



# Units of measurement

## Converting metric and Imperial units, and converting areas and volumes.

Check that you can:

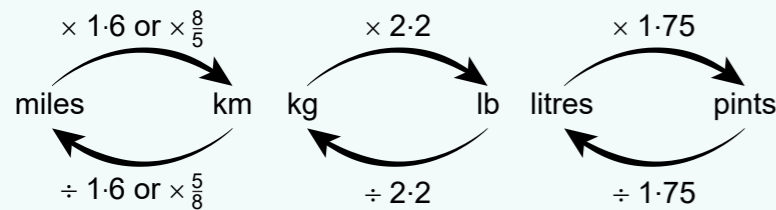
- ◆ recognise Imperial units of measurement for length, mass and volume
- ◆ convert between different metric units for length, mass and volume
- ◆ convert between different units of time.

### Converting between metric and Imperial units

The Imperial system of measurement is far more complex than the metric system as the relationships between the different units are less simple. There are three conversions between metric and Imperial units that you will be expected to know.

Length conversion	Mass conversion	Volume conversion
5 miles = 8km OR 1 mile = 1.6km	1kg = 2.2lb (pounds)	1 litre = 1.75 pints

Remember that  $\approx$  means 'approximately equal to'. The following diagrams can be used to convert between metric and Imperial units:



#### Example 1

Convert 3 miles into km.

#### Answer

$$3 \times 1.6 = 4.8\text{km}$$

When the number of miles to be converted is a multiple of 5 or the number of km to be converted is a multiple of 8, it is easier to use the conversion 5 miles  $\approx$  8km.

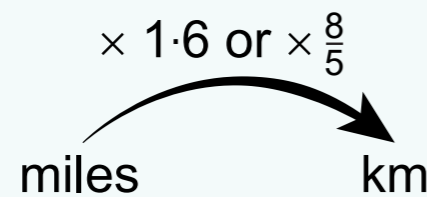
Using this conversion, to go from km to miles we  $\times \frac{5}{8}$ .

#### Example 2

Without a calculator, convert 32km into miles.

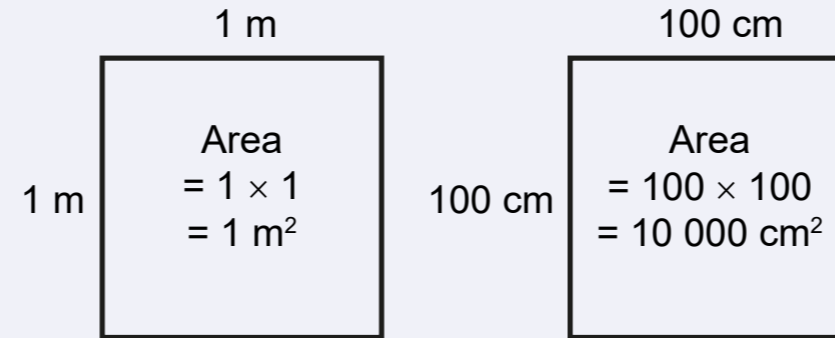
#### Answer

$$32 \times \frac{5}{8} = \frac{(32 \times 5)}{8} = \frac{160}{8} = 20 \text{ miles}$$



### Converting area measurements

Consider these two squares:

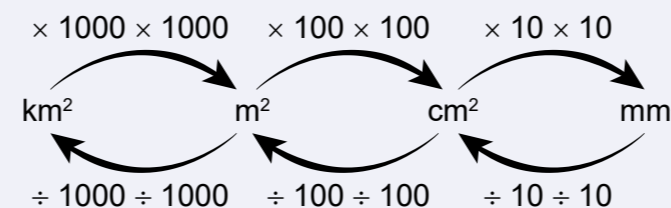


The length of the sides of the first square are 1 m long. However, as 1 m = 100cm, it means that both squares are the same size. Considering the areas of both squares, we can see that 1 m<sup>2</sup> must therefore be equal to 10000cm<sup>2</sup>. This is a different conversion to the length conversion of 1 m = 100cm. That is because we always multiply two lengths to form an area, meaning any length conversion will need to be used twice (the conversion squared).

