Online Math Center

Conversion of Units

How many feet are in 8 miles?
How many miles are in 3 kilometers?

To answer these questions and other similar conversion questions, we always set-up the problem in the same way. We use multiplication and canceling.

Multiply (what you want to covert) by (a conversion ratio).
Cancel units.
Simplify the answer (do the arithmetic).

A conversion ratio looks very much like a fraction except that in the fraction there are units such as miles, kilometers, inches, or centimeters too.

To correctly form the conversion ratio, the units of what you want to convert should be in the bottom (denominator) of the fraction.

If you want to convert "miles" to "kilometers", when you form the conversion fraction the units "miles" should be in the denominator of the fraction.

Example 1,

How many miles are in 3 kilometers?

Solution:

Multiply (what you want to covert) by (a conversion ratio)

You want to convert 3 kilometers.
So you would write 3 kilometers where it says "what you want to convert" AND you would have to form a conversion fraction with kilometers in the denominator.

Multiply (3 kilometers) by $\frac{(\ \ ?\ \text{miles}\ \ )}{(\ ?\ \text{kilometers})}$ < *notice kilometers on the bottom.*

We get the information about miles to kilometers from a conversion table such as found at http://startinbusiness.co.uk/si.htm

From the table we learn that 1 km = 0.621 miles,
so in the fraction replace the " ? miles " by " 0.621 miles " and the " ? kilometers " by " 1 km " .

Multiply (3 kilometers) by $\frac{(\ 0.621 \text{ miles}\ )}{(\ 1 \text{ kilometer}\ )}$

Cancel the word "kilometers".

$$(\ 3\ \cancel{\text{kilometers}}) * \frac{(\ 0.621 \text{ miles}\ )}{(\ 1\ \cancel{\text{kilometer}}\ )}$$

Multiply top times top and place the answer over the bottom of the fraction which in this case is "1".

$$\frac{(\ 3\ ) * (\ 0.621 \text{ miles}\ )}{1}$$

Simplify,

1.863 miles

Hence, there are about 1.863 miles in 3 kilometers.

Example 2,

How many feet are in 8 miles?

Multiply (what you want to covert) by (a conversion ratio)

$$(\ 8 \text{ miles}\ ) * \frac{(\ ?\ \text{feet}\ )}{(\ ?\ \text{miles})}$$ < *This time we want miles, so miles are in the denomionator*

Use the conversion table. 1 mile = 5280 feet

$$(\ 8 \text{ miles}\ ) * \frac{(\ 5280 \text{ feet}\ )}{(\ 1 \text{ mile}\ )}$$

Cancel "miles".

$$(\ 8\ \cancel{\text{miles}}\ ) * \frac{(\ 5280 \text{ feet}\ )}{(\ 1\ \cancel{\text{mile}}\ )}$$

Multiply top times top and place answer over bottom "1".

$$\frac{(\ 8\ ) * (5280 \text{ feet})}{1}$$

Simplify,

42,240 feet are in 8 miles.

Example 3,

Convert 1750 grams to drams.

Solution:

How many drams are in 1750 grams?

Multiply (what you want to covert) by (a conversion ratio)

$$(\ 1750 \text{ grams}\ ) * \frac{(\ ?\ \text{drams}\ )}{(\ ?\ \text{grams}\ )}$$

Use the conversion table. 1 gram = 0.56438339 drams

$$(\ 1750 \text{ grams}\ ) * \frac{(\ 0.56438339 \text{ drams}\ )}{(\ 1 \text{ gram}\ )}$$

Cancel "grams".

$$(\ 1750\ \cancel{\text{grams}}\ ) * \frac{(\ 0.56438339 \text{ drams}\ )}{(\ 1\ \cancel{\text{gram}}\ )}$$

Multiply top times top and place answer over bottom "1".

$$\frac{(\ 1750\ ) * (\ 0.56438339 \text{ drams}\ )}{1}$$

Simplify,

987.6709325 drams

Example 4,

How many grams are in 100 calories (carbohydrates)?

Multiply (what you want to covert) by (a conversion ratio)

$$(\ 100 \text{ calories}\ ) * \frac{(\ ?\ \text{grams}\ )}{(\ ?\ \text{calories}\ )}$$

Conversion: 4 calories / gram for carbohydrates

$$(100 \text{ calories}) * \frac{(1 \text{ grams})}{(4 \text{ calories})}$$

Cancel "calories".

$$(100 \cancel{\text{calories}}) * \frac{(1 \text{ grams})}{(4 \cancel{\text{calories}})}$$

Multiply top times top and place over bottom which is 4.

$$\frac{(100) * (1 \text{ gram})}{4}$$

Simplify,

$$\frac{100 \text{ grams}}{4}$$

25 grams.

Hence, there are 25 grams in 100 carbohydrate calories.

Example 5,

How many grams are in 100 calories (fats)?

Multiply (what you want to covert) by (a conversion ratio)

$$(100 \text{ calories}) * \frac{(? \text{ grams})}{(? \text{ calories})}$$

Conversion: 9 calories / gram for fats.

$$(100 \text{ calories}) * \frac{(1 \text{ grams})}{(9 \text{ calories})}$$

Cancel "calories".

$$(100 \cancel{\text{calories}}) * \frac{(1 \text{ grams})}{(9 \cancel{\text{calories}})}$$

Multiply top times top and place over bottom which is 9.

$$\frac{(100) * (1 \text{ gram})}{9}$$

Simplify,

$$\frac{100 \text{ grams}}{9}$$

11.1 grams.

Hence, there are 11.1 grams in 100 fat calories.

Multiple Conversions

Sometimes you'll need to go through a couple of sets of conversions to answer a question.
The method is the same.
Multiply (what you want to covert) by (a conversion ratio) by (another conversion ratio)

Example 1
How many yards are in 5 miles?

Multiply (what you want to covert) by (a conversion ratio) by (another conversion ratio)

$$\text{Multiply } (5 \text{ miles}) \text{ by } \left(\frac{?\text{ yards}}{?\text{ miles}}\right) \text{ by } (\text{another conversion ratio})$$

Use the conversion table. 1 mile = 5280 feet and 3 feet = 1 yard

Since the conversion table has miles to feet and feet to yards,
"miles" are on the bottom of the first fraction and "feet" are on the top.
Since "feet" are in the top in the first fraction, then "feet" must be in the bottom on the second fraction. "Yards" are on the top of the second fraction.

$$\text{Multiply } (5 \text{ miles}) \text{ by } \left(\frac{5280 \text{ feet}}{1 \text{ mile}}\right) \text{ by } \left(\frac{1 \text{ yard}}{3 \text{ feet}}\right)$$

Cancel miles and cancel feet.

$$(5\ \cancel{\text{miles}}) * \left(\frac{5280\ \cancel{\text{feet}}}{1\ \cancel{\text{mile}}}\right) * \left(\frac{1 \text{ yard}}{3\ \cancel{\text{feet}}}\right)$$

Multiply top times top over bottom times bottom
(i.e. multiply numerators and denominators separately):

$$\frac{(5) * (5280) * (1 \text{ yard})}{(1) * (3)}$$

Simplify,

$$\frac{26400 \text{ yards}}{3}$$

8800 yards

There are 8800 yards in 5 miles.