5.19 SOHCAHTOA (Trigonometry): 2-hour Pack

EDEXCEL 1MA1 · Calculator allowed · about 120 minutes

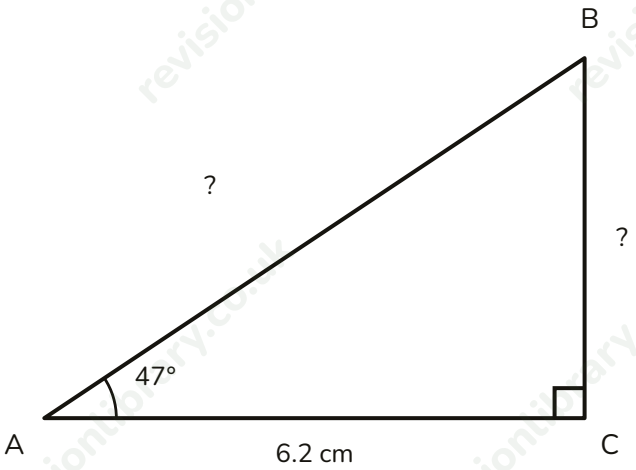
Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 In right-angled triangle ABC, the right angle is at C. Angle A = 47 degrees and the side AC (adjacent to angle A) = 6.2 cm.

Diagram NOT accurately drawn



(a) Calculate the length of the hypotenuse AB. Give your answer correct to 3 significant figures. **(2)**

.....

(b) Hence calculate the perimeter of triangle ABC. Give your answer correct to 3 significant figures. **(2)**

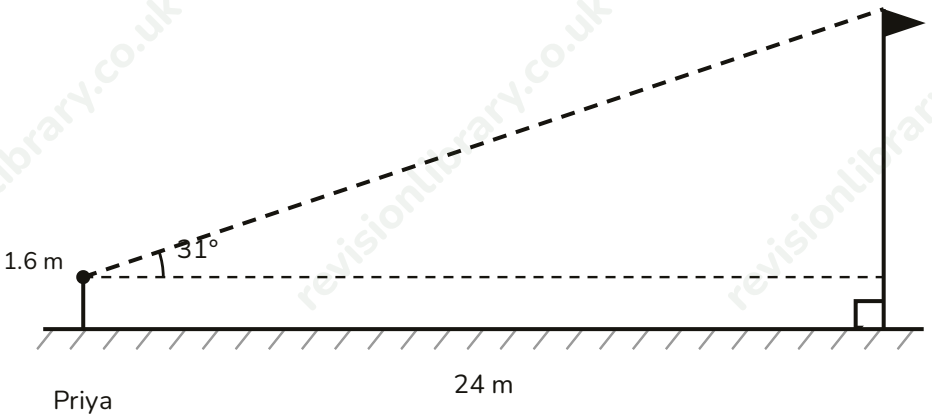
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(Total for Question 1 is 4 marks)

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2 Priya stands 24 m from the base of a tree, on level ground. The angle of elevation from her eyes to the top of the tree is 31 degrees. Priya's eyes are 1.6 m above the ground. Calculate the total height of the tree. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

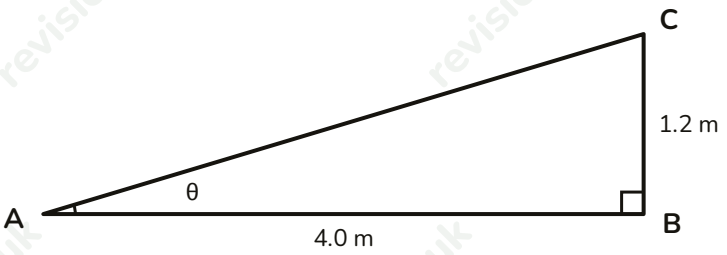


(Total for Question 2 is 3 marks)

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3 A ramp rises to a height of 1.2 m over a horizontal distance of 4.0 m.

Diagram NOT accurately drawn



(a) Work out the angle of incline, correct to the nearest degree. **(2)**

.....

