3.6 3D Pythagoras and Trigonometry: 1-hour Pack

AQA 8365 · Calculator allowed · about 60 minutes

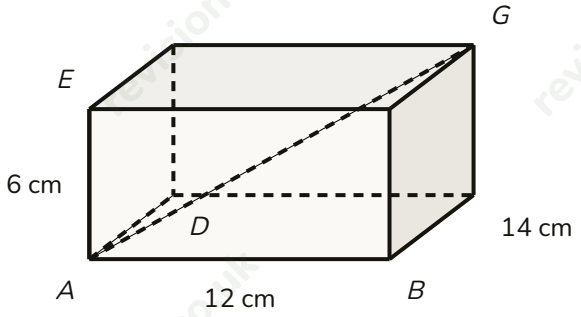
Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A cuboid ABCDEFGH has AB = 12 cm, AD = 14 cm and AE = 6 cm. Calculate the angle between the diagonal AG and the edge AE. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

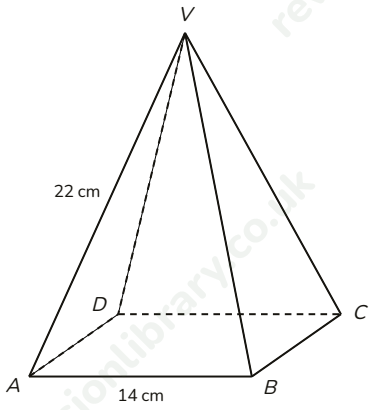


(Total for Question 1 is 3 marks)

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2 A pyramid has a square base ABCD with sides of length 14 cm. The apex V is directly above the centre of the base. Each sloping edge, such as VA, is 22 cm long. Calculate the height of the pyramid. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

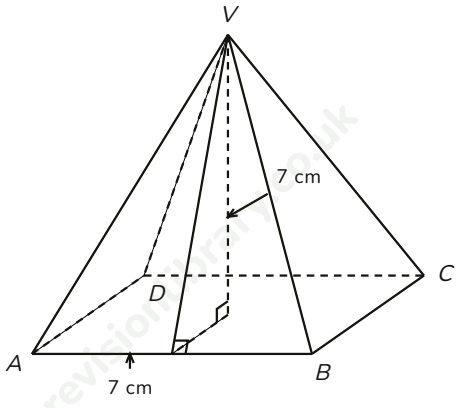


(Total for Question 2 is 3 marks)

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3 A pyramid has a square base ABCD with sides of length 7 cm. The apex V is 7 cm directly above the centre of the base. Calculate the angle between the sloping face VAB and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

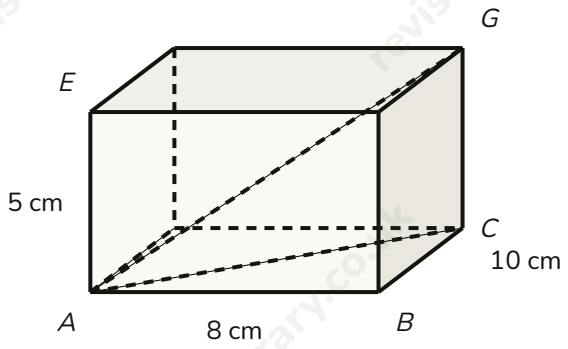


(Total for Question 3 is 3 marks)

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4 A cuboid ABCDEFGH has AB = 8 cm, BC = 10 cm and AE = 5 cm. Calculate the angle between the diagonal AG and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

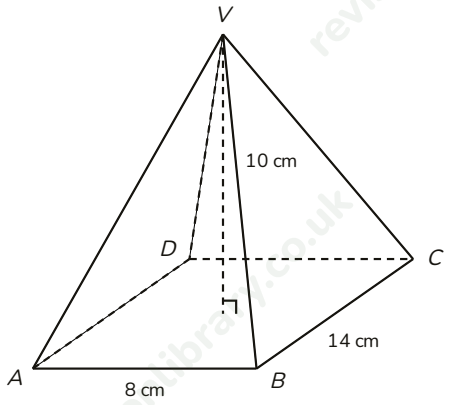


(Total for Question 4 is 3 marks)

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5 A pyramid has a rectangular base ABCD with AB = 8 cm and BC = 14 cm. The apex V is 10 cm vertically above the centre of the base. Calculate the length of the sloping edge VA. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

