4.20 3D Shapes, Plans and Elevations: Test Pack

Calculators not allowed · about 55 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

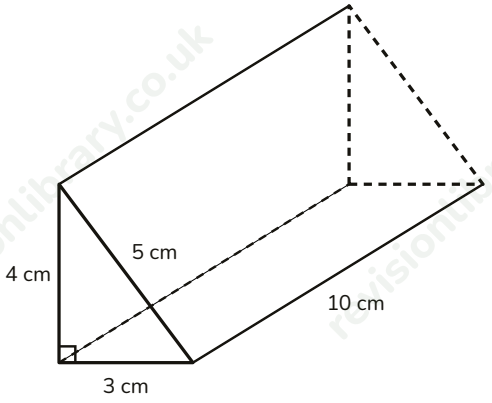
1 Write down the name of a solid that has 6 square faces, 12 equal edges and 8 vertices.

(1)

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2 A solid is a right triangular prism with triangular cross-section sides 3 cm, 4 cm, 5 cm and length 10 cm. Calculate the volume of the prism. (Area of triangle = 1/2 x base x height.)

Diagram NOT accurately drawn



(3)

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3 A right circular cylinder and a right prism stand with their bases horizontal. Explain how their top plans distinguish them, and describe the outline of the cylinder's front elevation.

(2)

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4 A student folds a net of a cube but one face is attached in the wrong place. Which properties of plans and elevations would show that the folded solid is not a cube? Give two properties to check.

(2)

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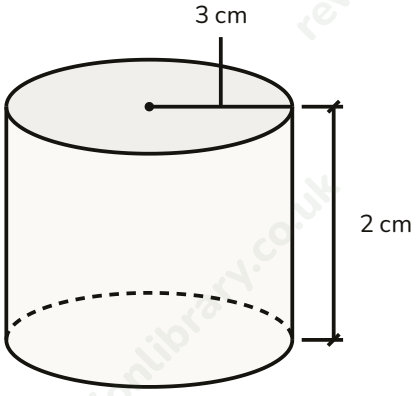
5 Eight identical small cubes of side 2 cm are arranged to form a larger cube. The small cube at the upper front right corner is then removed. Draw the top plan and front elevation, including visible edges, and calculate the total surface area of the resulting shape.

(5)

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6 A cylinder has radius 3 cm and height 2 cm. Work out its volume in terms of π.

Diagram NOT accurately drawn

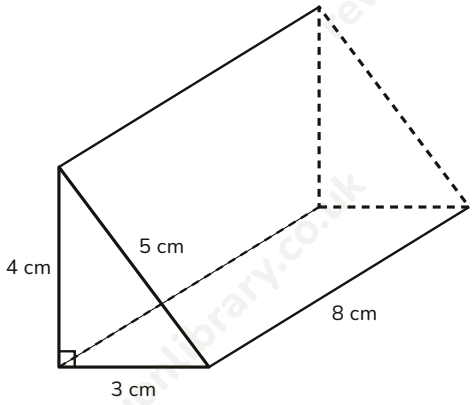


(3)

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7 A triangular prism has a right-angled triangle as its cross-section. The triangle has sides 3 cm, 4 cm and 5 cm (the longest side is 5 cm). The prism is 8 cm long. Work out the total surface area.

Diagram NOT accurately drawn



(4)

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8 A solid has 6 faces and 8 vertices. Use Euler's formula, F + V - E = 2, to work out the number of edges.

(2)

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

(2)

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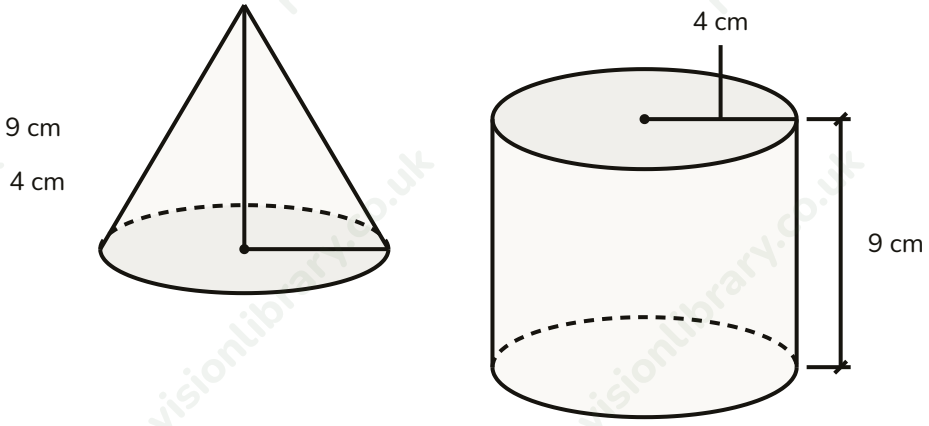
10 Draw the front elevation and a top plan for a cube with a small square hole cut through the centre from the top to the bottom. The cube has side 6 cm. The hole is a square of side 2 cm centred on the cube. Describe the shapes seen in the front elevation and top plan.