(b) Work out the length of the ramp (the sloping side) to 2 decimal places. **(3)**

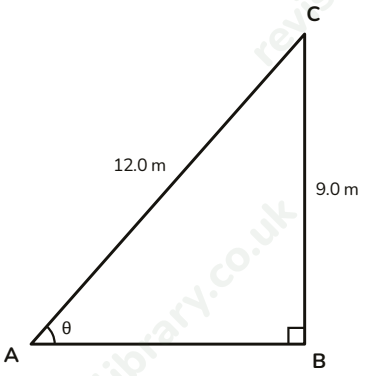
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(Total for Question 3 is 5 marks)

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4 A 12.0 m ladder reaches 9.0 m up a wall. The ladder touches the ground at a point a short distance from the wall.

Diagram NOT accurately drawn



(a) Work out the angle between the ladder and the ground, to the nearest degree. **(2)**

.....

(b) Work out the horizontal distance from the foot of the ladder to the wall, to 2 decimal places. **(3)**

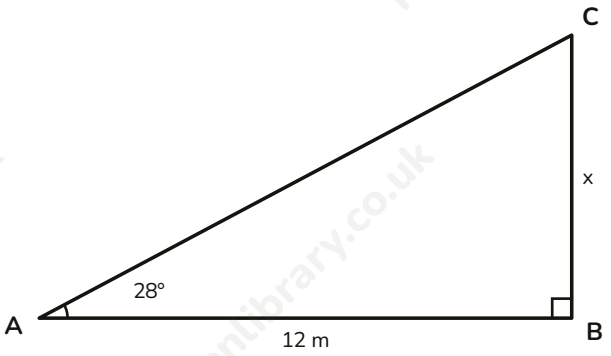
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(Total for Question 4 is 5 marks)

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5 A surveyor stands 12 m from the base of a tower. The angle of elevation to the top is 28 degrees. Work out the height of the tower. Give your answer to the nearest 0.1 metre. (Take the surveyor's eye level as ground level.)

Diagram NOT accurately drawn

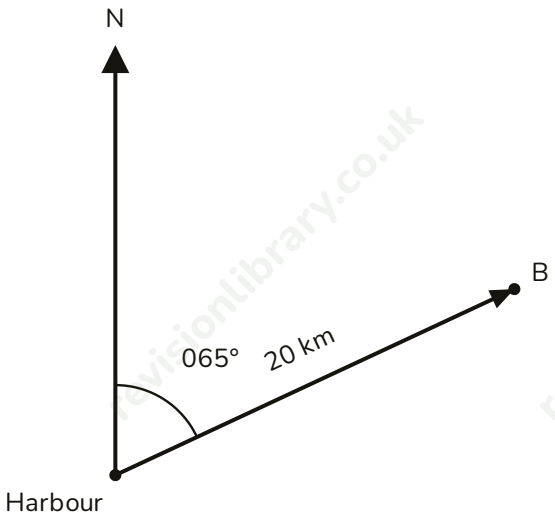


(Total for Question 5 is 4 marks)

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6 A boat sails from a harbour on a bearing of 065 degrees for a distance of 20 km, reaching point B.

Diagram NOT accurately drawn



(a) Calculate how far north of the harbour point B is. Give your answer correct to 3 significant figures. **(2)**

.....

(b) Calculate how far east of the harbour point B is. Give your answer correct to 3 significant figures. **(2)**

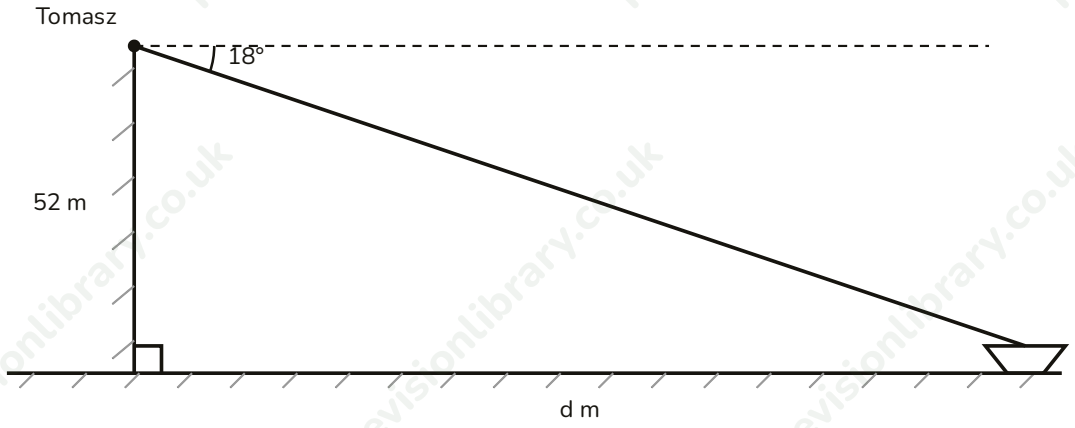
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(Total for Question 6 is 4 marks)