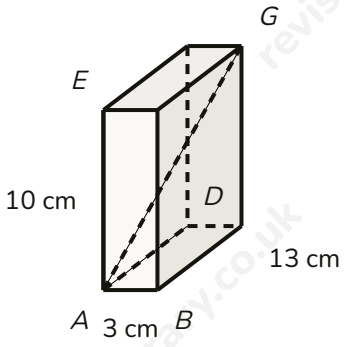


(Total for Question 5 is 3 marks)

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6 A cuboid ABCDEFGH has AB = 3 cm, AD = 13 cm and AE = 10 cm. Calculate the angle between the diagonal AG and the edge AE. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

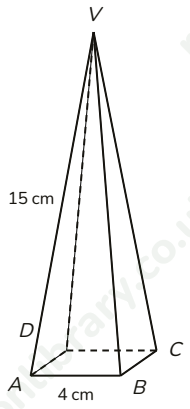


(Total for Question 6 is 3 marks)

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7 A pyramid has a square base ABCD with sides of length 4 cm. The apex V is directly above the centre of the base. Each sloping edge, such as VA, is 15 cm long. Calculate the height of the pyramid. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

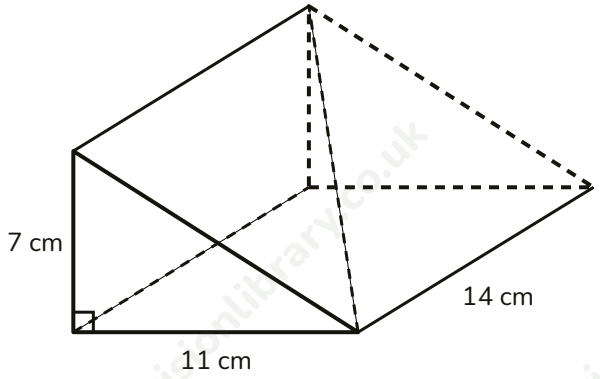


(Total for Question 7 is 3 marks)

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8 A triangular prism has a right-angled triangle as its cross-section, with perpendicular sides 11 cm and 7 cm. The length of the prism is 14 cm. Calculate the length of the longest straight line that can be drawn on or inside the prism, from one corner to the opposite corner. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

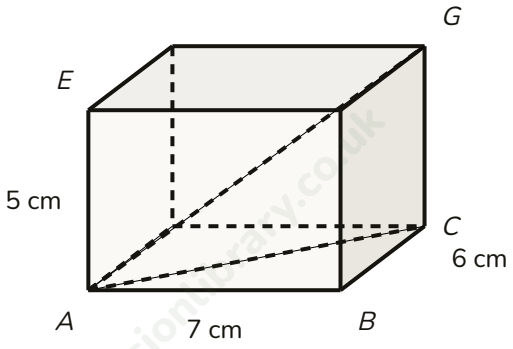


(Total for Question 8 is 3 marks)

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9 A cuboid ABCDEFGH has AB = 7 cm, BC = 6 cm and AE = 5 cm. Calculate the angle between the diagonal AG and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

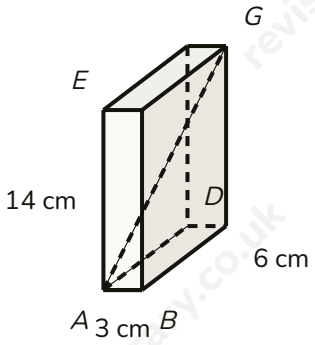


(Total for Question 9 is 3 marks)

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10 A cuboid ABCDEFGH has AB = 3 cm, AD = 6 cm and AE = 14 cm. Calculate the angle between the diagonal AG and the edge AB. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

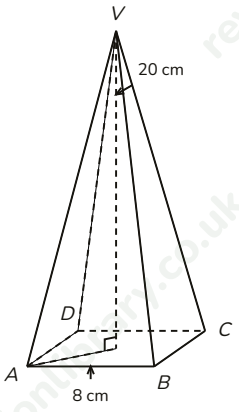


(Total for Question 10 is 3 marks)

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11 A pyramid has a square base ABCD with sides of length 8 cm. The apex V is 20 cm directly above the centre of the base. Calculate the angle between the sloping edge VA and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

