

Measurement (part 1)



Theory and examples

Learning Skills

Introduction:

Measurement includes length, area, volume and capacity, mass and time. In this document we will focus on perimeter, area and volume. Measurement also includes metric conversions which can be found in our [metric conversion](#) document. Explanations of some of the terms that have been used in this document can be found in the [glossary](#) on our website. [Part 2](#) of this document contains exercises to practise

This sheet will teach you to:

- Understand the concept perimeter in maths 2
- Understand the concept area in maths 3
- Use Metric Conversions 4
- Apply area and perimeter 5
- Understand the concept volume in maths 5

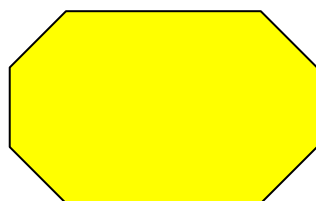
1. Definitions

Perimeter is the distance **around a shape** – it is a **length**.

Area is a measure of the space contained **within a shape** – it is measured in **squares**.

Volume is a measure of the space contained **within a solid** – it is measured in **cubes**.

A shape



A solid

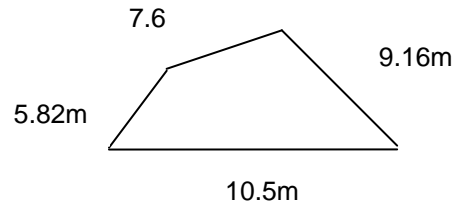


2. Perimeter

To calculate a perimeter, ensure that you have the length of all of the sides of the figure and ensure that all the measurements are in the same unit eg all in centimetres.

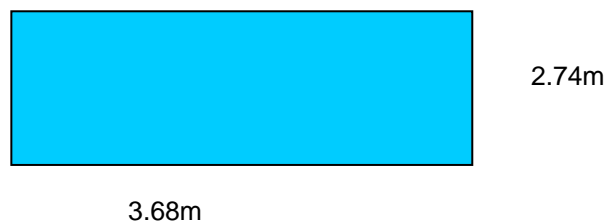
Examples

- a) Find the perimeter



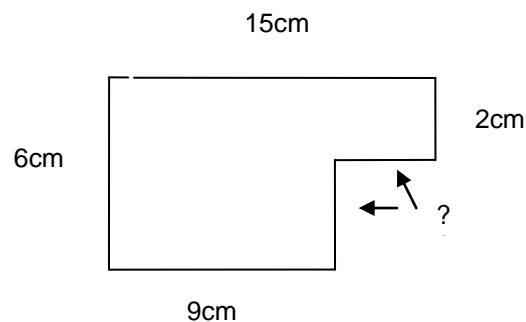
$$\text{Perimeter} = 10.5 + 5.82 + 7.6 + 9.16 = 33.08$$

- b) Find the perimeter



$$\text{Perimeter} = 3.68 + 3.68 + 2.74 + 2.74 = 12.84\text{m}$$

- c) Find the perimeter



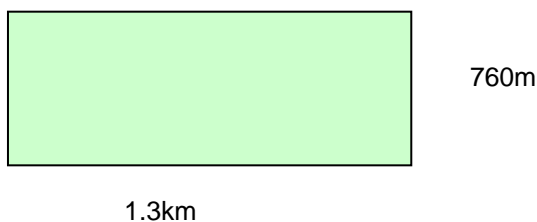
The shape has 6 sides but we are only given the length of 4 sides

The missing horizontal length is equal to $15\text{ cm} - 9\text{ cm} = 6\text{ cm}$.

The missing vertical length is $6\text{ cm} - 2\text{ cm} = 4\text{ cm}$

$$\text{Perimeter} = 15 + 2 + 6 + 4 + 9 + 6 = 42\text{ cm}$$

d) Find the perimeter



Change all measurements into metres or kilometres – 760m and 1300m or 0.76km and 1.3km

$$\text{Perimeter} = 2 \times 760 + 2 \times 1300 = 1520 + 2600 = 4120\text{m}$$

$$\text{Or perimeter} = 2 \times 0.76 + 2 \times 1.3 = 1.52 + 2.6 = 4.12\text{km}$$

3. Area

Area is a measure of the space inside a shape. It is measured by calculating the number of squares that are required to cover a shape. The common units used to measure area are:

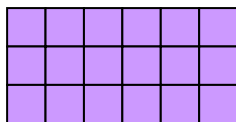
square centimetres (cm^2) for measuring smaller areas such as desk tops

square metres (m^2) used for measuring larger areas such as walls and playing fields

hectares (ha) for stating the area of properties or paddocks

square kilometres (km^2) used for measuring city areas or stating the size of countries.

4. Area of a rectangle



Note

$$\text{area} = \text{length} \times \text{breadth}$$

Area of a rectangle is found by multiplying the number of squares along the length of the rectangle with the number of squares along the breadth.

