HIGHER

7.15 3d Pythagoras and Trigonometry: 1-hour Pack

Total Marks

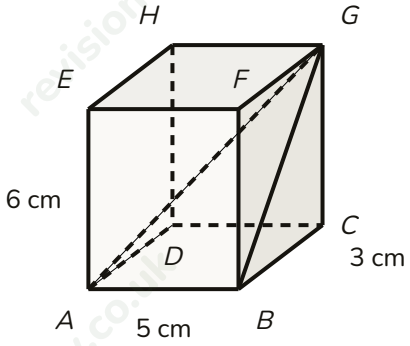
EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 ABCDEFGH is a cuboid with AB = 5 cm, BC = 3 cm and AE = 6 cm. Work out the size of angle BAG. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

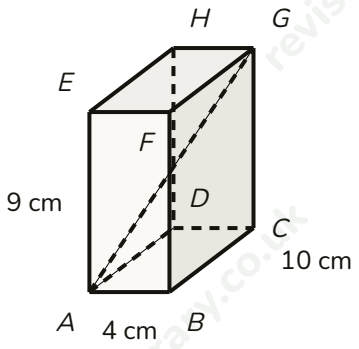


(Total for Question 1 is 4 marks)

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2 A storage crate is a cuboid measuring 4 cm by 10 cm by 9 cm. Work out the length of the longest diagonal of the storage crate. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

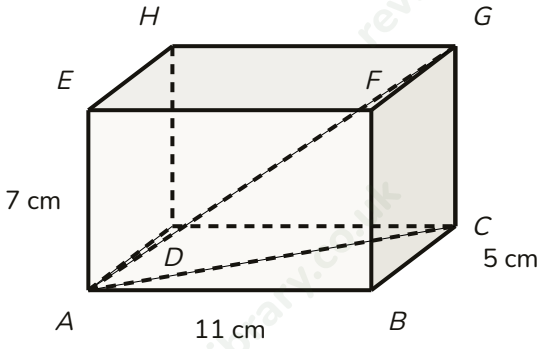


(Total for Question 2 is 3 marks)

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3 ABCDEFGH is a cuboid with AB = 11 cm, BC = 5 cm and AE = 7 cm, where ABCD is the base and AE is a vertical edge. Work out the size of the angle between the diagonal AG and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

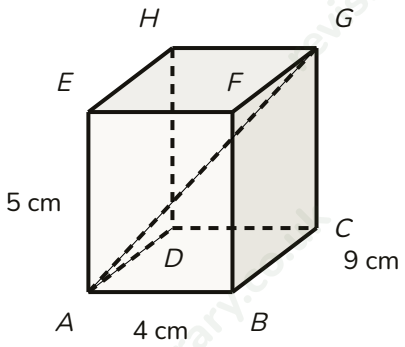


(Total for Question 3 is 4 marks)

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4 A fish tank is a cuboid measuring 4 cm by 9 cm by 5 cm. Work out the length of the longest diagonal of the fish tank. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

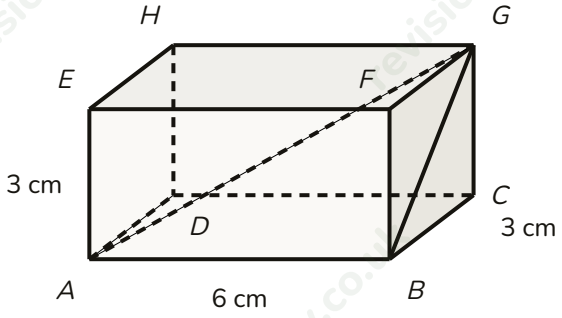


(Total for Question 4 is 3 marks)

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5 ABCDEFGH is a cuboid with AB = 6 cm, BC = 3 cm and AE = 3 cm. Work out the size of angle BAG. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

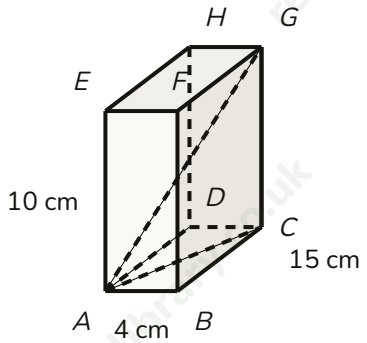


(Total for Question 5 is 4 marks)

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6 ABCDEFGH is a cuboid with AB = 4 cm, BC = 15 cm and AE = 10 cm, where ABCD is the base and AE is a vertical edge. Work out the size of the angle between the diagonal AG and the base ABCD. Give your answer correct to 1 decimal place.

