HIGHER

5.19H SOHCAHTOA (Trigonometry): Higher Tier Practice

Total Marks

EDEXCEL Edexcel 1MA1 · Calculator allowed · about 75 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A right-angled triangle has an angle of 38 degrees. The side opposite this angle is 5.0 cm. Work out sin 38 degrees to 3 significant figures, then use it to find the hypotenuse of the triangle. Give your answer to 3 significant figures.

(a) Work out sin 38 degrees to 3 significant figures. **(1)**

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(b) Using your answer to part (a), find the hypotenuse. Give your answer to 3 significant figures. **(2)**

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(Total for Question 1 is 3 marks)

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2 A right-angled triangle has adjacent side 7.5 cm and hypotenuse 13 cm. Find angle A correct to the nearest degree, where cos A = adjacent/hypotenuse.

(a) Find cos A to 4 decimal places then find angle A to the nearest degree. **(2)**

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(Total for Question 2 is 2 marks)

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3 In a right-angled triangle the two shorter sides are 9 cm (adjacent to angle B) and 12 cm (opposite to angle B). Without using Pythagoras, find angle B by using tan. Give your answer to 1 decimal place.

(a) Work out tan B then find B to 1 decimal place. **(2)**

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(Total for Question 3 is 2 marks)

4 A kite string makes an angle of 22 degrees with the ground. The length of the string from the flyer to the kite is 24 m. Find the vertical height of the kite above the ground, correct to 1 decimal place.

(a) Find the height using sin 22 degrees. **(2)**

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(Total for Question 4 is 2 marks)

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5 A right-angled triangle PQR has right angle at Q. Side PQ = 8.0 cm and PR = 13.0 cm. Find QR and then find angle R to the nearest degree.

(a) Find QR to 3 significant figures. **(2)**

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(b) Find angle R to the nearest degree. **(2)**

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(Total for Question 5 is 4 marks)

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6 Show that in any right-angled triangle the tangent of an acute angle is equal to the sine of that angle divided by the cosine of that angle. Give a short explanation using side lengths. This is a 'show that' question; all marks are for method and explanation.

(a) Show that $\tan \theta = \sin \theta / \cos \theta$ using opposite, adjacent and hypotenuse labels. **(3)**

(Total for Question 6 is 3 marks)

7 A surveyor stands at point A and measures the angle of elevation to the top of a tower as 31 degrees. She then walks 48 m closer to the tower along the level ground to point B and measures the angle of elevation as 46 degrees. Work out the height of the tower to the nearest metre.

(a) Find the height of the tower to the nearest metre. **(6)**

(Total for Question 7 is 6 marks)

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8 In triangle ABC, angle C is 90 degrees. The length AC = 5k cm and BC = 12 cm. The angle at A satisfies sin A = 3/5. Given this information, find k and then give the length AB to the nearest 0.1 cm.

(a) Find the value of k. **(3)**

(b) Find AB to the nearest 0.1 cm. **(3)**

(Total for Question 8 is 6 marks)

9 A ladder of length 7.5 m leans against a vertical wall. The foot of the ladder is x metres from the wall and the top reaches a height h metres. Express h in terms of x using Pythagoras, then show that $\tan\theta = \sqrt{7.5^2 - x^2} / x$ where θ is the angle the ladder makes with the ground. Hence find θ when x = 2.5, giving your answer to 1 decimal place.

(a) Express h in terms of x and show $\tan\theta = \sqrt{7.5^2 - x^2} / x$. **(3)**

(b) Find θ when x = 2.5, correct to 1 decimal place. **(3)**

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(Total for Question 9 is 6 marks)

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10 A triangular field ABC is not right-angled at any vertex. AB = 120 m, BC = 90 m, and angle ABC = 28 degrees. By dropping a perpendicular from A to the line BC (extending it if necessary), find the length AC. Give your answer to the nearest 0.1 m.