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7 From the top of a vertical cliff 52 m high, Tomasz observes a boat out at sea. The angle of depression from Tomasz to the boat is 18 degrees. Calculate the horizontal distance from the base of the cliff to the boat. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

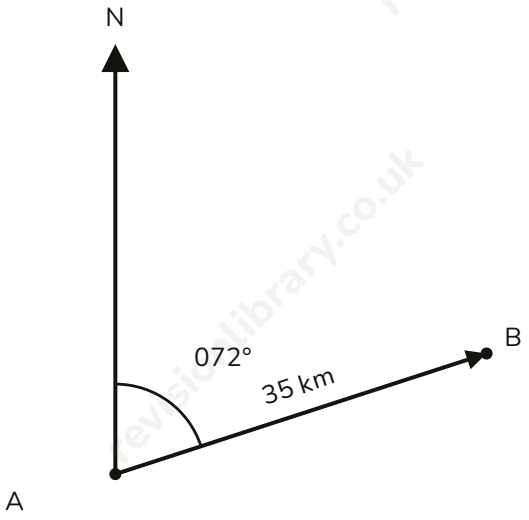


(Total for Question 7 is 3 marks)

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8 A ship sails from port A on a bearing of 072 degrees for 35 km, reaching point B.

Diagram NOT accurately drawn



(a) Calculate how far east of A point B is. Give your answer correct to 3 significant figures. **(2)**

.....

(b) Calculate how far north of A point B is. Give your answer correct to 3 significant figures. **(2)**

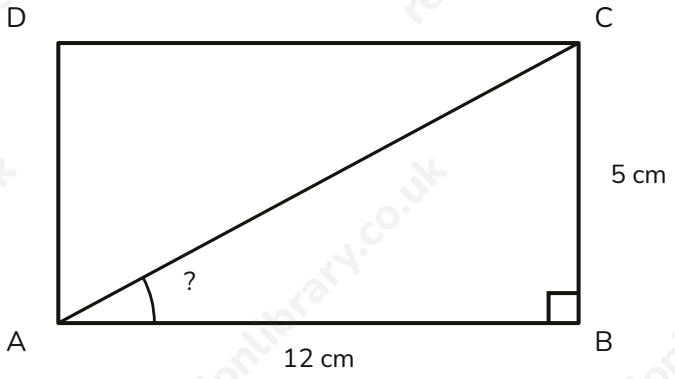
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(Total for Question 8 is 4 marks)

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9 A rectangle ABCD has length AB = 12 cm and width BC = 5 cm. The diagonal AC is drawn.

Diagram NOT accurately drawn



(a) Calculate the size of the angle between the diagonal AC and the side AB. Give your answer correct to 1 decimal place. **(2)**

.....

(b) Hence write down the size of the angle between the diagonal AC and the side BC. Give a reason for your answer. **(2)**

