9709	s10	ms	11

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1	$\tan x = k$		
	(i) $\tan(\pi - x) = -k$	B1 [1]	co. www Mark final answers
	(ii) $\tan\left(\frac{\pi}{2} - x\right) = \frac{1}{k}$	B1 [1]	co. www
	(iii) $\sin x = \frac{k}{\sqrt{1+k^2}}$ from 90° triangle.	M1 A1 [2]	Any valid method – 90° triangle or formulae.
2	$\left(2x-\frac{3}{x}\right)^5$		
	(i) $32x^5 - 240x^3 + 720x$	3 × B1 [3]	co. SC B2 for other 3 terms (i.e. ascending)
	(ii) $\left(1+\frac{2}{x^2}\right)(32x^5-240x^3+720x)$		
	Coeff of $x (1 \times 720) + (2 \times -240)$ $\rightarrow 240$	M1 A1√ [2]	Looks at exactly 2 terms. co from his answer to (i).
3	$9^{\text{th}} \text{ term} = 22, S_4 = 49$		
	(i) $a+8d = 22$ 2(2a+3d) = 49 Soln of sim eqns $\rightarrow d = 1.5, a = 10$	B1 B1 M1 A1 [4]	co co Solution of two linear sim eqns. co
	(ii) $a + (n-1)d = 46$ Substitutes for a and d $\rightarrow n = 25$	M1 A1 [2]	Correct formula needed and attempt to solve. co.
4	$y = 6x - x^2$		
	Meets $y = 5$ when $x = 1$ or $x = 5$. Integral = $3x^2 - \frac{1}{2}x^3$	B1 M1 A1	co
	Their limits (1 to 5) used $\rightarrow 30^{2/3}$ Area of rectangle = 20 Shaded area = $10^{2/3}$	$ \begin{array}{c} \text{DM1}\\ \text{B1}\\ \text{A1}\\ \text{[6]} \end{array} $	value at top limit – value at lower co to his x values co
	(integral of $6x - x^2 - 5$ B1, M1, A1 DM1 as above, then "-5x" B1 $$ A1)		

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a : ² a	2				
$x \mapsto 2\sin^2 x - 3e^2$	$\cos^2 x$				
(i) $2(1-\cos^2 x)$	$)-3\cos^2 x$	M1	Uses $s^2 + c^2 = 1$		
$\rightarrow 2-5\cos(2)$	$s^2 x (a=2, b=-5)$	A1	со		
(ii) Values are -	-3 and 2	$\begin{bmatrix} 2 \\ B1\sqrt{B1} \\ [2] \end{bmatrix}$			
(iii) $2-5\cos^2 x$	= -1				
$\rightarrow \cos^2 x = x = 0.685, 2$	0.6 2.46 (accept 0.684)	$ \begin{array}{c} B1 \\ B1 \\ B1 \\ [3] \end{array} $	co $\sqrt{100}$ for π – (firs SC B1 for both 39	t answer) 9.2 and 140.8	
$\frac{\mathrm{d}y}{\mathrm{d}x} = 3\sqrt{x} - 6$	(9, 2)				
(i) $y = \frac{3x^{\frac{3}{2}}}{\frac{3}{2}} - 6$	5x(+c)	B2,1	Loses 1 for each e	error – ignore + c	
$\begin{array}{l} (9,2) 2=3\\ \rightarrow \ c=2. \end{array}$	54 - 54 + c	M1 A1 [4]	Uses (9, 2) with in co.	ntegration to find c	
(ii) $\frac{\mathrm{d}y}{\mathrm{d}x} = 0 \rightarrow$	<i>x</i> = 4	B1	Ignore any <i>y</i> -valu	e	
$\frac{d^2 y}{d^2 x} = \frac{3x^{-\frac{1}{2}}}{2}$	-	M1 A1	Any valid method	l. co.	
\rightarrow +ve (or ³ / ₂	(4) Minimum	[3]			
$y = 2 - \frac{18}{2x+3}$					
(i) A is $(3, 0)$		B1	Anywhere – but n	ot from given ansv	ver
$\frac{\mathrm{d}y}{\mathrm{d}x} = 18(2x)$	$(\kappa+3)^{-2} \times 2$	B1 B1	B1 for $18(2x+3)^2$	$^{-2}$, B1 for ×2	
If $x = 3, m =$	$=\frac{4}{9}$.				
