28 GEOMETRY AND MEASURE: 3D SHAPES

LEARNING OBJECTIVES

- Classify three- and four-sided shapes
- Identify properties of 3D shapes
- Construct and interpret plans and elevations of 3D shapes
- Sketch nets of solids

SPECIFICATION LINKS

- G12, G13

STARTER ACTIVITY

- **What am I?; 5 minutes; page 180**
  Tell the student that you are thinking of one of the 2D shapes on the page. The student may ask you questions about this shape but the only answers you can give are 'yes' or 'no'. They can ask up to 10 questions to correctly identify the shape. Repeat but with the student choosing a shape and you asking the questions.

MAIN ACTIVITIES

- **3D shapes; 25 minutes; page 181**
  For each 3D shape, ask the student to work out:
  a) the number of vertices b) the number of edges c) the number of faces.
  Establish that a prism is a 3D shape with the same cross-section all along its length. Invite the student to identify prisms in the room.
- **Construct; 15 minutes; page 182**
  Multilink cubes work well for this activity; alternatively, you could use dice stuck together with sticky tack.

PLENARY ACTIVITY

- **Name a shape; 5 minutes**
  Ask the student to name a shape that:
  a) has no vertices (sphere) b) has 8 vertices (cube/cuboid) c) has 1 edge (cone)
  d) has 6 edges (triangular-based prism) e) has 2 faces (cone) f) has 1 face (sphere)
  g) has 6 faces (cube/cuboid) h) has 1 vertex (cone)

HOMEWORK ACTIVITY

- **Nets of a cube; 30 minutes; page 183**
  You may need to reinforce to the student that reflections and rotations of a net do not count as a different net.

SUPPORT IDEA

- **3D shapes/Construct** Provide the student with an object in each of the 3D shapes listed to help them count its vertices, edges and faces. You could ask them to find an object for each shape around the room or to think of real-life examples.

EXTENSION IDEAS

- **3D shapes** Challenge the student to work out how many planes of symmetry each shape has (cube = 9, cuboid = 3, cylinder = infinite, square-based pyramid = 4, triangular-based pyramid = 6, cone = infinite, sphere = infinite). You could also ask them to sketch a net for each shape.
- **Construct** Create more complex 3D shapes and ask the student to sketch the plan and front and side elevations.

PROGRESS AND OBSERVATIONS

STARTER ACTIVITY: WHAT AM I?

TIMING: 5 MINS

LEARNING OBJECTIVES

- Classify three- and four-sided shapes

EQUIPMENT

none

1. Guess which of these shapes your tutor is thinking of by asking up to 10 yes or no questions.

square	**parallelogram**	**rhombus**
trapezium	**kite**	**rectangle**
isosceles triangle	**equilateral triangle**	**right-angled triangle**
	scalene triangle	

