KS3.M-G15 Introduction to Trigonometry

AQA KS3.M-G15 · Calculators not allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 A right-angled triangle has angle A = 90 degrees, angle B = 30 degrees and hypotenuse 10 cm. Write down the lengths of the opposite and adjacent sides to angle B in words.

(a) Name the side opposite angle B. **(1)**

(b) Name the side adjacent to angle B (but not the hypotenuse). **(1)**

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2 Write down the trigonometric ratio you would use to find the length of the opposite side given the angle and hypotenuse. Give the ratio name and the formula in words.

(a) Name the ratio. **(1)**

(b) Write the formula in words. **(1)**

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3 Calculate the length of the opposite side in question 1 using sine. Give your answer to 1 decimal place. (Angle B = 30 degrees, hypotenuse = 10 cm.)

(a) Calculate opposite = sin(30) x hypotenuse. **(2)**

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4 A right-angled triangle has one acute angle 40 degrees. The side adjacent to the 40 degree angle measures 6 cm. Work out the length of the hypotenuse. Give your answer to 1 decimal place.

(a) Find hypotenuse using cosine: cos(40) = adjacent/hypotenuse. **(3)**

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5 A student uses tan to find a length. In a right-angled triangle angle C = 50 degrees and the side adjacent to C is 4 m. Find the length of the opposite side, giving your answer to 1 decimal place.

(a) Use tan(50) = opposite / adjacent to find opposite. **(3)**

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6 In a right-angled triangle the hypotenuse is 13 cm and one acute angle is 67 degrees. Which trig ratio would you use to find the side adjacent to the 67 degree angle? State the ratio name and formula.

(a) Name the ratio. **(1)**

(b) Write the formula in words. **(1)**

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7 A ladder leans against a wall making an angle of 75 degrees with the ground. The foot of the ladder is 2.0 m from the wall. Find the length of the ladder to 1 decimal place.

(a) Use cos(75) = adjacent / hypotenuse to find ladder length. **(3)**

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8 A right-angled triangle has sides 9 cm (opposite to angle X), 12 cm (adjacent to X) and hypotenuse 15 cm.
(a) Verify which trig ratio equals 9/15 for angle X.
(b) Use that ratio to find angle X to the nearest degree.

(a) State the trig ratio equal to 9/15. **(1)**

(b) Find angle X using sin^{-1}(9/15). **(3)**

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9 Find the missing side in the right-angled triangle. Angle Y = 23 degrees, hypotenuse = 14 cm. Find the adjacent side to angle Y, to 1 decimal place.

(a) Use cos(23) = adjacent / 14. **(3)**

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10 A student tries to use sin instead of cos to find the adjacent side in question 9. Explain briefly why sin(23) x 14 is incorrect for the adjacent side.

(a) Give a brief reason. **(2)**

11 Find angle Z in the right-angled triangle where opposite = 7 cm and adjacent = 24 cm. Give your answer to the nearest degree.

(a) Use tan to find the angle: tan(Z) = opposite / adjacent. **(2)**

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12 A right-angled triangle has one side 8 m and another side 15 m. Show that the triangle could have hypotenuse 17 m, then find one acute angle to the nearest degree using trigonometry.

(a) Show that $8^2 + 15^2 = 17^2$. **(1)**

(b) Find the angle opposite the side of length 8 m, to the nearest degree. **(2)**

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13 A right-angled triangle has an acute angle of 31 degrees and the opposite side is 5 cm. Find the hypotenuse to 1 decimal place.

(a) Use sin(31) = opposite/hypotenuse to find the hypotenuse. **(3)**

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14 A right-angled triangle has sides 10 cm (adjacent to angle A) and 24 cm (hypotenuse). Find angle A to the nearest degree.

(a) Use cos to find angle A: cos(A) = 10 / 24. **(2)**

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15 A right-angled triangle has angle P = 58 degrees and an opposite side 9 cm. Find the adjacent side, giving your answer to 1 decimal place.

(a) Use tan(58) = opposite / adjacent and rearrange to find adjacent. **(3)**

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16 A triangular roof has a right-angled cross section. The roof rises 3 m over a horizontal run of 5 m. Find the angle of elevation of the roof to the nearest degree.

(a) Use $\tan(\theta)$ = opposite / adjacent = 3 / 5. **(2)**

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17 Stretch: A right-angled triangle has hypotenuse 20 cm. One acute angle is twice the other. Find the two acute angles to the nearest degree.

(a) Let the smaller angle be x degrees. Then the other is 2x. Use sin or cos to set up an equation and find x. **(2)**

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18 Stretch: A right-angled triangle has one acute angle 22 degrees and the side adjacent to it measures 11 cm. The opposite side is increased by 20% while the adjacent side stays the same. Calculate the new angle to the nearest degree.

