

GCSE Maths: Trigonometry and Pythagoras in three dimensions, and combined problems (Higher): answers

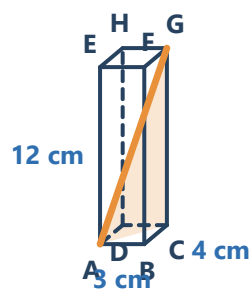
GCSE Maths - Pythagoras and Trigonometry - Higher - Lesson 20.11

Answers. Final answers to the worksheet questions. Full step-by-step solutions for every question are free at websink.site/gcse/maths/ch20-pythagoras-trigonometry/higher/trigonometry-and-pythagoras-in-three-dimensions-and/

Exercise 20M Trigonometry and Pythagoras in 3D Calculator allowed

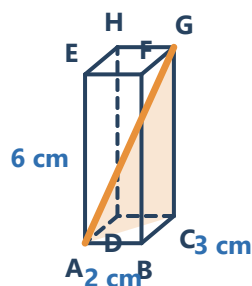
- 1 ABCDEFGH is a cuboid. Work out the length of the diagonal AG in each case. Give your answers correct to 1 decimal place if they are not exact.

- (a) $AB = 3$ cm, $BC = 4$ cm, $CG = 12$ cm



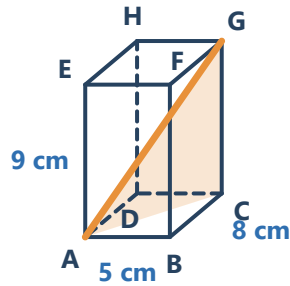
Answer: 13 cm

- (b) $AB = 2$ cm, $BC = 3$ cm, $CG = 6$ cm



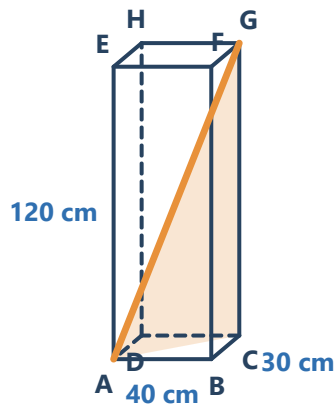
Answer: 7 cm

- (c) $AB = 5\text{ cm}$, $BC = 8\text{ cm}$, $CG = 9\text{ cm}$



Answer: 13.0 cm

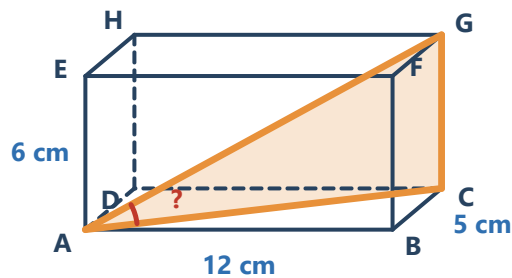
- 2 A storage box is a cuboid 40 cm long, 30 cm wide and 120 cm high. Work out the length of the longest straight rod that fits inside the box.



Answer: 130 cm

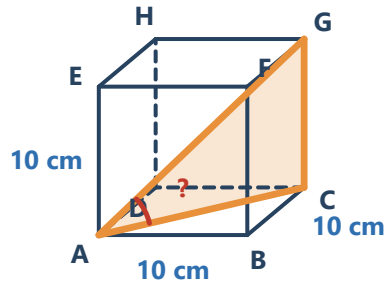
- 3 ABCDEFGH is a cuboid. Work out the angle between the diagonal AG and the base ABCD in each case. Give your answers correct to 1 decimal place.

