1.5 Pure: Trigonometry: 30-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Write down the exact value of cos(60 degrees).

(Total for Question 1 is 1 mark)

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2 Solve the following trigonometric equations, giving all solutions in the given ranges.

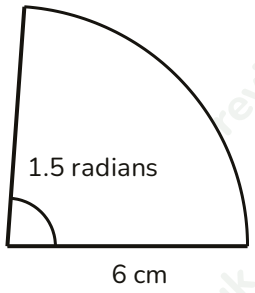
(a) Solve $2\sin(3\theta - 20 \text{ degrees}) = 1.2$ for $0 \text{ degrees} \leq \theta \leq 360 \text{ degrees}$, giving your answers to 1 decimal place. **(5)**

(b) Solve $\cos(x/2) = -0.85$ for $0 \text{ degrees} \leq x \leq 720 \text{ degrees}$, giving your answers to 1 decimal place. **(4)**

(Total for Question 2 is 9 marks)

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3 A sector has radius 6 cm and angle 1.5 radians at the centre. Find the area of the sector.



(Total for Question 3 is 1 mark)

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4 The depth of water, D metres, in a harbour, t hours after midnight on a particular day, is modelled by $D(t) = 6 + 2.5 \sin(30t)$, for $0 \leq t \leq 24$, where the angle is measured in degrees.

(a) State the maximum depth of water given by the model, and find the times during the 24 hour period at which it occurs. **(3)**

(b) Find the depth of water at 08:30, giving your answer to 3 significant figures. **(2)**

(c) Find the times during the 24 hour period at which the depth of water is exactly 7 m, giving your answers to the nearest minute. **(6)**

(Total for Question 4 is 11 marks)

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5 This question is about trigonometric identities and equations.

(a) Show that $(1 + \sin x)/\cos x + \cos x/(1 + \sin x) = 2 \sec x$. **(3)**

(b) Hence solve $(1 + \sin x)/\cos x + \cos x/(1 + \sin x) = 3$ for $0 \leq x < 360$ degrees, giving your answers to 1 decimal place. **(3)**

(Total for Question 5 is 6 marks)

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Mark scheme · 1.5 Pure: Trigonometry: 30-minute Pack

Question 1

1/2 cao	**B1**

Answer: 1/2

Question 2

(a) rearranges to sin(3theta - 20) = 0.6	**M1**
(a) finds a reference/principal angle, awrt 36.9 degrees	**M1**
(a) correct method to generate further values of (3theta - 20) using 180 - x and/or +360k, and converts back by adding 20 and dividing by 3	**M1**
(a) at least 3 of the 6 correct values, awrt 1 d.p.	**A1**
(a) all six correct: θ = 19.0, 54.4, 139.0, 174.4, 259.0, 294.4 (awrt), cao, no extra values in range	**A1**

(a) Answer: θ = 19.0, 54.4, 139.0, 174.4, 259.0, 294.4 degrees

(b) sets u = x/2 with correct range $0 \le u \le 360$	**M1**
(b) finds principal value arccos(-0.85), awrt 148.2 degrees	**M1**
(b) correct second value 360 - 148.2 = 211.8 degrees, and doubles both to find x	**M1**
(b) x = 296.4 and x = 423.6 (awrt 1 d.p.), cao, no extra values	**A1**

(b) Answer: x = 296.4 degrees, 423.6 degrees

Question 3

27 cm^2 cao	**B1**

Answer: 27 cm^2

Question 4

(a) maximum depth = 8.5 m	**B1**
(a) sets 30t = 90 (+360k) from sin(30t) = 1	**M1**
(a) t = 3 and t = 15, i.e. 03:00 and 15:00, both correct	**A1**

(a) Answer: Maximum depth 8.5 m, at 03:00 and 15:00

(b) substitutes t = 8.5 to give D = 6 + 2.5sin(255)	**M1**
(b) D = awrt 3.59 m cao	**A1**

(b) Answer: D = 3.59 m (3 s.f.)

(c) forms sin(30t) = 0.4	**M1**
(c) finds principal value arcsin(0.4), awrt 23.6 degrees	**M1**
(c) correct method to find all values of 30t within [0, 720] using 23.6+360k and (180-23.6)+360k	**M1**
(c) two correct times in the first 12 hours (00:47 and 05:13, ft)	**A1**
(c) two correct times in the second 12 hours (12:47 and 17:13, ft)	**A1**
(c) all four times correct to the nearest minute cao: 00:47, 05:13, 12:47, 17:13	**A1**

(c) Answer: 00:47, 05:13, 12:47, 17:13

Question 5

(a) writes over a common denominator cos x (1 + sin x)	**M1**
(a) numerator $(1 + \sin x)^2 + \cos^2 x = 2 + 2 \sin x$	**M1**
(a) factorises 2(1 + sin x) and cancels, giving 2/cos x = 2 sec x (cso)	**A1**

(a) Answer: expression = 2/cos x = 2 sec x

(b) uses the identity: 2 sec x = 3, so cos x = 2/3	**M1**
(b) x = 48.2	**A1**
(b) x = 311.8	**A1**

(b) Answer: x = 48.2, 311.8

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