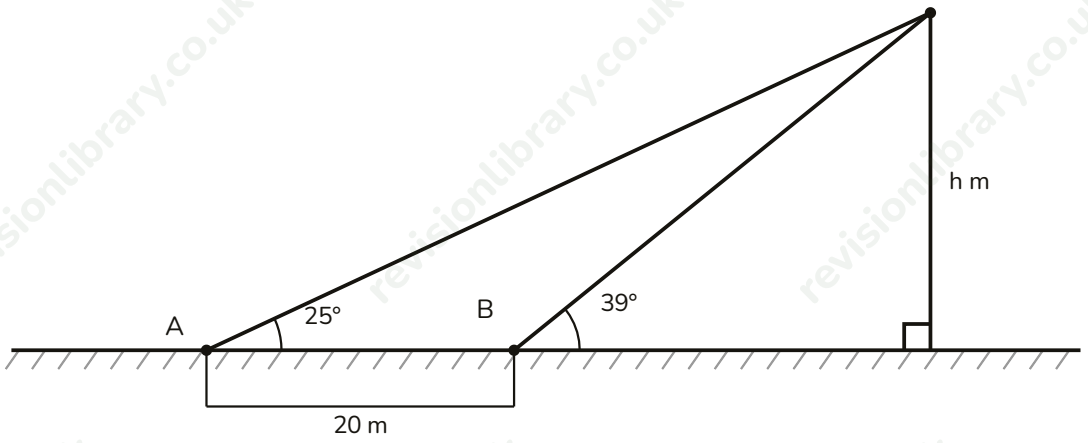
(Total for Question 9 is 4 marks)

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10 From a point A on level ground, the angle of elevation to the top of a tower is 25 degrees. From a point B, on the same straight line as A and the base of the tower and 20 m closer to the tower, the angle of elevation to the top of the tower is 39 degrees.

Calculate the height, h, of the tower. Give your answer correct to 3 significant figures.

Diagram NOT accurately drawn

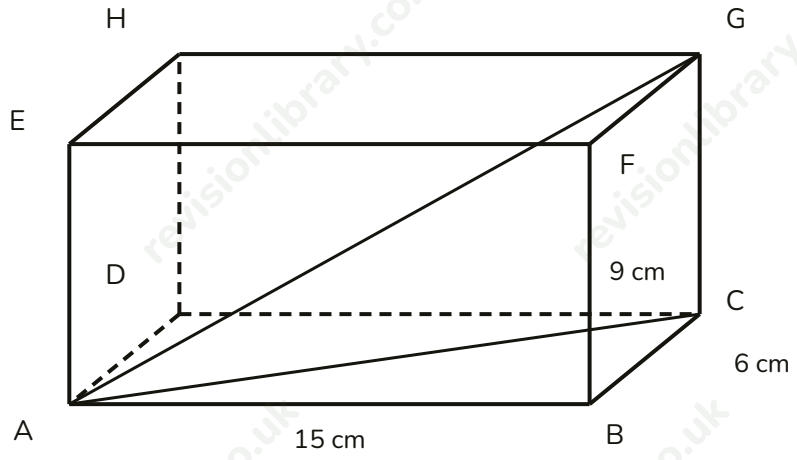


(Total for Question 10 is 5 marks)

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11 A cuboid ABCDEFGH has a rectangular base ABCD with AB = 15 cm and BC = 6 cm, and vertical edges of height 9 cm (AE = BF = CG = DH = 9 cm). The diagonal AC of the base is drawn, and the space diagonal AG from A to the diagonally opposite top vertex G is also drawn.

Diagram NOT accurately drawn



(a) Calculate the length of the diagonal AC of the base ABCD. Give your answer correct to 3 significant figures. **(2)**

.....

(b) Calculate the size of the angle between the diagonal AG and the base ABCD (angle GAC). Give your answer correct to 1 decimal place. **(3)**

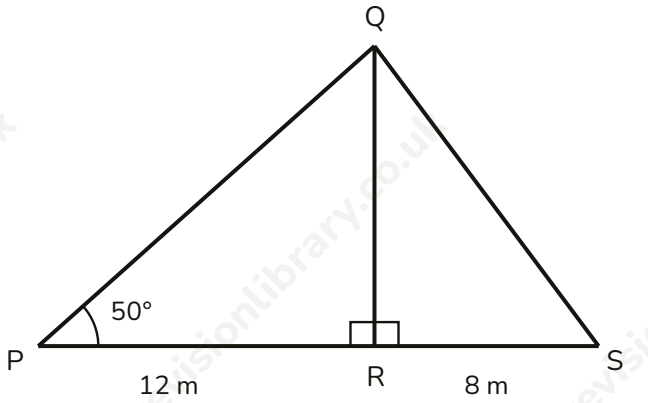
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(Total for Question 11 is 5 marks)

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12 The diagram shows the triangular cross-section of a roof truss, made from two right-angled triangles PQR and QRS sharing the vertical ridge support QR. The horizontal base PS is divided at R into PR = 12 m and RS = 8 m. The angle between PQ and the base at P is 50 degrees.

