



Pythagoras in three dimensions

About 45 minutes Calculator allowed 37 marks

Date _____

A Do Now

The first question is what today's lesson needs. The others bring back earlier topics.

- A1** Needed today [2 marks]

Find the distance between the points (1, 5) and (13, 0).

Answer

A2 From chapter 1 [2 marks]

By rounding each number to 1 significant figure, estimate the value of $\frac{26.7 \times 4.77}{0.463}$.

Answer

- A3** From chapter 9 [2 marks]

A solid hemisphere has volume $\frac{686}{3}\pi \text{ cm}^3$. Find its radius. ($V = \frac{2}{3}\pi r^3$)

Answer

A4 Key Stage 3 [2 marks]

Work out 92×88 without a calculator.

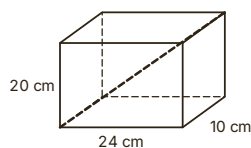
Answer

B Examples, then your turn

Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

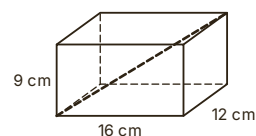
A cuboid is 24 cm by 10 cm by 20 cm. Work out the longest rod that fits inside it, to 1 decimal place.



Not drawn accurately

Hint Find the diagonal of the base first, then use it with the height.

- B1** A cuboid is 16 cm by 12 cm by 9 cm. Work out the longest rod that fits inside it, to 1 decimal place. [3 marks]

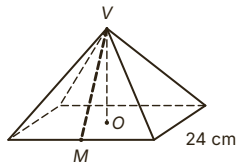


Not drawn accurately

Answer

EXAMPLE 2

A pyramid has a square base of side 24 cm. Its apex V is 16 cm above the centre O of the base. Work out VM .

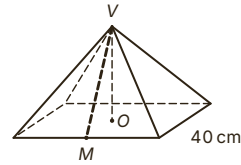


Not drawn accurately

Hint M is the middle of an edge, so OM is half a side. VOM has a right angle at O .

B2 A pyramid has a square base [3 marks]

of side 40 cm. Its apex V is 21 cm above the centre O of the base. Work out VM .

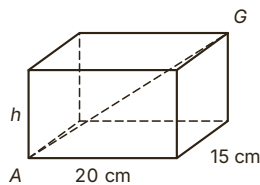


Not drawn accurately

Answer

c Practice

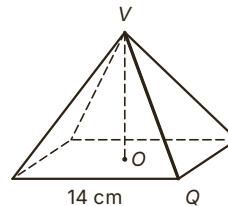
- C1** A cuboid is 20 cm long and 15 cm wide. Its diagonal AG is 29 cm. Work out its height h , to 1 decimal place. [3 marks]



Not drawn accurately

Answer

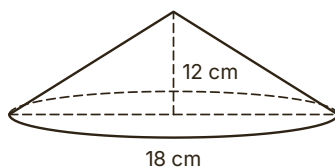
- C2** A pyramid has a square base of side 14 cm. Its apex V is 9 cm above the centre O of the base. Work out the sloping edge VQ , to 1 decimal place. [3 marks]



Not drawn accurately

Answer

- C3** A cone has a base diameter of 18 cm and a vertical height of 12 cm. Work out its slant height. [2 marks]



Not drawn accurately

Answer

- C4** P is the point $(2, -1, 4)$ and Q is the point $(7, 3, -4)$. Work out the distance PQ , to 1 decimal place. [3 marks]

Answer

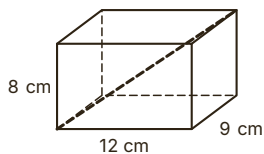
D Exam-style questions

D1

A cuboid is 12 cm by 9 cm by 8 cm. Mia says, "The longest line inside it is $12 + 9 + 8 = 29$ cm."

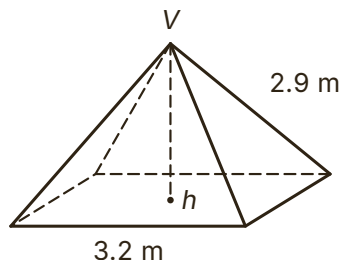
[3 marks]

Explain why Mia is wrong, and work out the correct length.



Not drawn accurately

- D2 A tent is a pyramid with a square base of side 3.2 m. Each of its four sloping edges is 2.9 m long. The top of the tent is directly above the centre of the base.



Not drawn accurately

- (a) Work out the height h of the tent. Give your answer to 3 significant figures. You must show your working. [4 marks]

Answer

- (b) Kai is 1.85 m tall. Can he stand up straight in the middle of the tent? Give a reason. [1 mark]

Total for D2: 5 marks

E Extension

No route is given. The hints are at the end of the sheet. Use one at a time.

E1 The edges of a cuboid are in the ratio 1 : 2 : 2. The longest straight line inside it is 24 cm. Work out the volume of the cuboid. [4 marks]

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Call the shortest edge x cm. What are the other two?
Hint 2 $x^2 + (2x)^2 + (2x)^2 = 24^2$.
Hint 3 $9x^2 = 576$, so $x = 8$ and the edges are 8, 16 and 16 cm.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

- I can use Pythagoras twice to find the longest line inside a cuboid. ☐ ☐ ☐
- I can find a sloping length inside a pyramid or a cone. ☐ ☐ ☐
- I can work backwards to find an edge or a height. ☐ ☐ ☐