Lesson - Properties of 2D and 3D shapes

Year: Year 2

Hello, I am Otto! Shapes are all around us: a football, a cereal box, a pizza, a road sign. In this chapter you describe 2D and 3D shapes using the words sides, vertices, faces and edges. You also sort shapes and find lines of symmetry.

Starter activity

Go on a shape hunt at home. Find something that is shaped like a cube, like a cuboid, like a cylinder and like a sphere. A dice is a cube, a cereal box is a cuboid, a tin of beans is a cylinder and a ball is a sphere. Which shape can roll? Which shape can you stack?

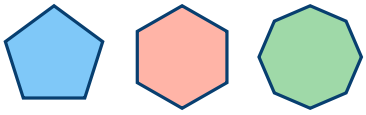
2D shapes

Definition: side and vertex

2D (flat) shapes have **sides** and **vertices**. A side is a straight line. A vertex is a corner where two sides meet. The plural of vertex is **vertices**.

Key fact: 2D shapes

Shape	Sides	Vertices
Triangle	3	3
Square	4 (all equal)	4
Rectangle	4 (opposite sides equal)	4
Pentagon	5	5
Hexagon	6	6
Octagon	8	8
Circle	1 curved side	0



A pentagon, a hexagon and an octagon. Each one has the same number of sides as vertices.

Worked example 1

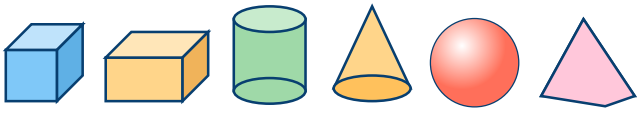
How many sides and vertices does a hexagon have?

A hexagon has **6 sides** and **6 vertices**. Hex- means six.

3D shapes

Definition: face, edge and vertex

3D (solid) shapes have **faces**, **edges** and **vertices**. A face is a flat or curved surface. An edge is where two faces meet. A vertex is a corner where edges meet.



Key fact: 3D shapes

Shape	Faces	Edges	Vertices
Cube	6 (squares)	12	8
Cuboid	6 (rectangles)	12	8
Square-based pyramid	5	8	5
Cylinder	3 (2 flat, 1 curved)	2 curved	0
Cone	2 (1 flat, 1 curved)	1 curved	1
Sphere	1 curved	0	0

Worked example 2

Describe a cuboid.

A cuboid has 6 rectangular faces, 12 edges and 8 vertices. A cube is a special cuboid because all of its faces are squares.

Worked example 3

Which 3D shape has 5 faces and 5 vertices?

A square-based pyramid has a square base and 4 triangular faces, so 5 faces. It has 5 vertices. The answer is a **square-based pyramid**.

Sorting shapes

Method: sorting shapes

1. Choose a rule, for example "has curved sides" or "has 4 vertices".
2. Check each shape against the rule.
3. Put each shape in the right group.

Worked example 4

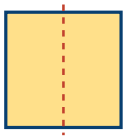
Sort the 2D shapes triangle, square, circle and rectangle into "has 4 sides" and "does not have 4 sides".

Has 4 sides: **square and rectangle**. Does not have 4 sides: **triangle (3 sides) and circle (1 curved side)**.

Symmetry

Definition: line of symmetry

A **line of symmetry** is a line that splits a shape into two halves that match exactly. If you fold along the line, one half fits perfectly on top of the other half.



A square has 4 lines of symmetry. This picture shows one of them.

Key fact: lines of symmetry

- A rectangle (that is not a square) has 2 lines of symmetry.
- A square has 4 lines of symmetry.
- A circle has lots of lines of symmetry.
- An equilateral triangle has 3 lines of symmetry.

Worked example 5

How many lines of symmetry does a rectangle have?

You can fold a rectangle in half across the middle in two ways: top to bottom and left to right. A rectangle has **2 lines of symmetry**. The diagonal is NOT a line of symmetry.

Shapes around us

Shapes are everywhere. A wheel is a circle and a football is a sphere. A window is often a rectangle or a square. A tent can be a triangular prism. A party hat looks like a cone. An ice cream cone is a cone, too. A tin of soup is a cylinder. Architects use shapes in their designs for houses and bridges.

Worked example 6

Which 2D shape can you see on the face of a cube?

Each face of a cube is a **square**. A cube has 6 square faces.

Worked example 7

A shape has 4 sides and 4 vertices. Opposite sides are equal and all the angles are right angles. It is not a square. What is it?

A shape with 4 sides, opposite sides equal and right angles is a **rectangle**.

Watch out

A square is a special rectangle, but a rectangle that is not a square has only 2 lines of symmetry. A sphere is NOT a circle: a circle is flat (2D) and a sphere is solid (3D). Also be careful: a cylinder has 2 flat faces and 1 curved face, and a cube has 12 edges, not 6.

Did you know?

The Great Pyramid in Egypt is a square-based pyramid. It is about 4500 years old and has 4 triangular faces and a square base. Bees build honeycomb from hexagons, because hexagons fit together with no gaps and use the least wax.

Otto's tip

To count the sides of a 2D shape, put a finger on one vertex and count each side as you go round. Make a mark so you know where you started. For 3D shapes, count faces first, then edges, then vertices, and use a model if you can.