Diagram NOT accurately drawn



(a) Calculate the height of the ridge support, QR. Give your answer correct to 3 significant figures. **(3)**

.....

(b) Calculate the size of the angle between QS and the base at S (angle QSR). Give your answer correct to 1 decimal place. **(3)**

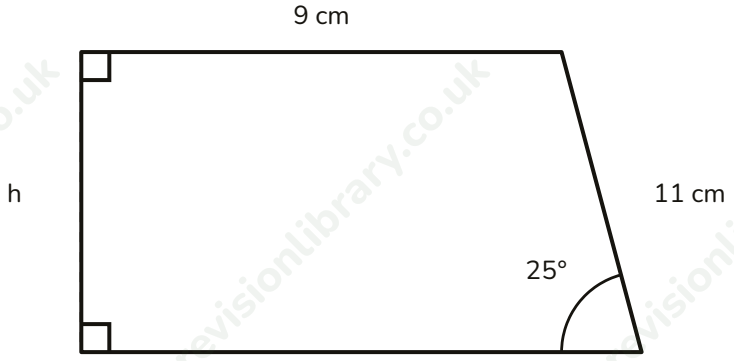
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(Total for Question 12 is 6 marks)

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13 The cross-section of a plastic door-stop is a right-angled trapezium. The top parallel side is 9 cm, the left side is vertical (a right angle at top and bottom), and the slanted right side has length 11 cm and makes an angle of 25 degrees with the horizontal base.

Diagram NOT accurately drawn



(a) Calculate the height of the trapezium and the length of the base. Give each answer correct to 3 significant figures. **(3)**

.....

(b) Calculate the area of the cross-section. **(2)**

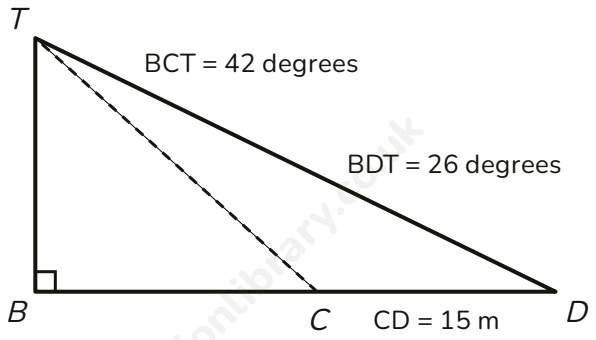
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(Total for Question 13 is 5 marks)

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14 A vertical tree TB stands on horizontal ground, with its base at B. From a point C on the ground, in line with B, the angle of elevation of the top of the tree, T, is 42 degrees. From a point D, further from the tree than C, with C between B and D and CD = 15 m, the angle of elevation of T is 26 degrees.

Diagram NOT accurately drawn



(a) By forming two equations for the height, h, of the tree (using triangles TBC and TBD), calculate h. Give your answer correct to 3 significant figures. **(4)**

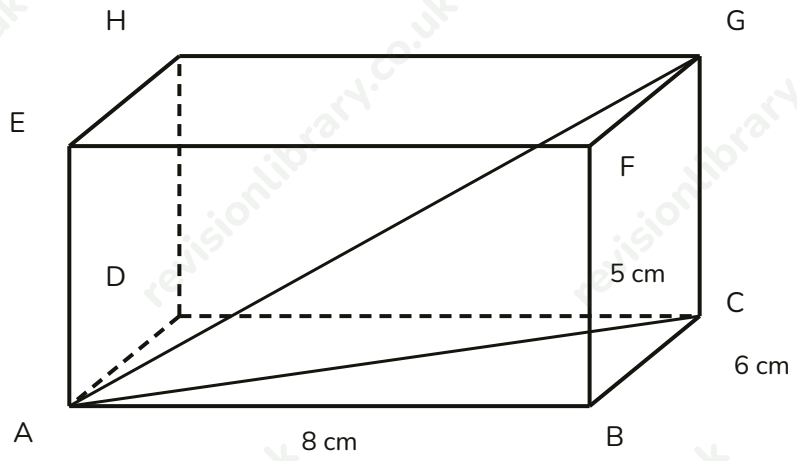
(b) Hence calculate the distance BC. **(2)**

