HIGHER

7.15 3d Pythagoras and Trigonometry: Test Pack

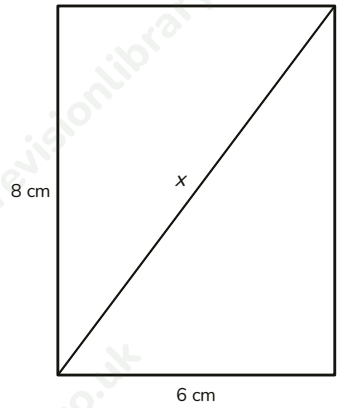
EDEXCEL 1MA1 · Calculator allowed · about 60 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Work out the length of the diagonal of a rectangle with sides 6 cm and 8 cm.

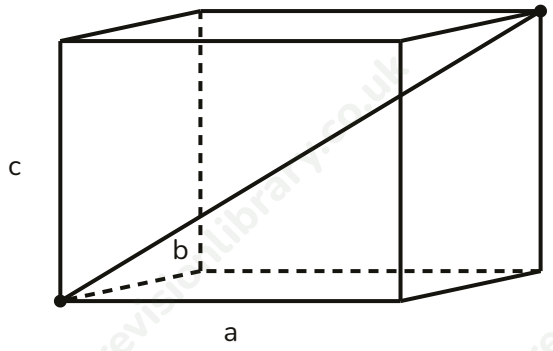


(Total for Question 1 is 1 mark)

© Revision Library | revisionlibrary.co.uk

2 A cuboid has edge lengths a, b and c, as shown.

Diagram NOT accurately drawn



(a) Which expression gives the length of the main diagonal of the cuboid? **(1)**

- ☐ A) $\sqrt{a + b + c}$
- ☐ B) $\sqrt{a^2 + b^2 + c^2}$
- ☐ C) $a^2 + b^2 + c^2$
- ☐ D) $\sqrt{a * b * c}$

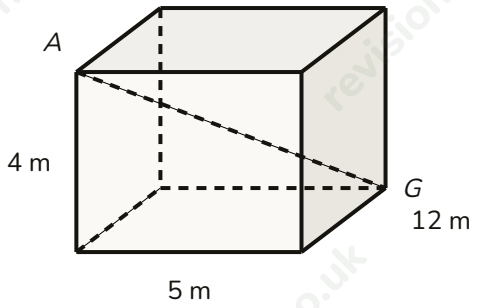
(b) A cuboid has a = 3 cm, b = 4 cm and c = 12 cm. Calculate the length of the main diagonal. **(2)**

.....

(Total for Question 2 is 3 marks)

© Revision Library | revisionlibrary.co.uk

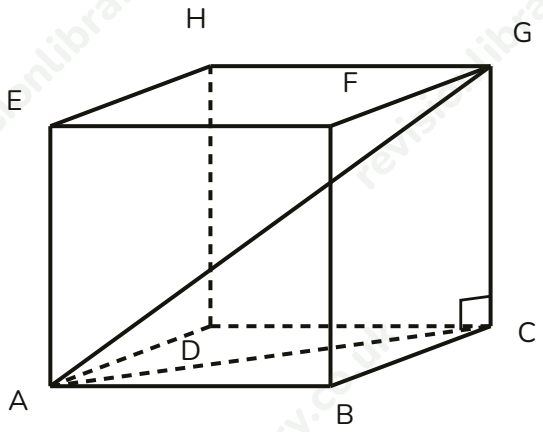
3 A rectangular prism has length 5 m, width 12 m and height 4 m. Find the distance from a top front corner to the opposite bottom back corner. Give your answer to 2 decimal places.



(Total for Question 3 is 2 marks)

---

4 The diagram shows a cuboid ABCDEFGH, with diagonal AG drawn together with AC, the diagonal of the base ABCD. E, F, G and H are directly above A, B, C and D respectively.



(a) Give a reason why triangle ACG is right-angled at C. **(1)**

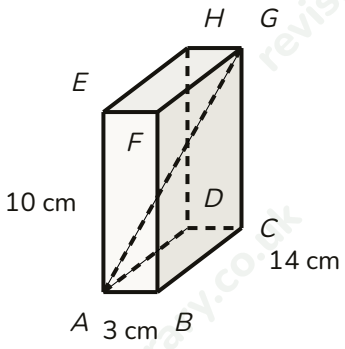
(b) State which line segment represents the projection of AG onto the base ABCD. **(1)**

(Total for Question 4 is 2 marks)

© Revision Library | revisionlibrary.co.uk

5 A block is a cuboid measuring 3 cm by 14 cm by 10 cm. Work out the length of the longest diagonal of the block. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

