

Boost your performance and confidence with these topic-based exam questions

Practice questions created by actual examiners and assessment experts

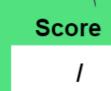
Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

Time allowed

2002



Percentage

%

Maths

Mark Scheme

AQA AS & A LEVEL

3.6 E: Trigonometry

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3(a)	$R = \sqrt{13}$ Or 3.6	B1	1				
(b)	$\frac{\sin\alpha}{\cos\alpha} = \tan\alpha = \frac{2}{3} \qquad \alpha \approx 33.7$	M1A1	2	Allow M1 for tan $\alpha = \frac{-2}{3}$ or $\pm \frac{3}{2}$			
				AG convincingly obtained			
(c)	maximum value $=\sqrt{13}$	B1F					
	$\cos\left(\theta + 33.7\right) = 1 \qquad \left(\theta = -33.7\right)$	M1					
	$\theta = 326.3$	A1	3	AWRT 326			
	Total		6				
6(a)	$\cos 2x = 2\cos^2 x - 1$	B1B1	2				
4(1 1	1			
4(a)(i	$\sin 2x = 2 \sin x \cos x$	BI					
(ii	$\cos 2x = 2\cos^2 x - 1$	B1	1				
(b) $\sin x$	M1		Use of their $\cos 2x \operatorname{or} \sin 2x$			
	$\sin 2x - \tan x = 2\sin x \cos x - \frac{\sin x}{\cos x}$	M1		Use of $\tan x = \frac{\sin x}{2}$ and the other			
	$=\sin x \left(2\cos x - \frac{1}{\cos x}\right)$			$\cos x$ double angle identity			
				double angle identity			
	$= \sin x \left(\frac{2\cos^2 x - 1}{\cos x} \right) = \tan x \cos 2x$	A1	3	AG convincingly obtained			
(C	$) \tan x \cos 2x = 0 x = 180$	B1		Ignore $x = 0$, $x = 360^{\circ}$ & any others			
				outside range			
	$\cos 2x = 0$ or $\cos^2 x = \frac{1}{2} \left(\text{or } \sin^2 x = \frac{1}{2} \right)$	M1					
	<i>x</i> = 45	A1					
	<i>x</i> = 135, 225, 315	Al	4	CAO max 3/4 for answers in radians			
	Tota	l	9				



		D1	1	
3(a)	$\cos 2x = 1 - 2\sin^2 x$	B1	1	
b)(i)	$3\sin x - \cos 2x = 3\sin x - (1 - 2\sin^2 x)$	M1		Candidate's $\cos 2x$ or $\sin^2 x$
	$= 3\sin x - 1 + 2\sin^2 x$	A1	2	AG
(ii)	$2\sin^2 x + 3\sin x - 2 = 0$	M1		Soluble quadratic form
	$(2\sin x - 1)(\sin x + 2) = 0$	M1		Attempt to solve (allow one error in formula, allow sign errors)
	$\sin x = \frac{1}{2}$ $x = 30$ $x = 150$	M1 A1	4	\sin^{-1} and two solutions ($0^{\circ} < x < 360^{\circ}$) A0 if radians
	Allow misread for			
	$2\sin^2 x + 3\sin x - 1 = 0$	(M1)		Soluble quadratic form
	$\sin x = \frac{-3 \pm \sqrt{17}}{4}$	(M1)		Use of formula (allow one error)
	<i>x</i> = 16.3°, 163.7°	(A1)		Max 3/4
(c)	$\int \frac{1}{2} (1 - \cos 2x) = \frac{x}{2} - \frac{\sin 2x}{4} (+c)$	M1A1	2	M1 – solve integral, must have 2 terms for $\sin^2 x$ from (a)
			9	
(a)	$\tan(x+x) = \frac{\tan x + \tan x}{1 - \tan x \tan x} \left(= \frac{2 \tan x}{1 - \tan^2 x} \right)$	M1 A1	2	A = B = x used
b)	$2 - 2\tan x - \frac{2\tan x(1 - \tan^2 x)}{2\tan x}$	M1		Substitute from (a)
	$2-2\tan x - (1-\tan x)(1+\tan x)$	M1		Simplification $2 - 2 \tan x - (1 - \tan^2 x)$
	$(1 - \tan x)(2 - (1 + \tan x))$	M1		$2-2\tan x - 1 + \tan^2 x$
	$(1-\tan x)^2$	A1	4	AG (convincingly obtained)
				$=(\tan x - 1)^2 = (1 - \tan x)^2$

Total

6

Any equivalent method



3(a)	R = 5	B1		
	$\tan \alpha = \frac{3}{4}$ (OE) $\alpha = 36.9^{\circ}$ (ISW 216.9)	M1A1	3	SC1 $\tan \alpha = \frac{4}{3}, \alpha = 53.1^{\circ}$
	-			R, α PI in (b)
(b)	$\cos(x - \alpha) = \frac{2}{R}$ $x - \alpha = 66.4^{\circ}$ $x = 103.3^{\circ}$	M1		
	$x - \alpha = 66.4^{\circ}$	A1		
	$x = 103.3^{\circ}$	A1F		
	$x = 330.4^{\circ}$	A1F	4	accept 330.5°, –1 each extra
				ft on acute α
(c)	minimum value $=-5$	B1F		ft on R
	$\cos(x - 36.9) = -1$	M1		SC $\cos(x+36.9)$ treat as miscopy
	$x = 216.9^{\circ}$	A1	3	216.9 or better accept graphics calculator solution to this accuracy SC Find max:
				max = 5 at $(x + 36.9)$ stated 1/3
				Max 8/10 for work in radians
	Total		10	