(Total for Question 14 is 6 marks)

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15 A cuboid ABCDEFGH has a rectangular base ABCD with AB = 8 cm and BC = 6 cm, and vertical edges of height 5 cm (AE = BF = CG = DH = 5 cm). G is the vertex vertically above C. The diagonal AC of the base is drawn, and the space diagonal AG from A to G is also drawn.

Diagram NOT accurately drawn



(a) Calculate the size of the angle between the diagonal AG and the base ABCD. **(3)**

.....

(b) Calculate the length of the space diagonal AG. Give your answer correct to 3 significant figures. **(2)**

.....

(Total for Question 15 is 5 marks)

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Mark scheme · 5.19 SOHCAHTOA (Trigonometry): 2-hour Pack

Question 1

(a) AB = 6.2 / cos(47) oe **M1**

(a) awrt 9.09 (cm) **A1**

(a) Answer: AB = 9.09 cm (3 s.f.)

(b) BC = 6.2 tan(47) oe, or use of Pythagoras with their AB (ft) **M1**

(b) awrt 21.9 (cm) ft their AB **A1**

(b) Answer: perimeter = 21.9 cm (3 s.f.)

Question 2

height above eye level = 24 tan(31) oe **M1**

total height = their (24 tan 31) + 1.6 **M1**

awrt 16 (m) **A1**

Answer: total height = 16 m (3 s.f.)

Question 3

(a) identify tan(θ) = opposite/adjacent so tan(θ) = 1.2/4.0 **M1**

(a) $\theta = \tan^{-1}(0.3) = 16.699...$ => 17 degrees to nearest degree cao **A1**

(a) Answer: 17 degrees

(b) use Pythagoras or use hypotenuse = adjacent / cos(θ); here hypotenuse = $\sqrt{4.0^2 + 1.2^2}$ **M1**

(b) calculate: length = $\sqrt{16 + 1.44} = \sqrt{17.44}$ **M1**

(b) length = 4.1761... => 4.18 m to 2 dp cao **A1**

(b) Answer: 4.18 m

Question 4

(a) identify sin(θ) = opposite/hypotenuse so sin(θ) = 9.0/12.0 **M1**

(a) $\theta = \sin^{-1}(0.75) = 48.590...$ => 49 degrees to nearest degree cao **A1**

(a) Answer: 49 degrees

(b) use cos(θ) = adjacent/hypotenuse or use Pythagoras: adjacent = $\sqrt{12^2 - 9^2}$ **M1**

(b) calculate: adjacent = $\sqrt{144 - 81} = \sqrt{63}$ **M1**

(b) adjacent = 7.937253... => 7.94 m to 2 dp cao **A1**

(b) Answer: 7.94 m

Question 5

identify tan(θ) = opposite/adjacent, so height = 12 * tan28 **M1**

substitute and use calculator: height = 12 * tan28 **M1**

height = 12 * 0.531709... = 6.38051... (correct intermediate value) **A1**

6.4 m to 1 dp cao **A1**

Answer: 6.4 m

Question 6

(a) 20 x cos(65) oe **M1**

(a) awrt 8.45 km **A1**

(a) Answer: 8.45 km (3 s.f.)

(b) 20 x sin(65) oe **M1**

(b) awrt 18.1 km **A1**

(b) Answer: 18.1 km (3 s.f.)

Question 7

correct identification that the angle at the boat (in the right-angled triangle) is 18 degrees, by alternate angles **M1**

distance = 52 / tan(18) oe **M1**

awrt 160 (m) **A1**

Answer: distance = 160 m (3 s.f.)