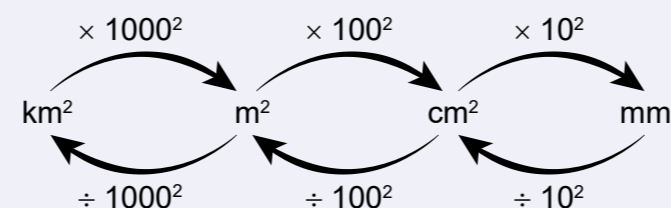
E.g. 1 cm = 10mm.

Therefore, 1 cm<sup>2</sup> = (10 × 10 =) 100mm<sup>2</sup> OR  
1 cm<sup>2</sup> = (10<sup>2</sup> =) 100mm<sup>2</sup>.

The following diagram can be used to convert between all the metric units of area.

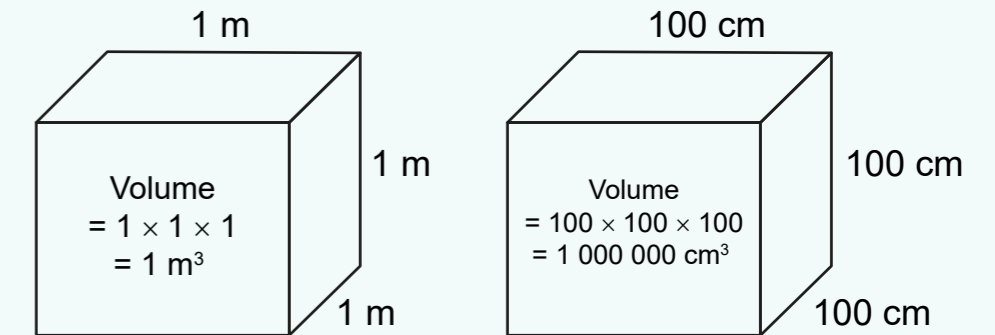


OR



### Converting volume measurements

Consider these 2 cubes:

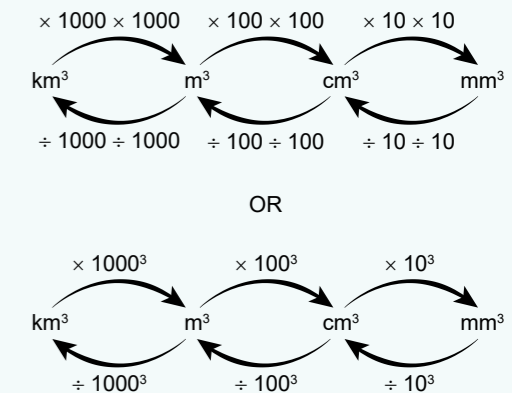


The length of the sides of the first cube are 1 m long. But as 1 m = 100cm, it means that both cubes are the same size. Considering the volumes of both cubes, we can see that 1 m<sup>3</sup> must therefore be equal to 1000000cm<sup>3</sup>. This is because we always multiply three lengths to form a volume, meaning any length conversion will need to be used three times.

E.g. 1 cm = 10mm.

Therefore, 1 cm<sup>3</sup> = (10 × 10 × 10 =) 1000mm<sup>3</sup> OR  
1 cm<sup>3</sup> = (10<sup>3</sup> =) 1000mm<sup>3</sup>.

This diagram can be used to convert between all the metric units of volume.

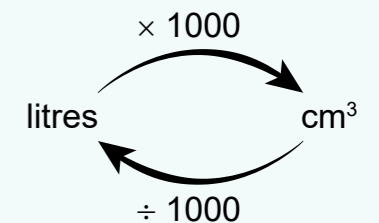


### Converting between cm<sup>3</sup> and litres

The definition of a litre is:

$$1 \text{ litre} = 1000\text{cm}^3$$

From this definition, we can see that 1ml = 1 cm<sup>3</sup>. The following diagram can be used for converting between litres and cm<sup>3</sup>.



### REMEMBER!

An area is formed by multiplying two lengths, and a volume is formed by multiplying three lengths.  
1 m = 100cm, but 1 m<sup>2</sup> = 10000cm<sup>2</sup>, and 1 m<sup>3</sup> = 1000000cm<sup>3</sup>.