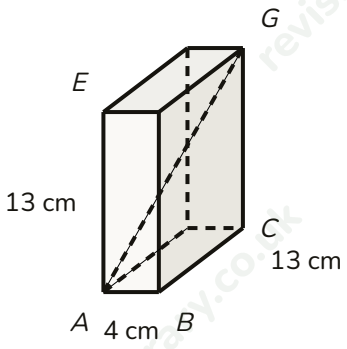


(Total for Question 11 is 3 marks)

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12 A cuboid ABCDEFGH has length AB = 4 cm, width BC = 13 cm and height AE = 13 cm.
Calculate the length of the diagonal AG. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

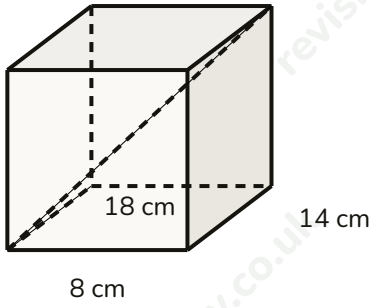


(Total for Question 12 is 3 marks)

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13 A cuboid has length 8 cm and width 14 cm. The length of its space diagonal is 18 cm. Work out the height of the cuboid.

Diagram NOT accurately drawn

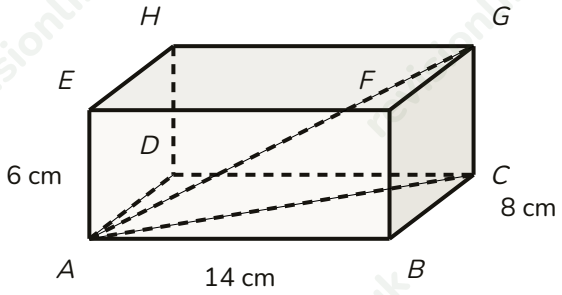


(Total for Question 13 is 3 marks)

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14 A cuboid ABCDEFGH has AB = 14 cm, BC = 8 cm and AE = 6 cm. Calculate the angle between the diagonal AG and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

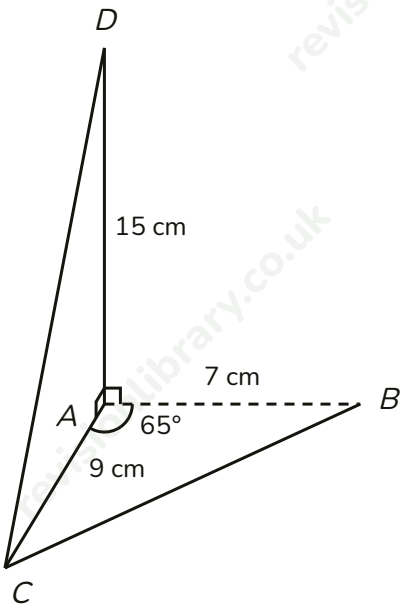


(Total for Question 14 is 3 marks)

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15 D is a point vertically above A, with DA = 15 cm perpendicular to the horizontal plane containing triangle ABC. In triangle ABC, AB = 7 cm, AC = 9 cm and angle BAC = 65 degrees.

Diagram NOT accurately drawn



(a) Use the cosine rule to find the length BC, giving your answer correct to 3 significant figures. **(3)**

.....

(b) Calculate the length DC, giving your answer correct to 3 significant figures. **(3)**

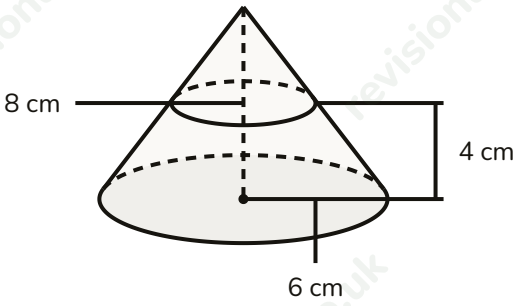
.....

(Total for Question 15 is 6 marks)

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16 A cone has base radius 6 cm and vertical height 8 cm.

Diagram NOT accurately drawn



(a) Find the slant height of the cone. **(2)**

.....

(b) Find the semi-vertical angle of the cone (the angle between the slant height and the vertical axis), giving your answer correct to 1 decimal place. **(2)**

.....

(c) The cone is cut by a plane parallel to the base, at a height of 4 cm from the base, creating a smaller cone on top. Find the radius of the circular cross-section where the cut is made. **(2)**

.....