Question 8

(a) east distance = 35 sin(72) oe **M1**

(a) awrt 33.3 (km) **A1**

(a) Answer: 33.3 km east

(b) north distance = 35 cos(72) oe **M1**

(b) awrt 10.8 (km) **A1**

(b) Answer: 10.8 km north

Question 9

(a) tan(angle) = 5/12 oe **M1**

(a) awrt 22.6 (degrees) **A1**

(a) Answer: 22.6 degrees (1 d.p.)

(b) 90 - their answer to part (a) (ft) **M1**

(b) awrt 67.4 (degrees), with reason that angles in triangle ABC sum to 180 degrees and angle ABC = 90 degrees, so angles BAC and ACB sum to 90 degrees **A1**

(b) Answer: 67.4 degrees (1 d.p.), because angles in triangle ABC sum to 180 degrees and angle ABC = 90 degrees, so angles BAC and ACB sum to 90 degrees

Question 10

distance from A to base of tower = h / tan(25) oe **P1**

distance from B to base of tower = h / tan(39) oe **P1**

forms equation h / tan(25) - h / tan(39) = 20 oe (using AB = 20 m) **P1**

h = 20 / (1/tan(25) - 1/tan(39)) oe, correctly rearranged and solved **M1**

awrt 22.0 m **A1**

Answer: 22.0 m (3 s.f.)

Question 11

(a) AC = $\sqrt{15^2 + 6^2}$ oe **M1**

(a) awrt 16.2 cm **A1**

(a) Answer: 16.2 cm (3 s.f.)

(b) recognises right angle at C (CG perpendicular to base), so tan(GAC) = GC / AC oe **M1**

(b) angle GAC = $\tan^{-1}(9 / (\text{their AC}))$ **M1**

(b) awrt 29.1 degrees **A1**

(b) Answer: 29.1 degrees (1 d.p.)

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Question 12

(a) tan(50) = QR / 12 oe	**M1**
(a) QR = 12 x tan(50)	**M1**
(a) awrt 14.3 m	**A1**
(a) Answer: 14.3 m (3 s.f.)	
(b) tan(QSR) = (their QR) / 8 oe	**M1**
(b) QSR = $\tan^{-1}$((their QR) / 8)	**M1**
(b) awrt 60.8 degrees	**A1**
(b) Answer: 60.8 degrees (1 d.p.)	

Question 13

(a) height = 11 sin(25) oe	**M1**
(a) base = 9 + 11 cos(25) oe	**M1**
(a) height awrt 4.65 (cm) AND base awrt 19 (cm)	**A1**
(a) Answer: height = 4.65 cm, base = 19 cm (3 s.f.)	
(b) area = 0.5 x (9 + their base) x their height, using the trapezium area formula (ft)	**M1**
(b) awrt 65 (cm^2)	**A1**
(b) Answer: area = 65 cm^2 (3 s.f.)	

Question 14

(a) BC = h/tan(42) oe (correct equation from triangle TBC)	**M1**
(a) BD = h/tan(26) oe (correct equation from triangle TBD)	**M1**
(a) correct method to combine: BD - BC = 15, leading to h(1/tan(26) - 1/tan(42)) = 15 or equivalent rearrangement	**M1**
(a) awrt 16 (m)	**A1**
(a) Answer: h = 16 m (3 s.f.)	
(b) BC = their h / tan(42) (ft)	**M1**
(b) awrt 17.7 (m)	**A1**
(b) Answer: BC = 17.7 m (3 s.f.)	

Question 15

(a) AC = $\sqrt{8^2 + 6^2}$ (Pythagoras in the base), leading to AC = 10 cm	**M1**
(a) tan(angle) = 5/10 (or 5/their AC) oe, using right-angled triangle ACG	**M1**
(a) awrt 26.6 (degrees)	**A1**
(a) Answer: 26.6 degrees (1 d.p.)	
(b) AG = $\sqrt{\text{their AC}^2 + 5^2}$ oe (Pythagoras in triangle ACG)	**M1**
(b) awrt 11.2 (cm)	**A1**
(b) Answer: AG = 11.2 cm (3 s.f.)	

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