1.13 Pure: Trigonometry Depth: 30-minute Pack

EDEXCEL 9MA0 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 In this question x is measured in degrees and $-180 < x \leq 180$.

(a) Solve the quadratic equation $y^2 - 1 = 0$ and hence state the possible values of cos x. **(2)**

(b) Hence solve $\cos^2 x - 1 = 0$ for $-180 < x \leq 180$, in degrees. **(4)**

(Total for Question 1 is 6 marks)

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2 This question is about trigonometric identities and equations.

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

(b) Hence solve $(\sin x + \cos x)^2 = 1/2$ for $0 \leq x < 360$ degrees, giving your answers to 1 decimal place. **(4)**

(Total for Question 2 is 6 marks)

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3 Show that, for $\sin \theta \cos \theta$ not equal to 0,

$\sec^2 \theta + \text{cosec}^2 \theta = \sec^2 \theta \, \text{cosec}^2 \theta$

(Total for Question 3 is 4 marks)

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4 $f(x) = 7 \sin x + 3 \cos x$, where x is in degrees.

(a) Express f(x) in the form $R \sin(x + \alpha)$, where $R > 0$ and $0 < \alpha < 90$ degrees. Give R as an exact value and α to 1 decimal place. **(4)**

(b) Write down the maximum value of f(x), and the smallest positive value of x at which it occurs, to 1 decimal place. **(2)**

(c) Solve $f(x) = 1$ for $0 \leq x < 360$ degrees, giving your answers to 1 decimal place. **(4)**

(Total for Question 4 is 10 marks)

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Mark scheme · 1.13 Pure: Trigonometry Depth: 30-minute Pack

Question 1

(a) factorises or uses the quadratic formula	**M1**
(a) cos x = 1 or cos x = -1	**A1**
(a) Answer: cos x = 1 or -1	
(b) finds a solution of cos x = 1 using inverse cos	**M1**
(b) solutions from cos x = 1: 0	**A1**
(b) repeats for cos x = -1	**M1**
(b) all solutions: 0, 180 degrees	**A1**
(b) Answer: 0, 180 degrees	

Question 2

(a) expands to $\sin^2 x + 2 \sin x \cos x + \cos^2 x$	**M1**
(a) uses $\sin^2 x + \cos^2 x = 1$ and $2 \sin x \cos x = \sin 2x$ (cso)	**A1**
(a) Answer: $(\sin x + \cos x)^2 = 1 + \sin 2x$	
(b) forms $\sin 2x = -1/2$	**M1**
(b) finds 2x = -30.0 and the symmetric value 180 + 30.0, extended by 360	**M1**
(b) any two correct values of x	**A1**
(b) all four values: 105.0, 165.0, 285.0, 345.0	**A1**
(b) Answer: x = 105.0, 165.0, 285.0, 345.0	

Question 3

writes $\sec^2 \theta$ and $\text{cosec}^2 \theta$ in terms of sin and cos, and combines over the common denominator $\sin^2 \theta \cos^2 \theta$	**M1**
correct combined numerator $\sin^2 \theta + \cos^2 \theta$	**A1**
uses $\sin^2 \theta + \cos^2 \theta = 1$ to simplify to $1 / (\sin^2 \theta \cos^2 \theta)$	**M1**
cso: rewrites $1/(\sin^2 \theta \cos^2 \theta)$ as $\sec^2 \theta \text{cosec}^2 \theta$	**A1**
Answer: Identity shown (proof)	

Question 4

(a) R cos α = 7 and R sin α = 3	**M1**
(a) $R = \sqrt{58}$	**A1**
(a) tan α = 3/7	**M1**
(a) α = 23.2 degrees	**A1**
(a) Answer: f(x) = $\sqrt{58}$ sin(x + 23.2)	
(b) maximum $\sqrt{58}$	**B1**
(b) x + 23.2 = 90, so x = 66.8	**B1**
(b) Answer: maximum $\sqrt{58}$ at x = 66.8	
(c) $\sin(x + 23.2) = 1/\sqrt{58}$	**M1**
(c) x + 23.2 = 7.5 or 172.5 (and adds 360 if needed)	**M1**
(c) x = 149.3	**A1**
(c) x = 344.3	**A1**
(c) Answer: x = 149.3, 344.3	

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