Lesson - Angles, circles and 3D shapes

Year: Year 6

Angle facts help us find missing angles. We also learn the parts of a circle and the nets of 3D shapes.

Starter activity

A builder is fixing a triangular frame for a roof. She needs the angle at the top and the two angles at the bottom to be exactly right. She also needs a circular window and a box with a lid that folds out of flat card. In this chapter you will learn the angle facts that help to find missing angles, the parts of a circle and how 3D shapes are made from nets.

Angle facts you need to know

Rule: angle facts

Angles on a straight line add up to 180°. Angles at a point add up to 360°. Angles in a triangle add up to 180°. Angles in a quadrilateral add up to 360°. Vertically opposite angles are equal.

Definition: isosceles and equilateral triangles

An **isosceles** triangle has two equal sides and two equal angles. An **equilateral** triangle has three equal sides and three angles of 60°.

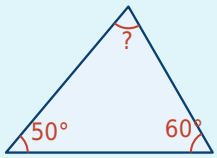
Finding missing angles

Method: finding a missing angle

1. Decide which angle fact applies.
2. Add up the angles you know.
3. Subtract from the total (180° or 360°).

Example 1

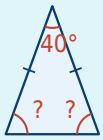
A triangle has angles of 50° and 60°. What is the third angle?



50 + 60 = 110. 180 − 110 = 70°.

Example 2

An isosceles triangle has an angle of 40° at the top. Find the base angles.

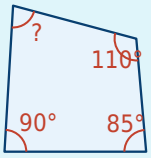


Not drawn accurately

The base angles together are 180 − 40 = 140°. They are equal, so each is 140 ÷ 2 = 70°.

Example 3

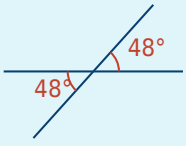
Three angles of a quadrilateral are 90°, 85° and 110°. Find the fourth.



90 + 85 + 110 = 285. 360 − 285 = 75°.

Example 4

Two straight lines cross and one angle is 48°. Find the other three angles.



The angle opposite is also 48° (vertically opposite). The other two lie on a straight line with it, so each is 180 − 48 = 132°.

Watch out

Do not mix up 180° (triangle, straight line) and 360° (quadrilateral, point). Diagrams are often not drawn accurately, so calculate rather than measure.

Drawing 2D shapes accurately

To draw a triangle from two angles and a side, draw the side first and use a protractor at each end. Use a ruler for lines and measure to the nearest millimetre.

Parts of a circle

Definition: parts of a circle

The **centre** is the middle point. The **radius** goes from the centre to the edge. The **diameter** goes across the circle through the centre. The **circumference** is the distance round the edge.

Key fact: radius and diameter

The diameter is twice the radius, so $d = 2r$. A circle with radius 4 cm has diameter 8 cm.

Example 5

A circle has diameter 14 cm. What is its radius?

14 ÷ 2 = 7 cm.

3D shapes and nets

Definition: net

A **net** is a flat shape that folds up to make a 3D shape. A cube has 6 faces, 12 edges and 8 vertices.

Key fact: common 3D shapes

A cuboid has 6 faces, a triangular prism has 5 faces, and a square-based pyramid has 5 faces and 8 edges.

Example 6

How many square faces are in the net of a cube?

A cube has 6 faces and all are squares, so its net has 6 squares.

More about angles and shapes

Method: finding missing angles in a diagram

1. Look for a straight line (180°), a point (360°), a triangle (180°) or a quadrilateral (360°).
2. Write down the angle fact you are using.
3. Add the angles you already know.
4. Subtract that total from 180° or 360° to find the missing angle.

Example 7

An isosceles triangle has one angle of 80°, and it is the angle between the two equal sides. Find the other angles.

The other two angles are equal, because it is an isosceles triangle. Angles in a triangle add up to 180°, so the other two angles add up to 180 − 80 = 100°. Each one is 100 ÷ 2 = **50°**.

Example 8

Find the missing angle at a point: 120°, 95° and 80° with a fourth angle x.

Angles at a point add up to 360°. 120 + 95 + 80 = 295, so $x = 360 - 295 = $ **65°**.

Example 9

A circle has a diameter of 11 cm. Find the radius and set the compasses to draw it.

The radius is 11 ÷ 2 = **5.5 cm**. Open the compasses until the point and the pencil are 5.5 cm apart, using a ruler. The pencil then draws a circle with a diameter of 11 cm.

Example 10

Check that a triangular prism fits the rule vertices + faces − edges = 2.

A triangular prism has 6 vertices, 5 faces and 9 edges. 6 + 5 − 9 = **2**. The rule works for all solid shapes with flat faces.

Watch out: common mistakes

Diagrams in a test are often not drawn accurately, so never measure an angle that is labelled “not drawn accurately”: calculate it. Do not use 180° when the shape is a quadrilateral, and do not use 360° for a triangle. Also, the radius is half the diameter, so a circle that is 10 cm wide needs the compasses set to 5 cm.

Reading and using a protractor

Put the centre of the protractor on the point (the vertex) of the angle, and line up the baseline with one arm. Read the scale that starts at 0° on that arm. If the angle is acute (less than 90°), the answer should be less than 90°, so you can check that you have chosen the right scale.

Did you know?

The number 360 appears in the circle because the ancient Babylonians counted in groups of 60. They also thought that the Sun took about 360 days to go round the sky, so they split a circle into 360 equal parts. We still use degrees today, 4 000 years later.

Otto's tip

Write the angle fact next to every step, such as “angles in a triangle add up to 180°”. It helps you spot mistakes!