(3)

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11 A cone and a cylinder have the same base radius 4 cm and the same height 9 cm. State whether the cone has the same volume as the cylinder. Give a brief reason.

Diagram NOT accurately drawn

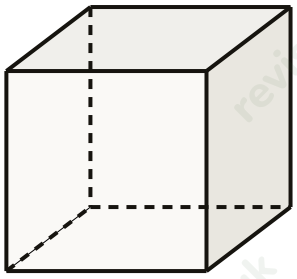


(2)

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12 A cube has side length 6 cm. Work out its total surface area.

Diagram NOT accurately drawn



6 cm

(2)

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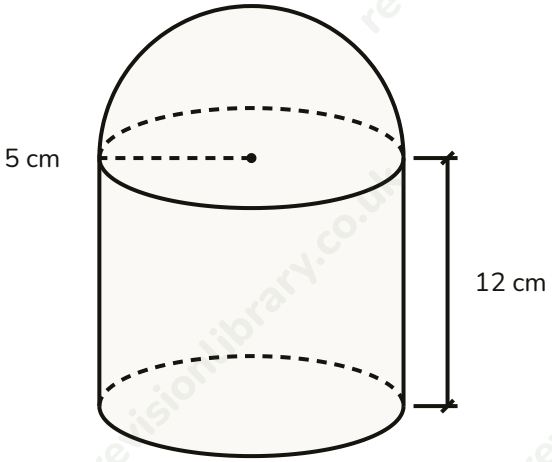
13 Identify the net of a square-based pyramid from these descriptions and give a reason: (i) four triangles attached to a non-square rectangle, (ii) one square and four rectangles attached, (iii) one square and four isosceles triangles attached.

(2)

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14 A solid is made by attaching a hemisphere of radius 5 cm to the flat face of a cylinder of radius 5 cm and height 12 cm. Write down the shapes you would see in the top plan and the front elevation.

Diagram NOT accurately drawn

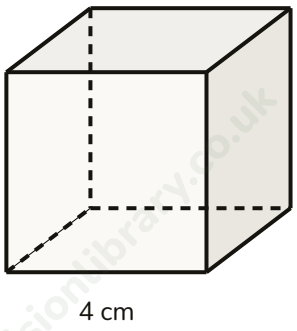


(3)

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15 A cube has side length 4 cm. A cross-shaped net is folded to make the cube. Calculate the length of the diagonal across one face and give the units.

Diagram NOT accurately drawn



(2)

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16 A rectangular block has width 10 cm across the front, depth 7 cm from front to back and vertical height 4 cm. Give the rectangle dimensions of the top plan, front elevation and side elevation, in cm.

(2)

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17 A cone has height 9 cm and base radius 4 cm. State how many curved faces, flat faces and edges it has.

(2)

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Mark scheme · 4.20 3D Shapes, Plans and Elevations: Test Pack

A correct answer earns full marks unless the question asks for working, a method, proof or explanation.

Question 1

Cube cao	**B1**

Answer: **Cube**

Question 2

finds area of triangular cross-section using base 3 and height 4 or recognises right triangle area = 1/2 x 3 x 4 = 6	**M1**
multiplies area by length 10 correctly to get volume method	**M1**
volume = 60 cm³ cao	**A1**

Answer: **60 cm^3**

Question 3

identifies a circular top plan for the cylinder and a polygonal top plan matching the base for the prism	**B1**
states that the cylinder has a rectangular front elevation with straight outline edges	**B1**

Answer: **The cylinder has a circular top plan; the prism has a polygonal top plan matching its base. The cylinder's front elevation is a rectangle with straight outline edges.**

Question 4

first correct property such as unequal face sizes or non-square faces	**B1**
second correct property such as misaligned vertices/edges so elevations do not match or incorrect number of faces visible in elevation	**B1**