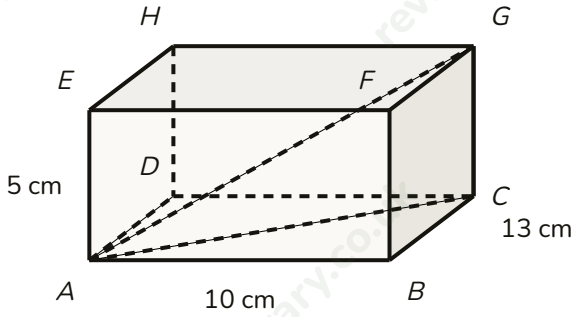


(Total for Question 5 is 3 marks)

---

6 ABCDEFGH is a cuboid with AB = 10 cm, BC = 13 cm and AE = 5 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

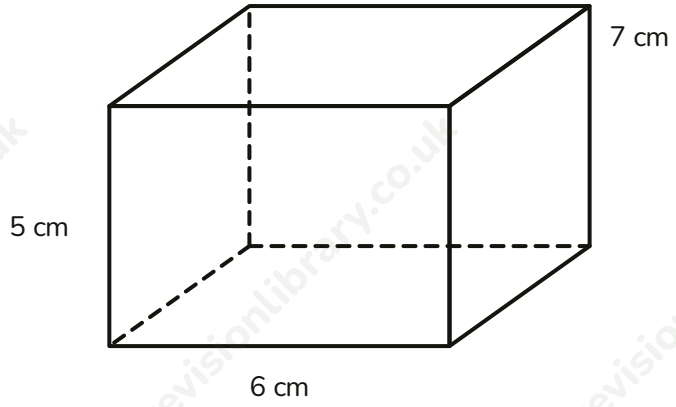


(Total for Question 6 is 4 marks)

© Revision Library | revisionlibrary.co.uk

7 A cuboid has dimensions 5 cm by 6 cm by 7 cm. Calculate the length of the main diagonal of the cuboid, giving your answer to 3 significant figures.

Diagram NOT accurately drawn

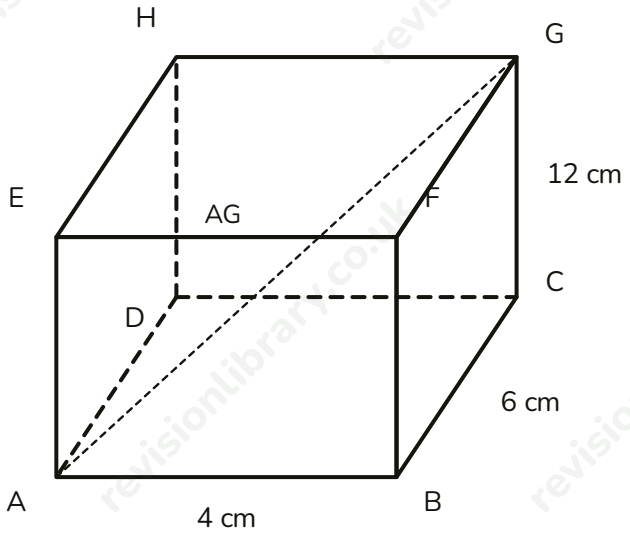


(Total for Question 7 is 3 marks)

© Revision Library | revisionlibrary.co.uk

8 The diagram shows a cuboid ABCDEFGH with AB = 4 cm, BC = 6 cm and CG = 12 cm.
Show that the length of the diagonal AG is 14 cm.

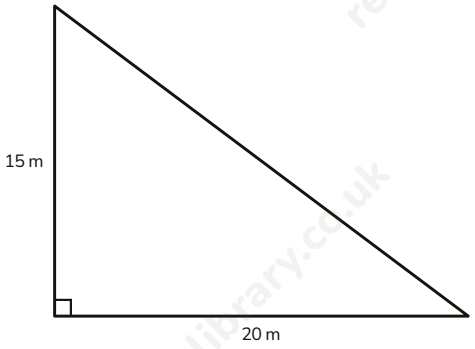
Diagram NOT accurately drawn



(Total for Question 8 is 3 marks)

© Revision Library | revisionlibrary.co.uk

9 A telegraph pole is 15 m high. A guy wire is attached to the top of the pole and fixed to the ground 20 m from the base of the pole. Work out the angle between the guy wire and the ground. Give your answer to 1 decimal place.



(Total for Question 9 is 2 marks)

---

10 A rectangular block measures 12 cm by 5 cm by 4 cm (length by width by height). Point A is the top corner at (0,0,4). Point B is the midpoint of the opposite bottom edge, which has endpoints (12,0,0) and (12,5,0).

(a) Find the straight-line distance AB, giving your answer to 2 decimal places. **(2)**

.....