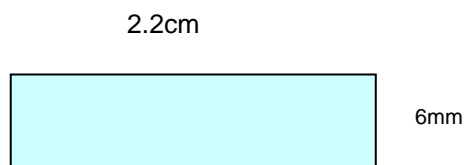
Examples

a) Find the area



$$\text{area} = 12\text{cm} \times 5\text{cm} = 60\text{cm}^2$$

b) Find the area



Note
Both measurements must be in the same units before area is worked out.

Use either 2.2 cm and 0.6 cm or 22mm and 6 mm.

$$area = 2.2cm \times 0.6cm = 1.32cm^2$$

$$or \quad area = 22mm \times 6mm = 132mm^2$$

5. Hectares

A hectare is a metric measurement for land.

1 hectare = 10 000 square metres

Example

Find the area in hectares of a rectangular paddock that is 750 metres by 640 metres



Note
Draw a diagram

$$area = 750m \times 640m = 480\,000m^2$$
$$= \frac{480000}{10000} = 48 \text{ hectares}$$

Note
each 10 000 m² represents 1 hectare

6. Metric Conversions

Because area is measured in squares then the metric conversion factors need to be adjusted.

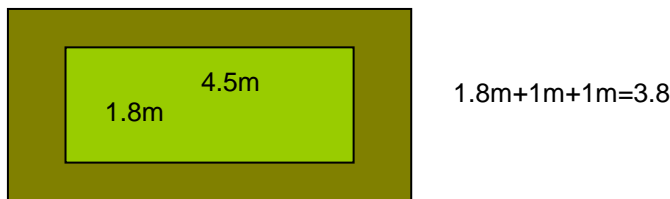
$$1 \text{ squarecentimetre} = 1cm \times 1cm = 10mm \times 10mm = 100mm^2$$

$$1 \text{ squaremetre} = 1m \times 1m = 100cm \times 100cm = 10\,000cm^2$$

7. Applications

Examples

- a) A rectangular garden bed measuring 4.5 metres by 1.8 metres is to have a 1 metre wide path around it. Find the area of the path.



$$4.5m + 1m + 1m = 6.5m$$

$$\text{total area} = 6.5m \times 3.8m = 24.7m^2$$

$$\text{area of garden bed} = 4.5m \times 1.8m = 8.1m^2$$

$$\text{area of path} = 24.7m^2 - 8.1m^2 = 16.6m^2$$

- b) How many tiles measuring 20 centimetres by 10 centimetres are needed to tile a square metre?

$$\text{area of each tile} = 20cm \times 10cm = 0.2m \times 0.1m = 0.02m^2$$

$$\text{number of tiles} = 1m^2 \div 0.02m^2 = 50$$

- c) How many tiles are needed to cover a kitchen floor measuring 3.25 metres by 2.7 metres?

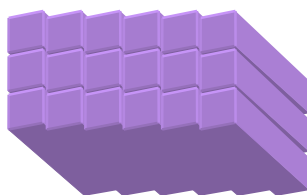
$$\text{area of floor} = 3.25m \times 2.7m = 8.775m^2$$

$$\text{number of tiles needed} = 8.775 \times 50 = 438.75 = 439$$

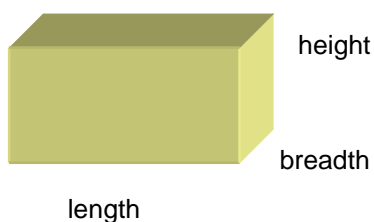
8. Volume

Volume is a measure of the space inside a solid. This space can be measured in cubic units or in the quantity of liquid that would be needed to fill it. This liquid volume is known as capacity.

To calculate the volume of a rectangular prism in cubic units, work out how many cubes are in one layer, and multiply by the number of layers.



In other words multiply the length by breadth by height



Note

$$\text{volume} = l \times b \times h$$

Example

Find the volume of a rectangular prism measuring 8cm by 10cm by 6cm.

$$volume = 8cm \times 10cm \times 6cm = 480cm^3$$

As with perimeter and area, before calculating volume make sure that all the measurements are in the same units.

9. Volume and Capacity

There is a direct link between the space inside a solid and how much water it will hold.

$$1cm^3 = 1 \text{ mL of water}$$

$$1m^3 = 1000 \text{ L of water}$$

Example

- a) Find the volume and the capacity of a small fish tank measuring 10 cm by 12 cm by 25 cm.

$$volume = 10cm \times 12cm \times 25cm = 3000cm^3$$

$$\text{therefore } capacity = 3000mL = 3L$$

- b) Find the capacity in litres of a tank measuring 1.2 m by 52 cm by 85 cm.

(remember that all measurements must be in the same units)

using 1.2m, 0.52m and 0.85m

$$volume = 1.2m \times 0.52m \times 0.85m = 0.5304m^3$$

$$capacity = 0.5304 \times 1000L = 530.4L$$

Note

Each cubic centimetre will hold 1 millilitre

Note

Each cubic metre will hold 1000 litres

10. For more information

Visit our Learning Skills website at <http://www.csu.edu.au/division/studserv/maths>

Part 2 of this document for exercises relating to this topic can be found at <http://www.csu.edu.au/division/studserv/maths/teachered.htm>

Copyright

© Learning Skills, Charles Sturt University, July 2009