Answer: **Check that all faces are squares of the same size; check that edges and vertices line up in the elevations (no misaligned edges or wrong number of faces visible)**

Question 5

top plan has a complete 4 cm by 4 cm square outline, with an internal L-shaped step boundary separating the front right 2 cm by 2 cm region from the rest	**B1**
front elevation has a complete 4 cm by 4 cm square outline, with an internal L-shaped step boundary separating the upper right 2 cm by 2 cm region from the rest	**B1**
finds surface area of the complete 2x2x2 cube (side 4 cm) = 6 x 4^2 = 96 cm², or equivalently 8 x (6 x 2^2) = 192 total minus 96 cm² for the 12 internal shared faces	**M1**
recognises that removing a corner cube takes away 3 exterior faces (3 x 2^2 = 12 cm²) but exposes 3 new faces of equal total area (3 x 2^2 = 12 cm²), leaving the surface area unchanged	**M1**
final surface area = 96 cm² cao	**A1**

Answer: **Top plan and front elevation both have complete 4 cm by 4 cm square outlines. Internal L-shaped step edges bound the front right 2 cm by 2 cm region in the plan and the upper right 2 cm by 2 cm region in the elevation. Surface area = 6 x 4^2 - 3 x 2^2 + 3 x 2^2 = 96 cm^2.**

Question 6

π x 3^2	**M1**
x 2	**M1**
18 π cm^3 cao	**A1**

Answer: **18 π cm^3**

Question 7

two triangles: 2 x 1/2 x 3 x 4 = 12	**M1**
perimeter of triangle x length: 12 x 8	**M1**
adds the triangles and the rectangles	**M1**
108 cm² cao	**A1**

Answer: **108 cm^2**

Question 8

6 + 8 - E = 2 or E = 6 + 8 - 2	**M1**
12 cao	**A1**

Answer: **12**

Question 9

two of the three numbers correct	**M1**
7 faces, 15 edges, 10 vertices cao	**A1**

Answer: **7 faces, 15 edges, 10 vertices**

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Question 10

identifies front elevation shows a plain 6 cm by 6 cm square with no hole visible (the hole runs from the top to the bottom, so it is hidden from the front)	M1
identifies top plan shows a square with a central square hole of side 2 cm	M1
both descriptions correct and refer to sizes or relative positions (eg central small square) cao	A1

Answer: **Front elevation: a plain 6 cm by 6 cm square (the 2 cm hole runs from top to bottom, so it cannot be seen from the front); Top plan: a 6 cm square with a central 2 cm square hole centred inside**

Question 11

some correct idea about relationship of cone and cylinder volumes e.g. cone volume = (1/3) cylinder volume if same height	M1
answer stating cone could not have same volume unless its height was 27 cm (cao) or explaining ratio 1:3	A1

Answer: **No. A cone with the same base and height has volume 1/3 of the cylinder; to equal the cylinder the cone would need height 27 cm (1/3 rule) so with height 9 cm it is smaller**

Question 12

6×6^2 or 36 seen	M1
216 cm² cao	A1

Answer: **$216\ cm^2$**

Question 13

chooses (iii) as the correct net	B1
gives reason that a square-based pyramid has triangular faces meeting at a point (oe)	B1

Answer: **(iii) because a square base with four triangular faces (isosceles) forms a square-based pyramid**

Question 14

identifies top plan shows a circle of radius 5 cm	M1
identifies front elevation shows a rectangle (cylinder height 12) topped by a semicircle (hemisphere) or a half-circle profile	M1
both descriptions correct and mention radius/height or semicircle shape cao	A1

Answer: **Top plan: circle radius 5 cm. Front elevation: rectangle 12 cm high with a semicircle of radius 5 cm on top (the hemisphere appears as a half-circle)**

Question 15

uses Pythagoras correctly: $\text{diagonal}^2 = 4^2 + 4^2$	M1
diagonal = $4\sqrt{2}$ cm or 5.657... cm cao	A1

Answer: **$4\sqrt{2}$ cm**

Question 16

gives two of the three plans correct	M1
all three correct: 10 x 7, 10 x 4, 7 x 4 cao	A1

Answer: **Top: 10 x 7, Front: 10 x 4, Side: 7 x 4**

Question 17

identifies two categories correctly (eg curved face = 1 and flat face = 1)	M1
all three correct: 1 curved face, 1 flat face, 1 edge cao	A1

Answer: **Curved faces = 1, Flat faces = 1, Edges = 1**

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