- (a) $AB = 12\text{ cm}$, $BC = 5\text{ cm}$, $CG = 6\text{ cm}$



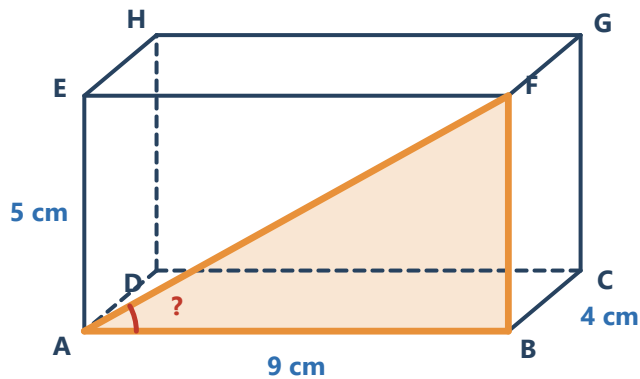
Answer: 24.8°

- (b) $AB = 10\text{ cm}$, $BC = 10\text{ cm}$, $CG = 10\text{ cm}$



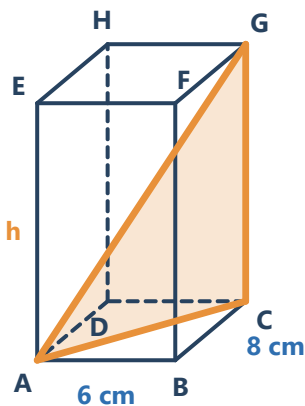
Answer: 35.3°

- 4 ABCDEFGH is a cuboid with $AB = 9\text{ cm}$, $BC = 4\text{ cm}$ and $BF = 5\text{ cm}$. Work out the angle between the face diagonal AF and the base ABCD, correct to 1 decimal place.



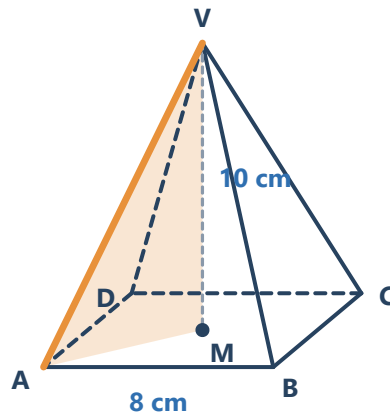
Answer: 29.1°

- 5 ABCDEFGH is a cuboid with $AB = 6\text{ cm}$ and $BC = 8\text{ cm}$. The diagonal AG is 15 cm long. Work out the height CG of the cuboid, correct to 1 decimal place.



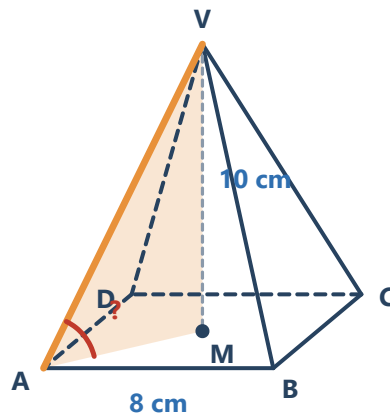
Answer: 11.2 cm

- 6 VABCD is a pyramid with a square base ABCD of side 8 cm . The apex V is 10 cm directly above the centre of the base. Work out the length of the edge VA, correct to 1 decimal place.



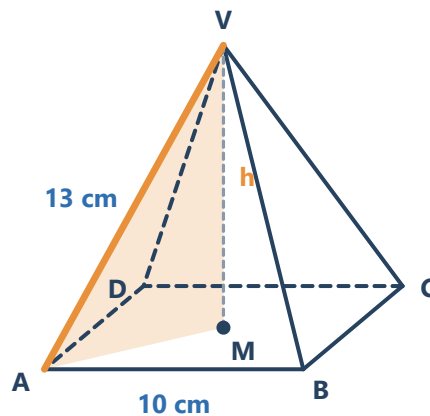
Answer: 11.5 cm

- 7 For the same pyramid, work out the angle between the edge VA and the base ABCD, correct to 1 decimal place.