(a) Find original opposite, increase it by 20% then find new angle using tan^{-1}. **(2)**

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Question 1

- (a) **B1** opposite side to angle B named correctly (opposite)
- (a) Answer: **Opposite**
- (b) **B1** adjacent side to angle B named correctly (adjacent)
- (b) Answer: **Adjacent**

Question 2

- (a) **B1** sine named as the correct ratio (sine)
- (a) Answer: **Sine**
- (b) **B1** sine = opposite divided by hypotenuse stated
- (b) Answer: **Sine = opposite / hypotenuse**

Question 3

- (a) **M1** method: opposite = sin(30) x 10 or use of 0.5 x 10
- (a) **A1** 5.0 cm cao
- (a) Answer: **5.0 cm**

Question 4

- (a) **M1** method: hypotenuse = adjacent / cos(40) or equivalent
- (a) **A1** hypotenuse = 6 / cos(40) shown
- (a) **A1** 7.8 cm to 1 dp cao
- (a) Answer: **7.8 cm**

Question 5

- (a) **M1** method: opposite = adjacent x tan(50)
- (a) **A1** correct substitution: opposite = 4 x tan(50)
- (a) **A1** 4.8 m to 1 dp cao
- (a) Answer: **4.8 m**

Question 6

- (a) **B1** cosine named
- (a) Answer: **Cosine**
- (b) **B1** cosine = adjacent / hypotenuse stated
- (b) Answer: **Cosine = adjacent / hypotenuse**

Question 7

- (a) **M1** method: hypotenuse = adjacent / cos(75)
- (a) **A1** substitution: 2.0 / cos(75) shown
- (a) **A1** 7.7 m to 1 dp cao
- (a) Answer: **7.7 m**

Question 8

- (a) **B1** sine named since opposite/hypotenuse = 9/15
- (a) Answer: **Sine**
- (b) **M1** method: X = sin^{-1}(9/15) or equivalent
- (b) **A1** correct substitution and evaluation shown
- (b) **A1** 37 degrees to nearest degree cao
- (b) Answer: **37 degrees**

Question 9

- (a) **M1** method: adjacent = 14 x cos(23)
- (a) **A1** correct substitution shown
- (a) **A1** 12.9 cm to 1 dp cao
- (a) Answer: **12.9 cm**

Question 10

- (a) **M1** reference to definitions: sin = opposite/hypotenuse and cos = adjacent/hypotenuse
- (a) **A1** statement that sin(23) x 14 gives the opposite, not the adjacent, so it is wrong
- (a) Answer: **Because sin relates opposite to hypotenuse, sin(23) x 14 gives the opposite side. To find the adjacent we must use cos(23) x 14.**

Question 11

- (a) **M1** method: Z = arctan(7/24) or equivalent
- (a) **A1** 16 degrees to nearest degree cao
- (a) Answer: **16 degrees**

Question 12

- (a) **B1** calculation 64 + 225 = 289 or statement that sums match 17^2
- (a) Answer: **64 + 225 = 289**
- (b) **M1** method: sin(θ) = opposite/hypotenuse = 8/17 or equivalent
- (b) **A1** 28 degrees to nearest degree cao
- (b) Answer: **28 degrees**

Question 13

- (a) **M1** method: hypotenuse = opposite / sin(31)
- (a) **A1** correct substitution shown
- (a) **A1** 9.7 cm to 1 dp cao
- (a) Answer: **9.7 cm**

Question 14

- (a) **M1** method: A = arccos(10/24)
- (a) **A1** 65 degrees to nearest degree cao
- (a) Answer: **65 degrees**

Question 15

- (a) **M1** method: adjacent = opposite / tan(58)
- (a) **A1** correct substitution shown
- (a) **A1** 5.6 cm to 1 dp cao
- (a) Answer: **5.6 cm**

Question 16

- (a) **M1** method: θ = arctan(3/5)
- (a) **A1** 31 degrees to nearest degree cao
- (a) Answer: **31 degrees**

Question 17

- (a) **M1** method: recognise angles sum to 90 so x + 2x = 90, hence x = 30
- (a) **A1** angles are 30 degrees and 60 degrees cao
- (a) Answer: **30 degrees and 60 degrees**

Question 18

- (a) **M1** method: original opposite = adjacent x tan(22); new opposite = 1.2 x original opposite; new angle = arctan(new opposite / 11)
- (a) **A1** 26 degrees to nearest degree cao
- (a) Answer: **26 degrees**