

3D Shapes - Faces, Edges and Vertices

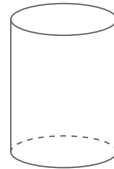
Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (3 marks)

- (a) Write down the mathematical name of this solid shape.



It has two flat circular ends joined by one curved surface.

Answer: Cylinder

Tip: Give the name of the **3-D** solid. “Circle” is a 2-D shape, so it scores no marks.

- (b) Write down the mathematical name of this solid shape.

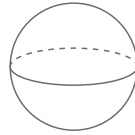


It has one flat circular base and a curved surface that goes up to a point.

Answer: Cone

Tip: Just write “cone”. “Triangle” and “circle” are 2-D shapes, so they score no marks.

- (c) Write down the mathematical name of this solid shape.



It is a ball shape, with one curved surface and no flat faces.

Answer: Sphere

Tip: “Circle” is a 2-D shape, so it scores no marks. The 3-D solid is a sphere.

2 (2 marks)

The diagram shows a pyramid.

The base of the pyramid is a pentagon.

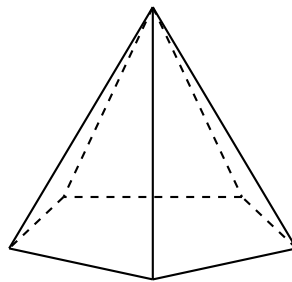


*Diagram **NOT** accurately drawn*

- (a) Write down the number of vertices of the pyramid.

The base is a pentagon, so it has 5 corners.

There is 1 more vertex at the top of the pyramid.

$$5 + 1 = 6$$

Answer: 6

- (b) Write down the number of edges of the pyramid.

There are 5 edges round the pentagon base.

There are 5 sloping edges going up to the top.

$$5 + 5 = 10$$

Answer: 10

Tip: Count the edges you cannot see as well (the dashed lines). Edges are the lines where two faces meet.

3 (2 marks)

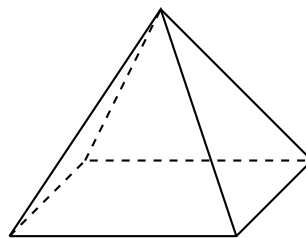
- (a) In the space below, draw a sketch of a square-based pyramid.

Draw a square base (it looks like a parallelogram when you draw it in 3-D).

Mark a point above the middle of the base.

Join each corner of the base to that point.

For example:



Answer: A sketch of a square-based pyramid

Tip: All four sloping edges must meet at **one** point at the top. If the top is a line, you have drawn a prism.

- (b) Write down the number of faces of a square-based pyramid.

The base is a square: 1 face.

There is a triangle above each side of the square: 4 faces.

$$1 + 4 = 5$$

Answer: 5

Tip: Don't forget the square base. It is a face too, even though the pyramid stands on it.

4 (2 marks)

Here is a 3-D shape.

Some of its vertices are labelled.

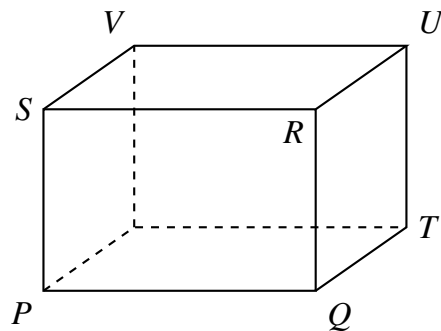


Diagram **NOT** accurately drawn

(a) Write down the name of this 3-D shape.

It has 6 faces and every face is a rectangle.

Answer: Cuboid

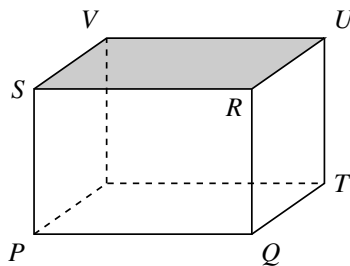
Tip: “Rectangle” is a 2-D shape, so it scores no marks. The 3-D shape is a cuboid.

(b) Shade in the face $RUVS$.

Find the corners R , U , V and S on the diagram.

R to U , U to V , V to S and S back to R are all edges, so they go round one face.

$RUVS$ is the top face of the cuboid.



Answer: The top face shaded

Tip: The letters go round the face in order. Check that each letter is joined to the next one by an edge.

5 (2 marks)

A hexagonal prism has two ends that are hexagons.

Write down the number of faces, edges and vertices of a hexagonal prism.

A hexagon has 6 sides.

Faces: 2 hexagon ends + 6 rectangles = 8

Edges: 6 on each end + 6 joining the ends = $6 + 6 + 6 = 18$

Vertices: 6 on each end = $6 + 6 = 12$

Answer: 8 faces, 18 edges, 12 vertices

Marks: 2 marks for all three correct. 1 mark for two correct.

6 (2 marks)

Here is a prism.

Each end of the prism is an octagon.

