

1



The diagonal from one corner of a cube to the opposite corner is 6 cm. Find the exact volume of the cube.

$$3s^2 = 36, s = \sqrt{12} = 2\sqrt{3}$$

$$(2\sqrt{3})^3 = 8 \times 3\sqrt{3}$$

$$24\sqrt{3} \text{ cm}^3$$

Answer

2



A cuboid has edges x cm, $(x + 1)$ cm and $(x + 3)$ cm. Its longest diagonal is $3\sqrt{10}$ cm. Find x .

$$x^2 + (x + 1)^2 + (x + 3)^2 = 90$$

$$3x^2 + 8x - 80 = 0$$

$$(3x + 20)(x - 4) = 0$$

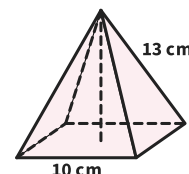
$$x = 4$$

Answer

3



The pyramid has a square base and all four sloping edges are 13 cm. Find the angle between a sloping edge and the base, to 1 decimal place.



$$\text{corner to centre} = \frac{1}{2}\sqrt{200} = 5\sqrt{2}$$

$$\cos \text{ of the angle} = \frac{5\sqrt{2}}{13}$$

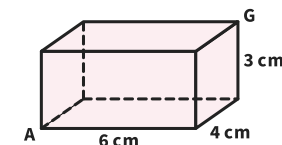
$$57.0^\circ$$

Answer

4



An ant walks on the outside of this closed box from A to G. Find the shortest distance it can walk, to 3 significant figures.



unfold two faces into one rectangle

$$\text{best: } \sqrt{6^2 + (4 + 3)^2} = \sqrt{85}$$

$$9.22 \text{ cm}$$

Answer

5



A ball of radius 5 cm fits exactly inside a cube, touching all six faces. Find the distance from a corner of the cube to the nearest point of the ball. Give an exact answer.

$$\text{corner to centre} = \frac{1}{2} \times 10\sqrt{3} = 5\sqrt{3}$$

subtract the radius 5

$$(5\sqrt{3} - 5) \text{ cm}$$

Answer

6



Each of the six edges of a triangular based pyramid is 6 cm. The top is directly above a point of the base that is $\frac{2}{3}$ of the way along each line from a corner to the midpoint of the opposite side. Find the exact height.

$$\text{line} = \sqrt{6^2 - 3^2} = 3\sqrt{3}$$

$$\frac{2}{3} \text{ of it} = 2\sqrt{3}$$

$$\text{height} = \sqrt{36 - 12} = \sqrt{24}$$

$$2\sqrt{6} \text{ cm}$$

Answer

7



The edges of a cuboid are in the ratio 1 : 2 : 2. Show that its longest diagonal is exactly 3 times its shortest edge.

edges $a, 2a, 2a$

$$\sqrt{a^2 + 4a^2 + 4a^2} = \sqrt{9a^2} = 3a$$

$$3a$$

Reason

8



A cube has edges of length a . Prove that its longest diagonal is $a\sqrt{3}$, and that this diagonal makes the same angle with the base whatever the size of the cube.

$$\text{base diagonal} = a\sqrt{2}$$

$$\sqrt{2a^2 + a^2} = a\sqrt{3}$$

$$\tan \theta = \frac{a}{a\sqrt{2}} = \frac{1}{\sqrt{2}}, \text{ no } a \text{ left}$$

$$\theta = 35.3^\circ \text{ for every cube}$$

Proof