MAIN ACTIVITY: 3D SHAPES

TIMING: 25 MINS

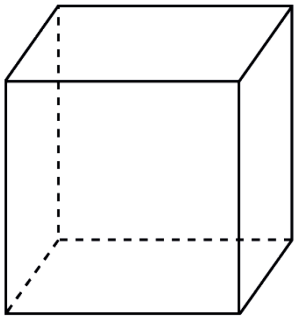
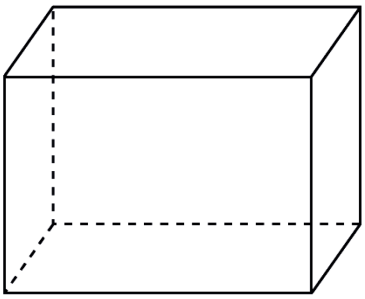
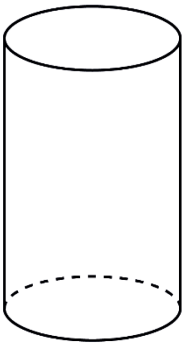
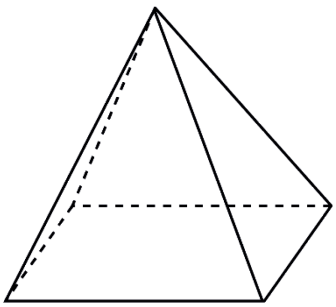
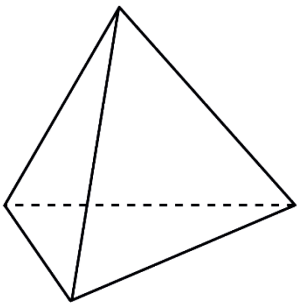
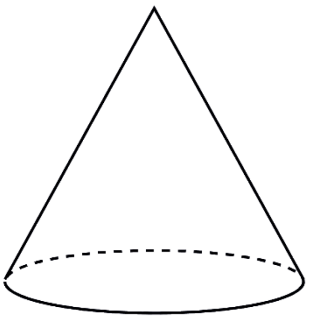
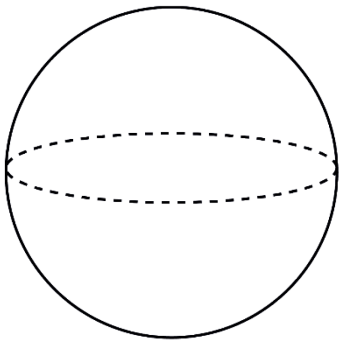
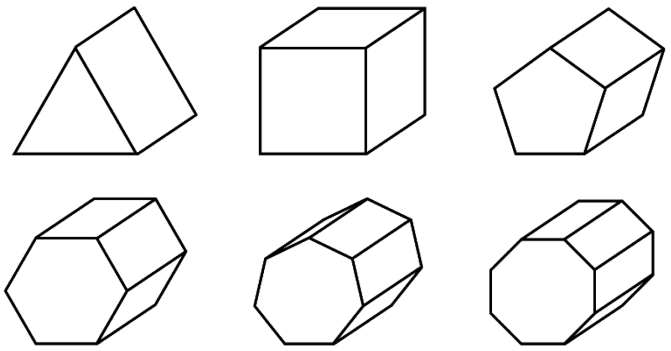
LEARNING OBJECTIVES

- Identify properties of 3D shapes

EQUIPMENT

none

1. How many vertices, edges and faces does each of these shapes have? Write your answers around the shapes.

<table>
<tr><td>cube
  </td><td>cuboid
  </td><td>cylinder
  </td></tr>
<tr><td>square-based pyramid
  </td><td>triangular-based pyramid
  </td><td>cone
  </td></tr>
<tr><td>sphere
  </td><td colspan="2">prisms
  </td></tr>
</table>

MAIN ACTIVITY: CONSTRUCT

TIMING: 15 MINS

LEARNING OBJECTIVES

- Construct and interpret plans and elevations of 3D shapes

EQUIPMENT

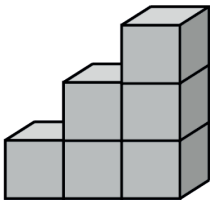
- cubes

The **plan** of a shape is the view from above – think 'bird's eye view'.

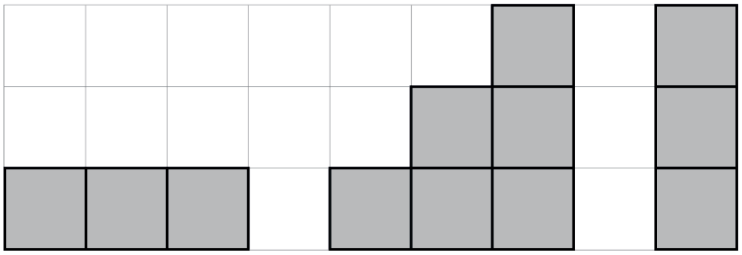
The **front** and **side elevations** are the views from the front and side.

Example:

Here is a shape made of cubes.