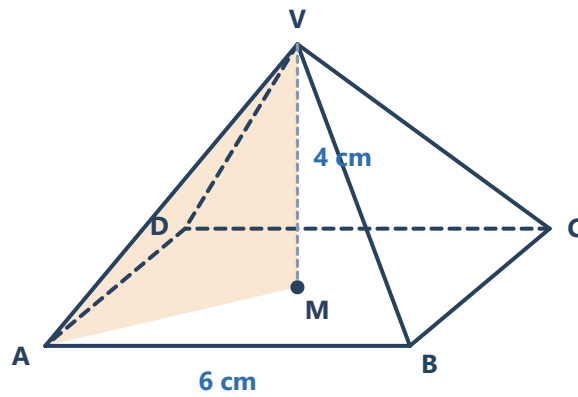
Answer: 60.5°

- 8 VABCD is a pyramid with a square base of side 10 cm. The apex V is directly above the centre M of the base. The edge VA is 13 cm long. Work out the height VM of the pyramid, correct to 1 decimal place.



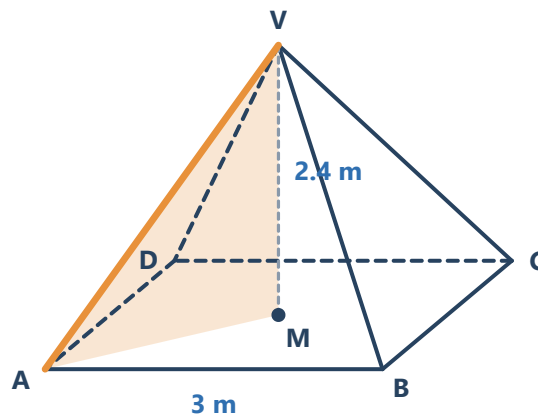
Answer: 10.9 cm

- 9 A square-based pyramid has a base of side 6 cm and a vertical height of 4 cm. Work out the angle between a sloping face and the base, correct to 1 decimal place.



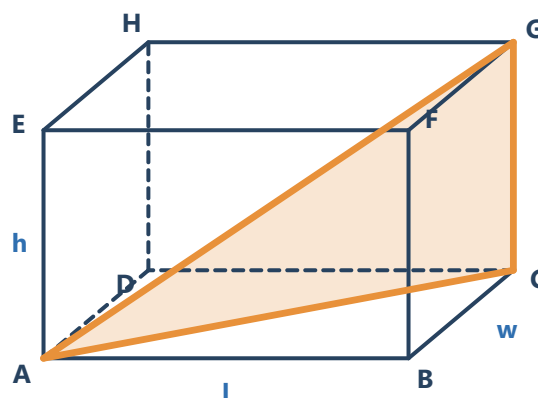
Answer: 53.1°

- 10 A tent is a pyramid with a square base of side 3 m. The apex is 2.4 m vertically above the centre of the base. Each of the four sloping edges is a pole. Work out the length of one pole, correct to 1 decimal place.



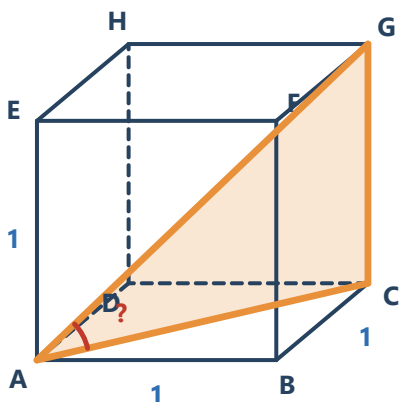
Answer: 3.2 m

- 11 ABCDEFGH is a cuboid with $AB = l$, $BC = w$ and $CG = h$. Show that $AG^2 = l^2 + w^2 + h^2$.



Answer: $AG^2 = AC^2 + h^2 = l^2 + w^2 + h^2$

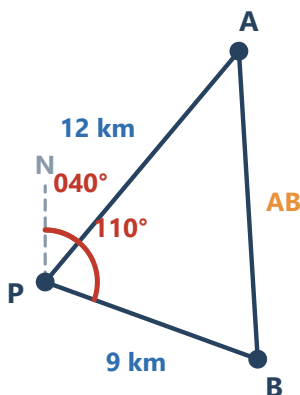
- 12 Challenge.** ABCDEFGH is a cube. **Show that** the angle between the diagonal AG and the base ABCD is 35.3° , correct to 1 decimal place.