(b) Find the angle between AB and the base plane to 1 decimal place. **(2)**

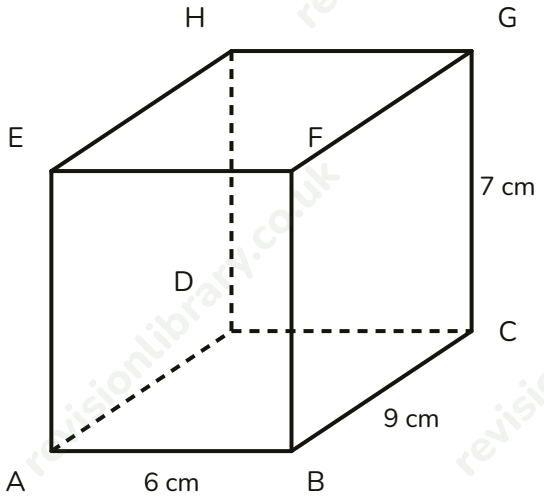
.....

(Total for Question 10 is 4 marks)

© Revision Library | revisionlibrary.co.uk

11 The diagram shows a cuboid ABCDEFGH with AB = 6 cm, BC = 9 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 AG, giving your answer to 3 significant figures. **(2)**

.....

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

.....

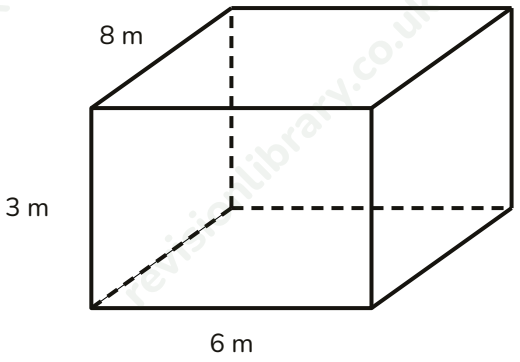
(Total for Question 11 is 5 marks)

© Revision Library | revisionlibrary.co.uk

12 A warehouse manager, Ravi, has a storage room in the shape of a cuboid with length 8 m, width 6 m and height 3 m. He wants to store a metal pole of length 10.5 m by laying it along the main diagonal of the room.

Determine, showing your working, whether the pole will fit in the room.

Diagram NOT accurately drawn

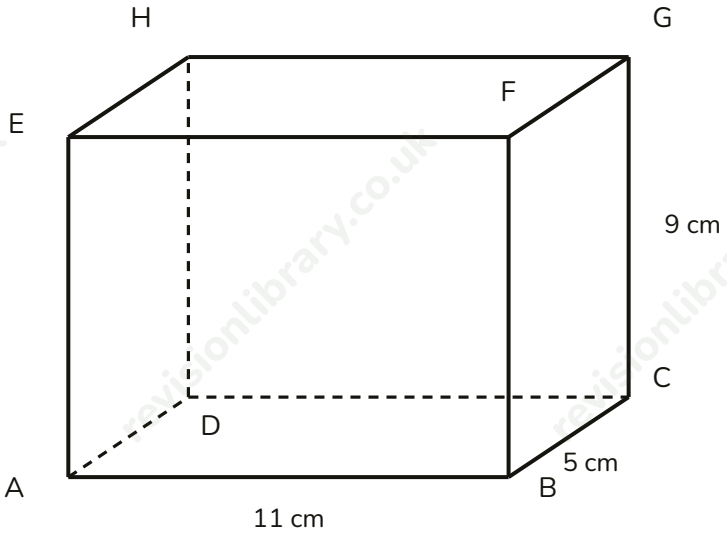


(Total for Question 12 is 4 marks)

© Revision Library | revisionlibrary.co.uk

13 The diagram shows a cuboid ABCDEFGH with AB = 11 cm, BC = 5 cm and CG = 9 cm. E, F, G and H are directly above A, B, C and D respectively.

Diagram NOT accurately drawn



(a) Calculate the length of BG, the diagonal of the face BCGF, giving your answer to 3 significant figures. **(2)**

.....

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

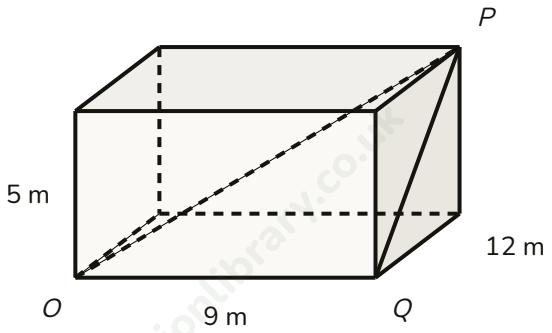
.....