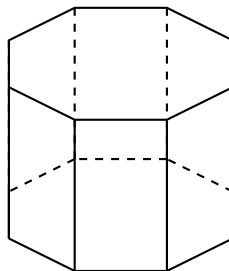


*Diagram **NOT** accurately drawn*

(a) Write down the number of faces of the prism.

There are 2 octagon faces, one at each end.

An octagon has 8 sides, so there are 8 rectangles joining the two ends.

$$2 + 8 = 10$$

Answer: 10

Tip: Count the faces at the back that you cannot see as well.

(b) Write down the number of vertices of the prism.

Each octagon end has 8 vertices (corners).

$$8 + 8 = 16$$

Answer: 16

7 (2 marks)

The diagram shows a square-based pyramid.

All the edges of the pyramid are the same length.

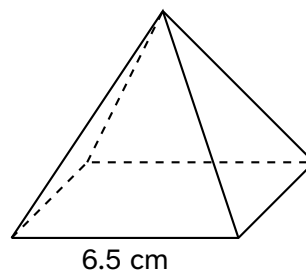


Diagram **NOT** accurately drawn

Work out the total length of the edges of the pyramid.

There are 4 edges round the square base.

There are 4 sloping edges going up to the top.

So the pyramid has $4 + 4 = 8$ edges.

$$8 \times 6.5 = 52 \text{ cm}$$

Answer: 52 cm

Tip: Count the edges, not the faces or the vertices. A square-based pyramid has 5 faces and 5 vertices, but 8 edges.

Marks: 1 mark for (number of edges) $\times$ 6.5, e.g. 8×6.5 . 1 mark for 52.

8 (4 marks)

Here is a triangular prism.

The two ends of the prism are equilateral triangles.

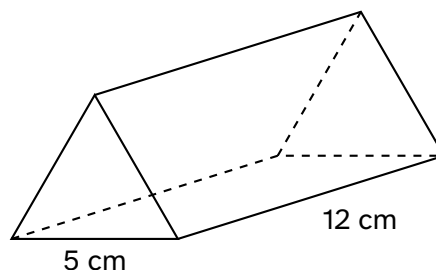


Diagram **NOT** accurately drawn

- (a) Write down the number of vertices of the prism.

Each triangular end has 3 corners.

$$3 + 3 = 6$$

Answer: 6

- (b) Write down the number of faces of the prism.

The two ends are triangles: 2 faces.

Each side of the triangle is joined to the other end by a rectangle: 3 faces.

$$2 + 3 = 5$$

Answer: 5

- (c) Work out the total length of all the edges of the prism.

Each triangular end has 3 edges of length 5 cm, so the two ends have 6 edges of 5 cm.

$$6 \times 5 = 30 \text{ cm}$$

There are 3 long edges of 12 cm joining the two ends.

$$3 \times 12 = 36 \text{ cm}$$

Total: $30 + 36 = 66 \text{ cm}$

Answer: 66 cm

Tip: The edges are not all the same length. Count the short edges on the ends and the long edges separately.

Marks: 1 mark for 6×5 or 3×12 . 1 mark for 66.

9 (2 marks)

Here is a cuboid.

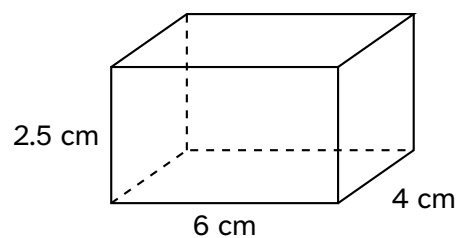


Diagram **NOT** accurately drawn

Work out the total length of all the edges of the cuboid.

A cuboid has 12 edges.

There are 4 edges of each length: 6 cm, 4 cm and 2.5 cm.

$$4 \times 6 = 24$$

$$4 \times 4 = 16$$

$$4 \times 2.5 = 10$$

$$\text{Total: } 24 + 16 + 10 = 50 \text{ cm}$$

Answer: 50 cm

Tip: Don't just add $6 + 4 + 2.5 = 12.5$. That only counts 3 of the 12 edges.

Marks: 1 mark for a correct method, e.g. $4 \times (6 + 4 + 2.5)$. 1 mark for 50.

10 (3 marks)

Rosie has a piece of wire 2 m long.
She is going to make some frames in the shape of a cube.
She needs wire for every edge of each frame.
Each edge of a frame is 7 cm long.
Work out the greatest number of frames Rosie can make.

A cube has 12 edges.

Wire for one frame: $12 \times 7 = 84$ cm

Change 2 m into cm: $2 \text{ m} = 200 \text{ cm}$

$200 \div 84 = 2.38 \dots$

Rosie can make 2 whole frames (two frames use 168 cm; three would need 252 cm).

Answer: 2 frames

Tip: Change 2 m into 200 cm first. Then round down: Rosie cannot make part of a frame.

Marks: 1 mark for $12 \times 7 (= 84)$. 1 mark for $200 \div 84$, or for $84 + 84 = 168$ and $84 + 84 + 84 = 252$ (both amounts in cm). 1 mark for 2.
