Basic Math - Scientific Notation

- Scientific Notation is a convenient method for expressing very large or very small numbers.

- It expresses a number in the form: \( N \times 10^n \) where \( N \) is between 1 and 10, and \( n \) is a positive or negative integer.

- To find \( n \), count the number of places the decimal point must be moved to give the coefficient \( N \). If the decimal point must be moved to the left, \( n \) is positive; if to the right, \( n \) is negative.

Basic Math - Scientific Notation

- Let’s do some examples to illustrate. Express the following numbers in scientific notation:

  - \( 25.43 = 2.543 \times 10^1 \)
  - \( 5719 = 5.719 \times 10^3 \)
  - \( 0.0819 = 8.19 \times 10^{-2} \)

Basic Math - Scientific Notation

- We might also see numbers that look like the following examples:

  - \( 12.3 \times 10^3 = (1.23 \times 10^1) \times 10^3 = 1.23 \times 10^{(1+3)} = 1.23 \times 10^4 \)
  - \( 0.037 \times 10^{-4} = (3.7 \times 10^{-2}) \times 10^{-4} = 3.7 \times 10^{(-2-(-4))} = 3.7 \times 10^{-6} \)
Basic Math - Prefixes

» A prefix on a unit tells us something about how big a number is. Some common prefixes are shown below.

- tera = $10^{12}$
- giga = $10^9$
- mega = $10^6$
- kilo = $10^3$
- milli = $10^{-3}$
- micro = $10^{-6}$
- nano = $10^{-9}$
- pico = $10^{-12}$

Basic Math - Units

» A number without units is pretty useless. Some common units are shown below.

- meter
- liter
- gram
- joule
- calorie
- hectare
- ton
- tonne
- watt

Basic Math - Precision & Accuracy

» Precision and accuracy are NOT the same thing, though many people use them interchangeably.

Example

We measure the temperature of a bucket of water using two different thermometers. One thermometer has a mark every degree; the other thermometer has markings every tenth of a degree.

We would predict the temperature to be...

We would predict the temperature to be...
Basic Math - Precision & Accuracy

> Which thermometer is more precise?

The one on the right is more precise

Which thermometer is more accurate?

Both are equally accurate

Basic Math - Unit Conversion

> Uses the units associated with numbers as a guide in working out the arithmetic. Units associated with numbers undergo the same kinds of mathematical operations as the numbers themselves.

Example: How many kg are there in 175 lb?

You can always start by looking at the units involved: in this case we have lbs and want kg.

\[ \text{lbs} \times \left( \frac{\text{conversion}}{\text{factor}} \right) = \text{kg} \]

\[ \text{unit you want on top of factor} \quad \text{unit you want to get rid of on bottom} \]
Basic Math - Unit Conversion

**Example**

How many kg are there in 175 lb?

You can always start by looking at the units involved; in this case we have lbs and want kg.

\[ \text{lbs} \times \left( \frac{\text{conversion factor}}{\text{unit}} \right) = \text{kg} \]

\[ \text{lbs} \times \left( \frac{\text{kg}}{\text{lb}} \right) = \text{kg} \]

\[ 175 \text{ lbs} \times \left( \frac{\text{kg}}{\text{lb}} \right) = 79.4 \text{ kg} \]

Basic Math - Unit Conversion

**Example**

How many yd² are there in 27 ft²?

You can always start by looking at the units involved; in this case we have ft² and want yd².

\[ \text{ft} \times \left( \frac{\text{conversion factor}}{\text{unit}} \right) = \text{yd} \]

\[ \text{ft} \times \left( \frac{\text{yd}}{3 \text{ ft}} \right) = \text{yd} \]

\[ \text{ft}^2 \times \left( \frac{\text{yd}^2}{3^2 \text{ ft}^2} \right) = \text{yd}^2 \]

\[ 27 \text{ ft}^2 \times \left( \frac{\text{yd}^2}{3^2 \text{ ft}^2} \right) = 3 \text{ yd}^2 \]