(Total for Question 16 is 6 marks)

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Mark scheme · 3.6 3D Pythagoras and Trigonometry: 1-hour Pack

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

Question 1

AG = $\sqrt{376}$ = 19.391	**M1**
cos (angle) = 6 / AG (triangle A-E-G is right-angled)	**M1**
72.0 degrees cao	**A1**

Answer: 72.0 degrees

Question 2

AC = $\sqrt{14^2 + 14^2}$ or half-diagonal = 9.899	**M1**
$h^2 = 22^2$ - (half diagonal)^2 = 386.00	**M1**
19.6 cm cao	**A1**

Answer: 19.6 cm

Question 3

right-angled triangle with the vertical height identified	**M1**
M is the midpoint of AB; tan (angle) = 7 / 3.5	**M1**
63.4 degrees cao	**A1**

Answer: 63.4 degrees

Question 4

AC = $\sqrt{8^2 + 10^2}$ = 12.806	**M1**
tan (angle GAC) = 5 / AC	**M1**
21.3 degrees cao	**A1**

Answer: 21.3 degrees

Question 5

AC = $\sqrt{8^2 + 14^2}$ and half of AC = 8.062	**M1**
$VA^2 = 10^2$ + (half AC)^2	**M1**
12.8 cm cao	**A1**

Answer: 12.8 cm

Question 6

AG = $\sqrt{278}$ = 16.673	**M1**
cos (angle) = 10 / AG (triangle A-E-G is right-angled)	**M1**
53.1 degrees cao	**A1**

Answer: 53.1 degrees

Question 7

AC = $\sqrt{4^2 + 4^2}$ or half-diagonal = 2.828	**M1**
$h^2 = 15^2$ - (half diagonal)^2 = 217.00	**M1**
14.7 cm cao	**A1**

Answer: 14.7 cm

Question 8

hypotenuse of the cross-section = $\sqrt{11^2 + 7^2}$	**M1**
$d^2 = (11^2 + 7^2) + 14^2$ = 366	**M1**
19.1 cm cao	**A1**

Answer: 19.1 cm

Question 9

AC = $\sqrt{7^2 + 6^2}$ = 9.220	**M1**
tan (angle GAC) = 5 / AC	**M1**
28.5 degrees cao	**A1**

Answer: 28.5 degrees

Question 10

AG = $\sqrt{241}$ = 15.524	**M1**
cos (angle) = 3 / AG (triangle A-B-G is right-angled)	**M1**
78.9 degrees cao	**A1**

Answer: 78.9 degrees

Question 11

right-angled triangle with the vertical height identified	**M1**
tan (angle) = 20 / 5.657	**M1**
74.2 degrees cao	**A1**

Answer: 74.2 degrees

Question 12

$AC^2 = 4^2 + 13^2$ (face diagonal) seen	**M1**
$AG^2 = AC^2 + 13^2$ = 354	**M1**
18.8 cm cao	**A1**

Answer: 18.8 cm

Question 13

$8^2 + 14^2 + h^2 = 18^2$	**M1**
h^2 = 64	**M1**
8 cm cao	**A1**

Answer: 8 cm

Question 14

AC = $\sqrt{14^2 + 8^2}$ = 16.125	**M1**
tan (angle GAC) = 6 / AC	**M1**
20.4 degrees cao	**A1**

Answer: 20.4 degrees

Question 15

(a) correct cosine rule set up, $BC^2 = 7^2 + 9^2$ - 2(7)(9)cos(65)	**M1**
(a) correct evaluation, BC^2 = 130 - 126cos(65) = 76.75 (accept awrt)	**M1**
(a) BC = 8.76 cm (3sf) cao	**A1**

(a) Answer: 8.76 cm (3sf)

(b) recognises triangle DAC is right-angled at A, since DA is perpendicular to the plane ABC	**M1**
(b) DC = $\sqrt{DA^2 + AC^2} = \sqrt{15^2 + 9^2}$	**M1**
(b) DC = 17.5 cm (3sf) cao	**A1**

(b) Answer: 17.5 cm (3sf)

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Question 16

(a) $l = \sqrt{6^2 + 8^2}$ **M1**

(a) l = 10 cm cao **A1**

(a) Answer: 10 cm

(b) tan(angle) = 6/8 (radius over height) **M1**

(b) angle = 36.9 degrees (1dp) cao **A1**

(b) Answer: 36.9 degrees (1dp)

(c) uses similar triangles: r/6 = 4/8 (the smaller cone's height over the original height) **M1**

(c) r = 3 cm cao **A1**

(c) Answer: 3 cm

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