Lesson - Converting units, area, perimeter and volume

Year: Year 6

We convert units to compare measurements. We also find the perimeter and area of shapes and the volume of cuboids.

Starter activity

Mia is helping her dad to put new carpet in the living room. She measures the room and finds it is 4.5 m long and 3.2 m wide. The carpet shop sells carpet by the square metre, but the room measurements are in metres and the shop sign uses feet and inches. In this chapter you will learn to convert between units and find the perimeter, area and volume of different shapes.

Converting between metric units

Key fact: metric facts

1 km = 1 000 m, 1 m = 100 cm, 1 cm = 10 mm, 1 kg = 1 000 g and 1 litre = 1 000 ml. Multiply to go to a smaller unit. Divide to go to a larger unit.

Method: converting units

1. Decide whether the new unit is smaller or larger.
2. Multiply by 10, 100 or 1 000 for a smaller unit, and divide for a larger unit.
3. Check the answer is sensible.

Example 1

Convert 2.35 m to centimetres and 4 500 ml to litres.

2.35 × 100 = 235 cm. 4 500 ÷ 1 000 = 4.5 litres.

Metric and imperial units

Key fact: approximate equivalents

1 inch is about 2.5 cm. 1 foot is about 30 cm. 1 mile is about 1.6 km. 1 kg is about 2.2 pounds. 1 gallon is about 4.5 litres.

Example 2

A road sign shows 30 miles. About how many kilometres is that?

30 × 1.6 = 48, so about 48 km.

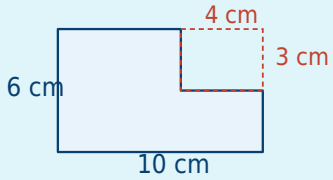
Perimeter and area

Definition: perimeter and area

Perimeter is the distance round a shape. **Area** is the space inside it, in square units. For a rectangle, $A = l \times w$.

Example 3

A 10 cm by 6 cm rectangle has a 4 cm by 3 cm corner cut out. Find the area.



Area of the whole rectangle is 10 × 6 = 60. Area of the cut-out is 4 × 3 = 12. The area is 60 − 12 = 48 cm².

Note

Shapes with the same area can have different perimeters. A 4 by 4 square and a 8 by 2 rectangle both have area 16 cm², but perimeters of 16 cm and 20 cm.

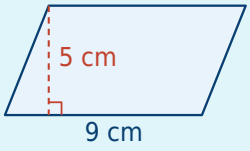
Area of parallelograms and triangles

Rule: area of a parallelogram

Area of a parallelogram = base × perpendicular height. The height is measured at right angles to the base, not along the slanted side.

Example 4

Find the area of a parallelogram with base 9 cm and height 5 cm.



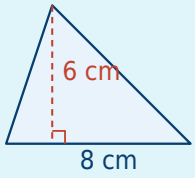
$9 \times 5 = 45$ cm².

Rule: area of a triangle

Area of a triangle = base × height ÷ 2. A triangle is half of a parallelogram with the same base and height.

Example 5

A triangle has base 8 cm and perpendicular height 6 cm. Find its area.



$8 \times 6 \div 2 = 48 \div 2 = 24$ cm².

Watch out

Use the perpendicular height, not the slanted side. Do not forget to halve when finding the area of a triangle.

Volume of cubes and cuboids

Definition: volume

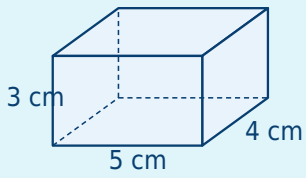
Volume is the amount of space inside a 3D shape, measured in cubic units such as cm³.

Rule: volume of a cuboid

Volume of a cuboid = length × width × height.

Example 6

Find the volume of a cuboid 5 cm by 4 cm by 3 cm, and of a cube with sides 6 cm.



$5 \times 4 \times 3 = 60$ cm³. For the cube, $6 \times 6 \times 6 = 216$ cm³.

More about measures

Method: finding the area of a compound shape

1. Split the shape into rectangles (or triangles) you know.
2. Work out the length and width of each part, using subtraction if the sides are not shown.
3. Find the area of each part.
4. Add the areas, or subtract the part that has been cut out, and write the unit.

Example 4

An L-shape is made from a 10 m by 5 m rectangle with a 4 m by 1.5 m corner removed. Find the area.

The whole rectangle has an area of 10 × 5 = 50 m². The corner is 4 × 1.5 = 6 m². The area of the L-shape is 50 − 6 = **44 m²**.

Example 5

A triangle has a base of 9 cm and a perpendicular height of 6 cm. Find the area. Then find the base of a triangle with the same height and area 36 cm².

Area = $\frac{1}{2} \times 9 \times 6 = 27$ cm². For the second triangle, $\frac{1}{2} \times b \times 6 = 36$, so $3b = 36$ and the base is **12 cm**.

Example 6

A tank is 40 cm long, 25 cm wide and 20 cm high. How many litres does it hold?

Volume = 40 × 25 × 20 = 20 000 cm³. Since 1 litre = 1 000 cm³, we divide: 20 000 ÷ 1 000 = **20 litres**.

Example 7

A recipe uses 450 g of flour. How many kilograms is this? About how many pounds?

450 ÷ 1 000 = 0.45 kg. We use 1 kg ≈ 2.2 pounds, so 0.45 × 2.2 = 0.99, which is about **1 pound**.

Watch out: common mistakes

Always check that all the measurements are in the same unit before you calculate. Do not mix up perimeter (a length, in cm or m) and area (squares, in cm² or m²). The height of a triangle or parallelogram is the *perpendicular* height, not the slanted side. Finally, 1 m³ is 1 000 litres, but 1 m² is not 100 cm²: it is 10 000 cm².

Volume and capacity

Volume is the amount of space a solid takes up. Capacity is how much a container can hold. A cube with an edge of 10 cm has a volume of 1 000 cm^3, and that is exactly 1 litre. A cube with an edge of 1 cm has a volume of 1 cm^3, which is exactly 1 millilitre.

Did you know?

The metric system was invented in France about 230 years ago. Before that, every town used different units, which made trade very difficult. The metre was first defined as one ten-millionth of the distance from the North Pole to the equator. Today almost every country in the world uses metric units, but we still use miles on UK road signs.

Otto's tip

Always write the unit. Squares for area, cubes for volume. A missing unit loses a mark!