

Exercise 1.1

Starting with the definition 1 in. = 2.54 cm, find the number of (a) kilometers in 1.00 mile and (b) feet in 1.00 km.

Solution

Part (a)

The aim is to start with inches and centimeters, use known conversion factors, and end up with kilometers and miles. Arrange each fraction so that the appropriate units cancel.

$$\frac{2.54 \cancel{\text{cm}}}{1 \cancel{\text{in}}} \times \frac{1 \cancel{\text{m}}}{100 \cancel{\text{cm}}} \times \frac{1 \text{ km}}{1000 \cancel{\text{m}}} \times \frac{12 \cancel{\text{in}}}{1 \cancel{\text{ft}}} \times \frac{5280 \cancel{\text{ft}}}{1 \text{ mile}} = \frac{(2.54)(1)(1)(12)(5280) \text{ km}}{(1)(100)(1000)(1)(1) \text{ mile}} \approx \frac{1.609 \text{ km}}{1 \text{ mile}}$$

Part (b)

Since only feet are needed, this calculation has one less step than before.

$$\frac{2.54 \cancel{\text{cm}}}{1 \cancel{\text{in}}} \times \frac{1 \cancel{\text{m}}}{100 \cancel{\text{cm}}} \times \frac{1 \text{ km}}{1000 \cancel{\text{m}}} \times \frac{12 \cancel{\text{in}}}{1 \text{ ft}} = \frac{(2.54)(1)(1)(12) \text{ km}}{(1)(100)(1000)(1) \text{ ft}} \approx \frac{3.408 \times 10^{-4} \text{ km}}{1 \text{ ft}}$$

Invert the ratio so that feet are on top.

$$\left(\frac{3.408 \times 10^{-4} \text{ km}}{1 \text{ ft}} \right)^{-1} \approx \frac{3281 \text{ ft}}{1 \text{ km}}$$