Diagram NOT accurately drawn

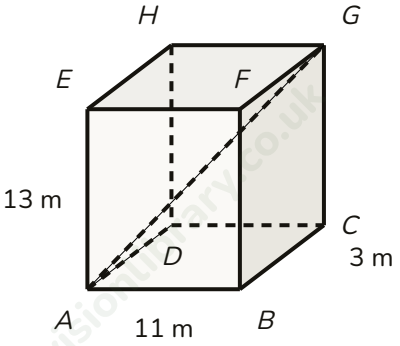


(Total for Question 6 is 4 marks)

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7 A room is a cuboid 11 m long, 3 m wide and 13 m high. Work out the length of the longest straight line from one corner of the floor to the opposite corner of the ceiling. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn



(Total for Question 7 is 3 marks)

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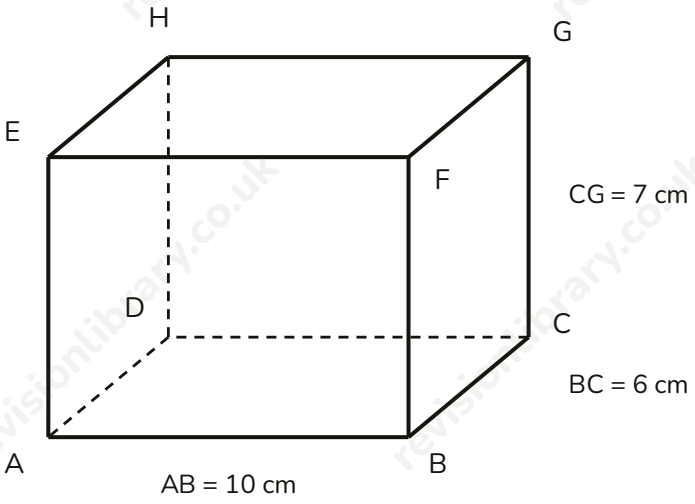
8 A rectangular pool is 9 m by 12 m. The depth at one shallow corner is 1.2 m and at the diagonally opposite deep corner is 2.4 m. A straight line runs from the shallow bottom corner to the deep bottom corner. Find the length of this line. Give your answer to 2 decimal places.

(Total for Question 8 is 3 marks)

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9 The diagram shows a cuboid ABCDEFGH with AB = 10 cm, BC = 6 cm and CG = 7 cm. E, F, G and H are directly above A, B, C and D respectively.

Diagram NOT accurately drawn



(a) Calculate the length of the diagonal AC of the base ABCD, giving your answer to 3 significant figures. **(2)**

.....

(b) Calculate the size of angle GAC, the angle between the diagonal AG and the base ABCD, giving your answer correct to 1 decimal place. **(3)**

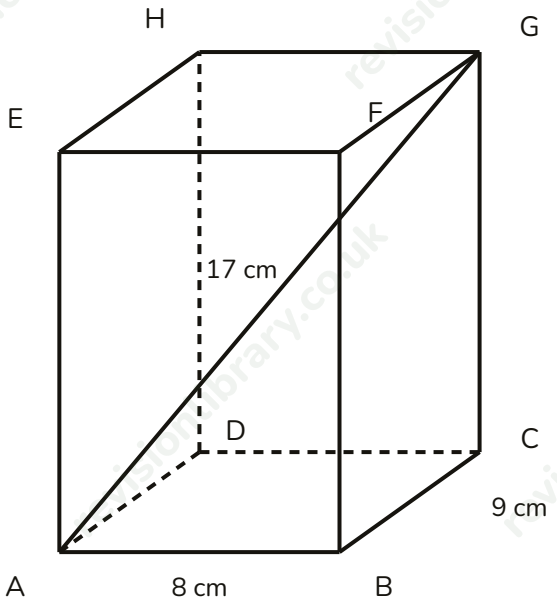
.....

(Total for Question 9 is 5 marks)

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10 The diagram shows a cuboid ABCDEFGH with AB = 8 cm and BC = 9 cm. The length of the diagonal AG is 17 cm. E, F, G and H are directly above A, B, C and D respectively.

Diagram NOT accurately drawn



(a) Calculate the length of AC, the diagonal of the base ABCD, giving your answer to 3 significant figures. **(2)**

.....

