Pythagoras and trigonometry in 3D: 10 practice questions

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Name: _____ Date: _____

Attempt all questions and show your working. Unless a question says otherwise, give lengths correct to two decimal places and angles correct to one decimal place. Suggested time: 15 to 20 minutes.

Section A: Consolidating (Questions 1-4)

Question 1

A rectangular box (cuboid) measures 3 cm by 4 cm by 12 cm. Find the length of its space diagonal (the diagonal joining opposite corners through the inside of the box).

Question 2

A rectangular box has a base 6 cm by 8 cm and a height of 24 cm.

(a) Find the length of a diagonal of the base.

(b) Find the length of the space diagonal.

Question 3

A vertical flagpole is 12 m tall. Find the angle of elevation of the top of the pole from a point on level ground 30 m from its base.

Question 4

A right pyramid has a square base of side 10 cm, and its apex is 12 cm directly above the centre of the base. Find the slant height of a triangular face (the distance from the apex to the midpoint of a base edge).

Section B: Standard (Questions 5-10)

Question 5

A cube has edges of 6 cm.

(a) Find the exact length of a space diagonal, and give it correct to two decimal places.

(b) Find the angle between a space diagonal and the base of the cube.

Question 6

ABCDEFGH is a cuboid. The base is the rectangle ABCD with AB = 8 cm and BC = 6 cm. The top is EFGH, with E directly above A, F above B, G above C and H above D. The height is CG = 5 cm.

(a) Find AC.

(b) Find AG.

(c) Find angle GAC, the angle between AG and the base.

Question 7

A right pyramid has a square base of side 8 m, and its apex is 10 m directly above the centre of the base.

(a) Find the exact distance from the centre of the base to a corner of the base, and give it correct to two decimal places.

(b) Find the length of a sloping edge (from the apex to a corner of the base).

(c) Find the angle between a sloping edge and the base.

Question 8

The base O of a vertical mobile phone tower is on level ground. From point A, 60 m due south of O, the angle of elevation of the top of the tower is 35°. Point B is due east of O, and from B the angle of elevation of the top is 25°.

(a) Find the height of the tower.

(b) Find the distance OB.

(c) Find the distance AB.

Question 9

A solid cone has base radius 7 cm and vertical height 24 cm.

(a) Find the slant height of the cone.

(b) Find the angle between the slanting side and the base.

Question 10

A wedge has a horizontal rectangular base ABCD with AB = 12 m and BC = 5 m. Points E and F are 3 m directly above D and C respectively, so the sloping face is the rectangle ABFE.

(a) Find AC.

(b) Find the length of the diagonal AF of the sloping face.

(c) Find the angle between AF and the base.

Pythagoras and trigonometry in 3D: answers

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Question 1

Answer: 13 cm (√(9 + 16 + 144))

Question 2

Answer: (a) 10 cm (b) 26 cm (√(10² + 24²))

Question 3

Answer: 21.8° (tan θ = 12/30)

Question 4

Answer: 13 cm (√(5² + 12²))

Question 5

Answer: (a) 6√3 ≈ 10.39 cm (b) 35.3° (tan θ = (6)/(6√2); also accept 35.2° from rounded lengths)

Question 6

Answer: (a) 10 cm (b) 11.18 cm (√(125), also accept 5√5) (c) 26.6° (tan θ = 5/10)

Question 7

Answer: (a) 4√2 ≈ 5.66 m (b) 11.49 m (√(32 + 100)) (c) 60.5° (tan θ = (10)/(4√2))

Question 8

Answer: (a) 42.01 m (60 tan 35°) (b) 90.10 m ((h)/(tan 25°); also accept 90.09 m from the rounded 42.01) (c) 108.25 m (angle AOB = 90°; also accept 108.24 m from rounded values)

Question 9

Answer: (a) 25 cm (b) 73.7° (tan θ = 24/7)

Question 10

Answer: (a) 13 m (b) 13.34 m (√(13² + 3²) = √(178)) (c) 13.0° (tan θ = 3/13)