(Total for Question 13 is 5 marks)

© Revision Library | revisionlibrary.co.uk

14 A cuboid measures 9 m by 12 m by 5 m (length by width by height). Consider the space diagonal from the origin O(0,0,0) to the opposite corner P(9,12,5), and the diagonal of the end face from Q(9,0,0) to P(9,12,5).

Find the angle between the space diagonal OP and the face diagonal QP. Give your answer to 1 decimal place.



(Total for Question 14 is 4 marks)

© Revision Library | revisionlibrary.co.uk

Mark scheme · 7.15 3d Pythagoras and Trigonometry: Test Pack

Question 1

10 cm cao **B1**

Answer: 10 cm (cao)

Question 2

(a) correct option identified **B1**

(a) Answer: B

(b) $\sqrt{3^2 + 4^2 + 12^2}$ **M1**

(b) 13 cm cao **A1**

(b) Answer: 13 cm

Question 3

use 3D Pythagoras: $\sqrt{5^2 + 12^2 + 4^2}$ oe **M1**

13.60 m awrt **A1**

Answer: 13.60 m (awrt)

Question 4

(a) CG is a vertical edge, so CG is perpendicular to every line in the horizontal base, including AC (oe) **B1**

(a) Answer: CG is perpendicular to the base ABCD, so angle ACG = 90 degrees.

(b) AC oe **B1**

(b) Answer: AC

Question 5

base diagonal^2 = $3^2 + 14^2$ **M1**

diagonal^2 = $205 + 10^2 = 305$ **M1**

17.5 cm cao **A1**

Answer: 17.5 cm

Question 6

AC = $\sqrt{10^2 + 13^2}$ = 16.401 **M1**

tan x = 5/AC **M1**

inverse tan used **M1**

17.0 degrees cao **A1**

Answer: 17.0 degrees

Question 7

$\sqrt{5^2 + 6^2 + 7^2}$ **M1**

$\sqrt{110}$ evaluated **M1**

awrt 10.5 cm **A1**

Answer: 10.5 cm (3 s.f.)

Question 8

$\sqrt{4^2 + 6^2 + 12^2}$ set up **M1**

= $\sqrt{196}$ **M1**

cso, = 14 cm shown fully **A1**

Answer: 14 cm (given, shown)

Question 9

use tan(θ) = opposite/adjacent = 15/20 oe **M1**

36.9 degrees awrt **A1**

Answer: 36.9 degrees (awrt)

Question 10

(a) find horizontal projection length = $\sqrt{12^2 + 2.5^2}$ = $\sqrt{150.25}$ oe **M1**

(a) 12.89 cm awrt **A1**

(a) Answer: 12.89 cm

(b) use tan(θ) = vertical / horizontal projection = 4 / $\sqrt{150.25}$ oe **M1**

(b) 18.1 degrees awrt **A1**

(b) Answer: 18.1 degrees

Question 11

(a) $\sqrt{6^2 + 9^2 + 7^2}$ **M1**

(a) awrt 12.9 cm **A1**

(a) Answer: 12.9 cm (3 s.f.)

(b) BG = $\sqrt{9^2 + 7^2}$ found, and angle ABG identified as 90 degrees, giving tan(angle GAB) = BG / AB (or equivalent using cos(angle GAB) = AB / AG) **M1**

(b) correct value substituted and inverse trig applied **M1**

(b) awrt 62.2 degrees **A1**

(b) Answer: 62.2 degrees (1 d.p.)

Question 12

$\sqrt{8^2 + 6^2 + 3^2}$ **M1**

$\sqrt{109}$ evaluated **M1**

awrt 10.4 m **A1**

dependent on A1, correct conclusion: No, the pole will not fit, since 10.4 m < 10.5 m (oe) **C1**

Answer: Diagonal = 10.4 m (3 s.f.); No, the pole does not fit since 10.4 m < 10.5 m

Question 13

(a) $\sqrt{5^2 + 9^2}$ **M1**

(a) awrt 10.3 cm **A1**

(a) Answer: 10.3 cm (3 s.f.)

(b) recognise AB is perpendicular to plane BCGF, so tan(angle AGB) = AB / BG **M1**

(b) tan(angle) = 11 / (their BG) evaluated **M1**

(b) awrt 46.9 degrees **A1**

(b) Answer: 46.9 degrees (1 d.p.)

Question 14

form vectors OP = (9,12,5) and QP = (0,12,5) and compute dot product = 9*0 + 12*12 + 5*5 = 169 **M1**

find magnitudes |OP| = $\sqrt{9^2+12^2+5^2}$ = $\sqrt{250}$, |QP| = 13 **M1**

use cos(θ) = dot / (|OP||QP|) and calculate θ = arccos(169 / ($\sqrt{250}$*13)) **M1**

34.7 degrees awrt **A1**

Answer: 34.7 degrees (awrt)

© Revision Library | revisionlibrary.co.uk