(b) Calculate the height CG of the cuboid, using the exact value of $AC^2 = 145$. **(3)**

.....

(Total for Question 10 is 5 marks)

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11 A rectangular tank inside dimensions are length 10 m, width 6 m and depth 4 m. A pipe runs from the top front-left corner of the tank to the midpoint of the bottom edge of the opposite end face. (Take the top front-left corner as point P at coordinates (0,0,4). The midpoint of that bottom edge is at (10,3,0).)

(a) Find the length of the pipe, giving your answer to 2 decimal places. **(3)**

.....

(b) Find the angle between the pipe and the base to 1 decimal place. **(4)**

.....

(Total for Question 11 is 7 marks)

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Mark scheme · 7.15 3d Pythagoras and Trigonometry: 1-hour Pack

Question 1

AG = $\sqrt{5^2 + 3^2 + 6^2}$ = 8.367	**M1**
triangle ABG has a right angle at B (BG perpendicular to AB) so cos x = 5/AG	**M1**
inverse cos used	**M1**
53.3 degrees cao	**A1**

Answer: 53.3 degrees

Question 2

base diagonal^2 = $4^2 + 10^2$	**M1**
diagonal^2 = 116 + 9^2 = 197	**M1**
14.0 cm cao	**A1**

Answer: 14.0 cm

Question 3

AC = $\sqrt{11^2 + 5^2}$ = 12.083	**M1**
tan x = 7/AC	**M1**
inverse tan used	**M1**
30.1 degrees cao	**A1**

Answer: 30.1 degrees

Question 4

base diagonal^2 = $4^2 + 9^2$	**M1**
diagonal^2 = 97 + 5^2 = 122	**M1**
11.0 cm cao	**A1**

Answer: 11.0 cm

Question 5

AG = $\sqrt{6^2 + 3^2 + 3^2}$ = 7.348	**M1**
triangle ABG has a right angle at B (BG perpendicular to AB) so cos x = 6/AG	**M1**
inverse cos used	**M1**
35.3 degrees cao	**A1**

Answer: 35.3 degrees

Question 6

AC = $\sqrt{4^2 + 15^2}$ = 15.524	**M1**
tan x = 10/AC	**M1**
inverse tan used	**M1**
32.8 degrees cao	**A1**

Answer: 32.8 degrees

Question 7

base diagonal^2 = $11^2 + 3^2$	**M1**
diagonal^2 = 130 + 13^2 = 299	**M1**
17.3 m cao	**A1**

Answer: 17.3 m

Question 8

horizontal diagonal = $\sqrt{9^2 + 12^2}$ = 15 m	**M1**
use 3D Pythagoras: $\sqrt{15^2 + (2.4 - 1.2)^2}$ oe	**M1**
15.05 m awrt	**A1**

Answer: 15.05 m (awrt)

Question 9

(a) $\sqrt{10^2 + 6^2}$	**M1**
(a) awrt 11.7 cm	**A1**

(a) Answer: 11.7 cm (3 s.f.)

(b) tan(angle) = 7 / (their AC) ft, using unrounded AC where possible	**M1**
(b) arctan evaluated	**M1**
(b) awrt 31.0 degrees	**A1**

(b) Answer: 31.0 degrees (1 d.p.)

Question 10

(a) $\sqrt{8^2 + 9^2}$	**M1**
(a) awrt 12.0 cm	**A1**

(a) Answer: 12.0 cm (3 s.f.)

(b) CG^2 = 17^2 - 145	**M1**
(b) CG^2 = 144	**M1**
(b) 12 cm cao	**A1**

(b) Answer: 12 cm

Question 11

(a) find horizontal projection length = $\sqrt{10^2 + 3^2}$ = $\sqrt{109}$ oe	**M1**
(a) use 3D Pythagoras: length = $\sqrt{109 + 4^2}$ = $\sqrt{125}$ oe	**M1**
(a) 11.18 m awrt	**A1**

(a) Answer: 11.18 m

(b) use tan(θ) = vertical / horizontal = 4 / $\sqrt{109}$ oe	**M1**
(b) substitute horizontal = $\sqrt{109}$ and calculate tan(θ) value oe	**M1**
(b) calculate θ = arctan(4 / 10.4403...) oe	**M1**
(b) 21.0 degrees awrt	**A1**

(b) Answer: 21.0 degrees

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