

Unit Conversions

the fraction cancelation trick

Textbooks give conversion factors which allow you to change from one set of units to another, such as

$$2.54 \text{ cm} = 1 \text{ in}$$

$$5280 \text{ ft} = 1 \text{ mile}$$

But writing them this way is not as useful as writing them as fractions, like this:

$$\frac{2.54 \text{ cm}}{1 \text{ in}}$$

$$\frac{5280 \text{ ft}}{1 \text{ mile}}$$

Since the top and bottom are equal, these are each just another way of writing “1”.

Then to convert a quantity from one set of units to another you multiply or divide by the appropriate conversion fraction.

How do you know whether to multiply or divide?

Answer: you do whichever results in getting the units to “cancel” right, just like canceling common factors in a fraction.

Example: How many centimeters in 1 foot?

$$1 \cancel{\text{ft}} \times \frac{12 \cancel{\text{in}}}{1 \cancel{\text{ft}}} \times \frac{2.54 \text{ cm}}{1 \cancel{\text{in}}} = 30.48 \text{ cm}$$

Example: How many miles in 5 kilometers?

$$5 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{100 \text{ cm}}{1 \text{ m}} \times \frac{1 \text{ ft}}{30.48 \text{ cm}} \times \frac{1 \text{ mile}}{5280 \text{ ft}}$$

$$= 3.11 \text{ miles}$$

Example: What is the speed limit on the Taconic Parkway, expressed in furlongs per fortnight?

1 furlong = 220 yd = 660 ft

1 fortnight = 14 days

$$\frac{55 \cancel{\text{ miles}}}{1 \cancel{\text{ hr}}} \times \frac{5280 \cancel{\text{ ft}}}{1 \cancel{\text{ mile}}} \times \frac{1 \text{ furlong}}{660 \cancel{\text{ ft}}} \times \frac{24 \cancel{\text{ hr}}}{1 \cancel{\text{ day}}} \times \frac{14 \cancel{\text{ day}}}{1 \text{ fortnight}}$$
$$= \frac{147,840 \text{ furlongs}}{1 \text{ fortnight}}$$