Answer: $\tan^{-1}(1 \div \sqrt{2}) = 35.3^\circ$

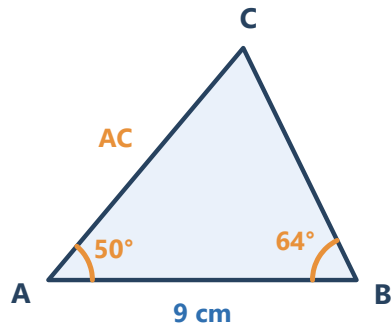
Exercise 20N Combined problems Calculator allowed

- 1** A port P has two ships leaving it. Ship A sails 12 km on a bearing of 040° . Ship B sails 9 km on a bearing of 110° . Work out (a) the distance AB between the ships, correct to 1 decimal place, (b) the bearing of B from A, to the nearest degree.



Answer: 12.3 km, 177°

- 2** In triangle ABC, $AB = 9$ cm, angle $A = 50^\circ$ and angle $B = 64^\circ$. Work out (a) the length of AC, (b) the area of the triangle. Give your answers correct to 1 decimal place.



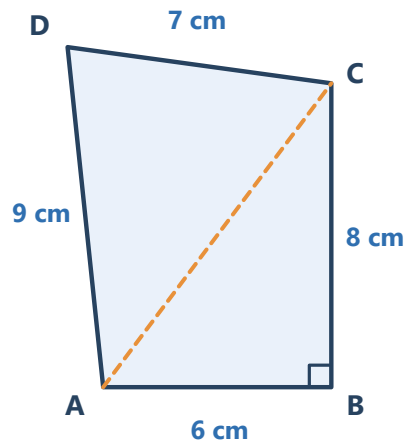
(a) AC

Answer: 8.9 cm

(b) area

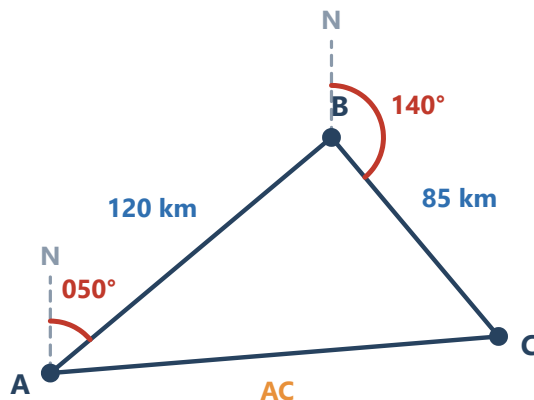
Answer: 30.5 cm²

- 3 In the quadrilateral ABCD, angle ABC = 90°, AB = 6 cm, BC = 8 cm, CD = 7 cm and DA = 9 cm. Work out the size of angle ADC, correct to 1 decimal place.



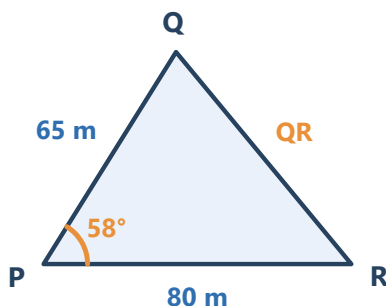
Answer: 76.2°

- 4 A plane flies 120 km from A to B on a bearing of 050°, and then 85 km from B to C on a bearing of 140°. Work out (a) the distance AC, correct to 1 decimal place, (b) the bearing of C from A, to the nearest degree.



Answer: 147.1 km, 085°

- 5 PQR is a triangular field. PQ = 80 m, PR = 65 m and angle QPR = 58° . Work out (a) the length of QR, (b) the area of the field. Give your answers correct to 1 decimal place.