(a) Use the perpendicular from A to line BC to find AC. Give your answer to the nearest 0.1 m. **(6)**

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(Total for Question 10 is 6 marks)

Mark scheme · 5.19H SOHCAHTOA (Trigonometry): Higher Tier Practice

Question 1

- (a) **B1** sin 38 degrees = 0.616 cao to 3 s.f.
- **(a) Answer: 0.616**
- (b) **M1** use sin = opposite/hypotenuse so hypotenuse = opposite / sin 38
- (b) **A1** 8.12 cm awrt (3 s.f.)
- **(b) Answer: 8.12 cm**

Question 2

- (a) **M1** use cos A = 7.5/13 = 0.57692308... and use arccos
- (a) **A1** 55 degrees cao
- **(a) Answer: 55 degrees**

Question 3

- (a) **M1** use tan B = opposite/adjacent = 12/9 = 4/3 and take arctan
- (a) **A1** 53.1 degrees cao
- **(a) Answer: 53.1 degrees**

Question 4

- (a) **M1** height = 24 * sin 22 degrees
- (a) **A1** 9.0 m awrt (1 d.p.)
- **(a) Answer: 9.0 m**

Question 5

- (a) **M1** use Pythagoras QR = $\sqrt{PR^2 - PQ^2}$ or equivalent
- (a) **A1** 10.2 cm awrt (3 s.f.)
- **(a) Answer: 10.2 cm**
- (b) **M1** use sin R = opposite/hypotenuse = PQ/PR = 8/13 (PQ is opposite angle R) and take arcsin
- (b) **A1** 38 degrees cao
- **(b) Answer: 38 degrees**

Question 6

- (a) **M1** state sin θ = opposite/hypotenuse and cos θ = adjacent/hypotenuse
- (a) **M1** divide sin θ by cos θ to get (opposite/hypotenuse)/(adjacent/hypotenuse) = opposite/adjacent
- (a) **A1** conclude tan θ = opposite/adjacent = sin θ / cos θ cso
- **(a) Answer: tan θ = sin θ / cos θ**

Question 7

- (a) **M1** use tan 31 = h / x and tan 46 = h / (x - 48) to form two equations
- (a) **M1** eliminate x: h = x * tan31 and h = (x - 48) * tan46 then set x * tan31 = (x - 48) * tan46
- (a) **M1** rearrange to x (tan31 - tan46) = -48 * tan46 and solve for x
- (a) **M1** find h using h = x * tan31
- (a) **A1** height = 69 m awrt (1 m)
- (a) **A1** method and final value consistent with working
- **(a) Answer: 69 m**

Question 8

- (a) **M1** use sin A = opposite/hypotenuse = BC / AB = 3/5 and express AB in terms of BC
- (a) **M1** use $AB^2 = AC^2 + BC^2$ with AC = 5k to create equation
- (a) **A1** k = 16/5 (3.2)
- **(a) Answer: k = 16/5 (3.2)**
- (b) **M1** use BC = 12 and sin A = 3/5 to get AB = 12 * 5/3
- (b) **A1** AB = 20.0 cm awrt (0.1 cm)
- (b) **A1** answers consistent with k value
- **(b) Answer: 20.0 cm**

Question 9

- (a) **M1** use Pythagoras $h^2 + x^2 = 7.5^2$ and hence $h = \sqrt{7.5^2 - x^2}$
- (a) **M1** tan θ = opposite/adjacent = h/x therefore $\tan \theta = \sqrt{7.5^2 - x^2} / x$
- (a) **A1** complete algebraic demonstration
- **(a) Answer: $h = \sqrt{56.25 - x^2}$ and $\tan \theta = \sqrt{56.25 - x^2} / x$**
- (b) **M1** substitute x = 2.5 to get $\tan \theta = \sqrt{56.25 - 6.25} / 2.5 = \sqrt{50} / 2.5$
- (b) **M1** evaluate $\tan \theta = \sqrt{50} / 2.5 = 7.0710678 / 2.5 = 2.82842712$ and take arctan
- (b) **A1** 70.5 degrees cao
- **(b) Answer: 70.5 degrees**

Question 10

- (a) **M1** drop a perpendicular from A to line BC, meeting it at D, forming right triangle ABD with angle ABD = 28 degrees and hypotenuse AB = 120 m
- (a) **M1** AD = 120 sin28 and BD = 120 cos28
- (a) **A1** AD = 56.34 m and BD = 105.95 m awrt
- (a) **M1** recognise BD > BC so D lies beyond C on the extension of BC, giving DC = BD - BC
- (a) **M1** apply Pythagoras in right triangle ADC: $AC = \sqrt{AD^2 + DC^2}$
- (a) **A1** AC = 58.6 m to the nearest 0.1 m cao
- **(a) Answer: AC = 58.6 m**