form (12 in : 1 ft >> 12 / 1). Then line it up on the line putting one unit above the horizontal line and the other below the line. Units will cancel out when there is one on top and one on bottom to match. Try to put a unit on the bottom that will cancel out with another unit that is already on the top.

12.56 feet 12 inches

1 foot

Keep putting more ratios in to the train tracks until the only unit left is the unit you want. Remember, when a unit appears both on top and on bottom, each one in the pair gets “killed off”. You should be left with one “survivor” which should be your desired unit.

12.56 feet 12 inches 2.54 cm 1 m

1 foot 1 in 100 cm

To calculate the value to match the new unit, multiply each fraction together. It would look like the following:

12.56 x (12 / 1) x (2.54 / 1) x (1 / 100)

The best way to put this into a calculator is basically how the train track reads. Keep the 1's as placeholders.

12.56 x 12 / 1 x 2.54 / 1 x 1 / 100

For significant figures, focus only on the initial measurement. Everything else is assumed to be a perfect ratio that has perfect, infinite significant figures, so the only number that has any meaningful significant figures is the number at the start of the equation.

12.56 x 12 / 1 x 2.54 / 1 x 1 / 100 = 3.828288 m = 3.828 m

Occasionally it is necessary to convert two units simultaneously using train tracks, such as going from miles per hour to meters per second. To do this, put the second unit on the bottom underneath the first, then solve for units for the top before solving for the units on the bottom. The "survivor" unit for the second initial unit will end up on the bottom, just as the "survivor" unit ends up on top for the first initial unit.

35 miles 5280 feet 12 in 2.54 cm 1 m

1 hour 1 mile 1 ft 1 in 100 cm

35 miles 5280 feet 12 in 2.54 cm 1 m 1 hour 1 min

1 hour 1 mile 1 ft 1 in 100 cm 60 min 60 sec

35 / 1 x 5280 / 1 x 12 / 1 x 2.54 / 1 x 1 / 100 x 1 / 60 x 1 / 60 = 156.46 = 156 35 mi/hr = 156 m/s