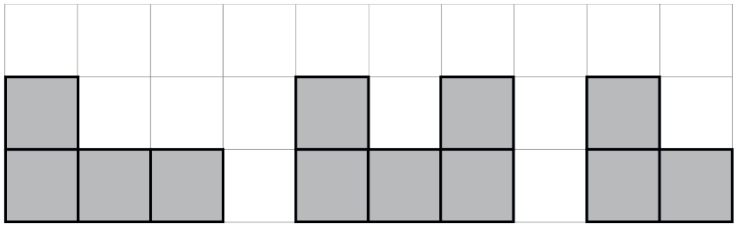


Here are the plans and elevations for the shape.



1. Make or draw your own 3D shape made of cubes. Then sketch its plan, front and side elevation.

2. Make or sketch the 3D shape that has this plan, front elevation and side elevation.



HOMEWORK ACTIVITY: NETS OF A CUBE

TIMING: 30 MINS

LEARNING OBJECTIVES

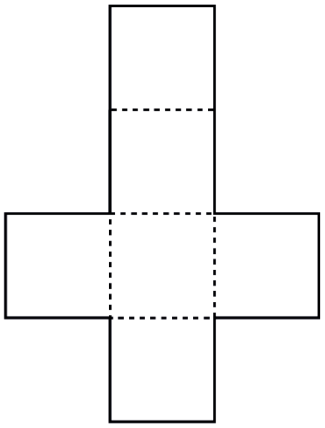
- Sketch nets of solids

EQUIPMENT

none

There are many different nets that fold to make a cube.

Here is one possible net.



1. Draw as many different nets that fold to make a cube as you can.

Remember that rotations and reflections do not count as different nets.

28 ANSWERS

STARTER ACTIVITY: WHAT AM I?

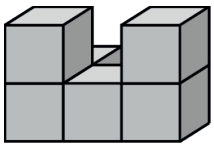
1. Check student names shapes correctly and can answer questions about their shape.

MAIN ACTIVITY: 3D SHAPES

1.

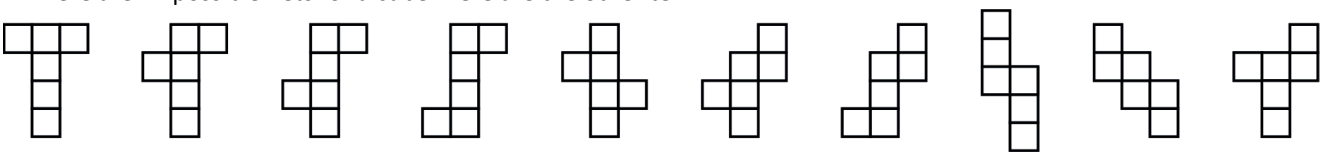
cube 8 vertices, 12 edges, 6 faces	**cuboid** 8 vertices, 12 edges, 6 faces	**cylinder** 0 vertices, 2 edges, 3 faces
square-based pyramid 5 vertices, 8 edges, 5 faces	**triangular-based pyramid** 4 vertices, 6 edges, 4 faces	**cone** 1 vertex, 1 edge, 2 faces
sphere 0 vertices, 0 edges, 1 face	**prisms** triangular: 6 vertices, 9 edges, 5 faces cuboid: 8 vertices, 12 edges, 6 faces pentagonal: 10 vertices, 15 edges, 7 faces hexagonal: 12 vertices, 18 edges, 8 faces heptagonal: 14 vertices, 21 edges, 9 faces octagonal: 16 vertices, 24 edges, 10 faces	

MAIN ACTIVITY: CONSTRUCT

1. Check student's answer.
2. 

HOMEWORK ACTIVITY: NETS OF A CUBE

1. There are 11 possible nets for a cube. Here are the other ten:



GLOSSARY

Plan view
The view of an object from directly above

Side/front elevation
The view of an object from the side/front

Net
A flat pattern than can be folded up to make a 3D shape