2. Learn How to Perform Conversions using Multiple Conversion Factors

Many conversion calculations require the use of more than one conversion factor to obtain the desired result. In these cases, we let the dimensions guide us through the calculations, telling us where to put the numeric values. This approach will be demonstrated in Example 3 and Example 4. We will be using the following equivalent relationships to perform these types of conversion calculations.

\[
\begin{align*}
12 \text{ in.} &= 1 \text{ ft} \\
3 \text{ ft} &= 1 \text{ yd} \\
5,280 \text{ ft} &= 1 \text{ mile} \\
2.54 \text{ cm} &= 1 \text{ in.}
\end{align*}
\]

Other equivalent relationships can be found on the conversion handout sheet found at the end of this sections material.

Example 3: How many miles are in 500,000 inches?

As always, we begin the conversion calculation by first writing the given quantity as a ratio using a 1 to represent the denominator.

\[
\frac{500,000 \text{ in.}}{1}
\]

Our first conversion factor will convert inches to feet by placing units of inches in the denominator and feet in the numerator.

\[
\frac{500,000 \text{ in.}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in.}}
\]

Our second conversion factor will now convert feet to miles by placing feet in the denominator and miles in the numerator.

\[
\frac{500,000 \text{ in.}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in.}} \cdot \frac{1 \text{ mi}}{5,280 \text{ ft}}
\]

Notice that the denominators of our conversion factors divide out the units in the preceding numerators. This leaves us with the desired units of miles. Here is what our completed conversion calculation will look like. We will round our final answer to the nearest one-thousandth.

\[
\frac{500,000 \text{ in.}}{1} \cdot \frac{1 \text{ ft}}{12 \text{ in.}} \cdot \frac{1 \text{ mi}}{5,280 \text{ ft}} = 7.891 \text{ mi}
\]

Based on our conversion calculation, we can now answer the question by stating there are approximately 7.891 miles in 500,000 inches.
Example 4: How many yards are in 4,500 centimeters?

Again, we first write the given quantity as a ratio using a 1 to represent the denominator.

\[
\frac{4,500 \text{ cm}}{1}
\]

Our first conversion factor will convert centimeters to inches by placing units of centimeters in the denominator and inches in the numerator.

\[
\frac{4,500 \text{ cm}}{1} \times \frac{1 \text{ in.}}{2.54 \text{ cm}}
\]

Our second conversion factor will now convert inches to feet by placing inches in the denominator and feet in the numerator.

\[
\frac{4,500 \text{ cm}}{1} \times \frac{1 \text{ in.}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in.}}
\]

Our third conversion factor will now convert feet to yards by placing feet in the denominator and yards in the numerator.

\[
\frac{4,500 \text{ cm}}{1} \times \frac{1 \text{ in.}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in.}} \times \frac{1 \text{ yd}}{3 \text{ ft}}
\]

Again we see that the denominators of our conversion factors divide out the units in the preceding numerators. Doing so leaves us with the desired units of yards. Here is what our completed conversion calculation will look like. We will round our final answer to the nearest one-thousandth.

\[
\frac{4,500 \text{ cm}}{1} \times \frac{1 \text{ in.}}{2.54 \text{ cm}} \times \frac{1 \text{ ft}}{12 \text{ in.}} \times \frac{1 \text{ yd}}{3 \text{ ft}} = 49.213 \text{ yd}
\]

Based on our conversion calculation, we can now answer the question by stating there are approximately 49.213 yards in 4,500 centimeters.

Perform the following conversion calculations using multiple conversion factors.

9) How many meters are in 1 mile? 11) Convert 3 pounds to grams.

10) How many seconds are in 1 year? 12) Convert 2 liters to ounces.