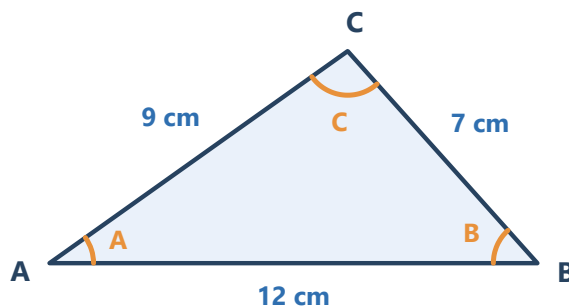
(a) QR

Answer: 71.5 m

(b) area

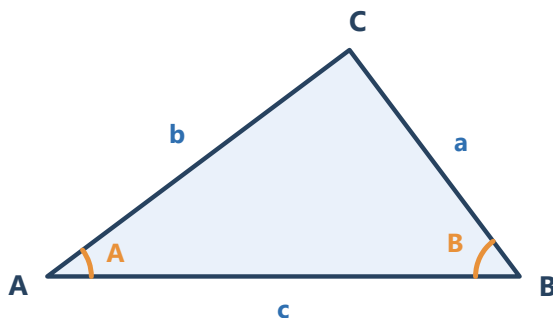
Answer: 2204.9 m²

- 6 A triangle has sides of length 7 cm, 9 cm and 12 cm. Work out the sizes of all three angles, correct to 1 decimal place. Show that they add up to 180° .



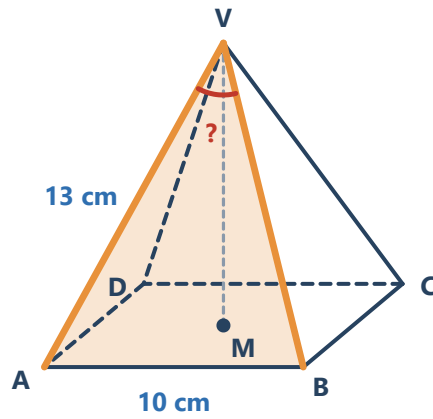
Answer: 96.4° , 35.4° , 48.2°

- 7 The area of a triangle ABC can be written as $\frac{1}{2} bc \sin A$ and also as $\frac{1}{2} ac \sin B$. Use this to prove the sine rule $a \div \sin A = b \div \sin B$.



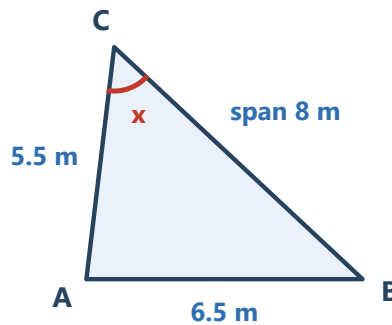
Answer: $\frac{1}{2} bc \sin A = \frac{1}{2} ac \sin B$ gives $b \sin A = a \sin B$, so $a \div \sin A = b \div \sin B$

- 8 VABCD is a pyramid with a square base of side 10 cm. Each sloping edge is 13 cm long. Work out the size of angle AVB, correct to 1 decimal place.



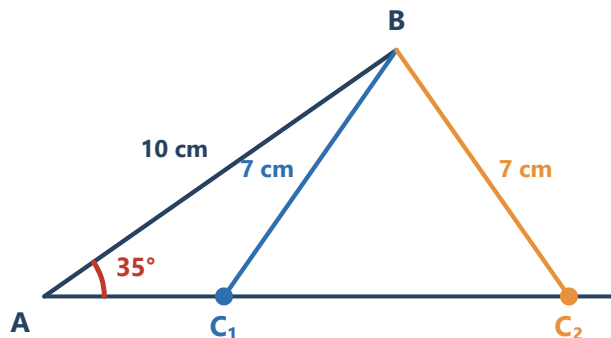
Answer: 45.2°

- 9 A roof truss is a triangle with a horizontal span of 8 m and rafters of lengths 5.5 m and 6.5 m. Work out the angle between the two rafters at the apex, correct to 1 decimal place.



Answer: 83.2°

- 10 **Challenge.** In triangle ABC, angle A = 35° , AB = 10 cm and BC = 7 cm. There are two different triangles that fit this information. Work out the two possible lengths of AC, correct to 1 decimal place.



Answer: 12.2 cm or 4.2 cm