<i>m</i> of norma	$l = -\frac{9}{4}$	M1	Use of $m_1m_2 = -1$	with <i>m</i> from dv/dx	;
Equation of	normal $v = -\frac{9}{4}(x-3)$	M1	Correct method for	or normal	
$\rightarrow 4v + 9r$	= 27	A1	co (answer was gi	ven)	
	_,	[6]			
(ii) Normal mee	ets <i>y</i> -axis at (0, 6 ³ / ₄)				
Curve meet	s <i>y</i> -axis at (0, −4)	M1	Needs to put $x = 0$) in both normal an	d
$\rightarrow BC = 10$)3/4	Al	curve. co		
	Page 5 $x \mapsto 2\sin^{2} x - 36$ (i) $2(1 - \cos^{2} x)$ $\rightarrow 2 - 5\cos^{2} x$ $\rightarrow 2 - 5\cos^{2} x$ (ii) Values are - (iii) $2 - 5\cos^{2} x$ $\rightarrow \cos^{2} x =$ x = 0.685, 2 $\frac{dy}{dx} = 3\sqrt{x} - 6$ (i) $y = \frac{3x^{\frac{3}{2}}}{\frac{3}{2}} - 6$ (j) $2 = \frac{3}{2}$ $\rightarrow c = 2$. (ii) $\frac{dy}{dx} = 0 \rightarrow$ $\frac{d^{2}y}{d^{2}x} = \frac{3x^{-\frac{1}{2}}}{2}$ $\rightarrow +ve \text{ (or 3)}$ $y = 2 - \frac{18}{2x + 3}$ (i) A is (3, 0) $\frac{dy}{dx} = 18(2x)$ If $x = 3, m =$ m of normal Equation of $\rightarrow 4y + 9x$ (ii) Normal mean Curve meet $\rightarrow BC = 10$	Page 5 Mark Scheme GCE AS/A LEV $x \mapsto 2 \sin^2 x - 3 \cos^2 x$ (i) $2(1 - \cos^2 x) - 3 \cos^2 x$ $\rightarrow 2 - 5 \cos^2 x$ $(a = 2, b = -5)$ (ii) Values are -3 and 2 (iii) $2 - 5 \cos^2 x = -1$ $\rightarrow \cos^2 x = 0.6$ $x = 0.685, 2.46$ (accept 0.684) $\frac{dy}{dx} = 3\sqrt{x} - 6$ (9, 2) (i) $y = \frac{3x^{\frac{3}{2}}}{\frac{3}{2}} - 6x (+c)$ (9, 2) $2 = 54 - 54 + c$ $(9, 2)$ $2 = 54 - 54 + c$ $\rightarrow c = 2$. (ii) $\frac{dy}{dx} = 0 \rightarrow x = 4$ $\frac{d^2 y}{d^2 x} = \frac{3x^{-\frac{1}{2}}}{2}$ $\rightarrow +ve$ (or ³ / ₄) Minimum $y = 2 - \frac{18}{2x + 3}$ (i) A is (3, 0) $\frac{dy}{dx} = 18(2x + 3)^{-2} \times 2$ If $x = 3, m = \frac{4}{9}$. m of normal $= -\frac{9}{4}$ Equation of normal $y = -\frac{9}{4}(x - 3)$ $\rightarrow 4y + 9x = 27$ (ii) Normal meets y-axis at (0, 6 ³ / ₄) Curve meets y-axis at (0, -4) $\rightarrow BC = 10^{3}/{4}$	Page 5 Mark Scheme: Teachers' GCE AS/A LEVEL – May/J $x \mapsto 2\sin^2 x - 3\cos^2 x$ M1 $\rightarrow 2 - 5\cos^2 x$ ($a = 2, b = -5$) A1 (ii) Values are -3 and 2 $B1\sqrt{B1\sqrt{2}}$ (iii) Values are -3 and 2 $B1\sqrt{B1\sqrt{2}}$ (iii) $2 - 5\cos^2 x = -1$ $2 \cos^2 x = 0.6$ $\rightarrow \cos^2 x = 0.6$ $x = 0.685, 2.46$ (accept 0.684) $B1\sqrt{3}$ $\frac{dy}{dx} = 3\sqrt{x} - 6$ $9, 2$ $B1\sqrt{3}$ (i) $y = \frac{3x^{\frac{3}{2}}}{\frac{3}{2}} - 6x(+c)$ B2,1 $[4]$ $(9, 2), 2 = 54 - 54 + c$ M1 $A1$ $(9, 2), 2 = 54 - 54 + c$ A1 $[4]$ $(ii) \frac{dy}{dx} = 0 \rightarrow x = 4$ B1 $M1$ $\frac{d^2y}{d^2x} = \frac{3x^{-\frac{1}{2}}}{2}$ M1 A1 $[3]$ $y = 2 - \frac{18}{2x + 3}$ $M1$ $M1$ $y = 2 - \frac{18}{2x + 3}$ $M1$ $M1$ $\frac{dy}{dx} = 18(2x + 3)^{-2} \times 2$ $B1$ $B1$ $Mf x = 3, m = \frac{4}{9}$ $M1$ $M1$ $y = 2 - \frac{18}{2x + 3}$ $M1$ $M1$ $y = 19x + 9x = 27$ $M1$ $M1$ $M1$ $M1$	Page 5 Mark Scheme: Teachers' version GCE AS/A LEVEL – May/June 2010 $x \mapsto 2\sin^2 x - 3\cos^2 x$ $\rightarrow 2 - 5\cos^2 x (a = 2, b = -5)$ M1 A1 Uses $s^2 + c^2 = 1$ co $\rightarrow 2 - 5\cos^2 x$ ($a = 2, b = -5$) A1 co (ii) Values are -3 and 2 B1 $\sqrt{12}$ B1 $\sqrt{12}$ Co (iii) $2 - 5\cos^2 x = -1$ $\rightarrow \cos^2 x = 0.6$ $x = 0.685, 2.46$ (accept 0.684) B1 $\sqrt{12}$ B1 $\sqrt{12}$ Co (i) $y = \frac{3x^{\frac{3}{2}}}{\frac{3}{2}} - 6x$ (+c) B2,1 Loses 1 for each 6 Loses 1 for each 6 Co (i) $y = \frac{3x^{\frac{3}{2}}}{\frac{3}{2}} - 6x$ (+c) B2,1 Loses 1 for each 6 Loses 0 (ii) $\frac{dy}{dx} = 0 \rightarrow x = 4$ $\frac{d^2y}{d^2x} = \frac{3x^{-\frac{1}{2}}}{2}$ M1 A1 Any valid method -3 + ve (or 3/2) Minimum (i) A is (3, 0) $\frac{dy}{dx} = 18(2x + 3)^{-2} \times 2$ $1f x = 3, m = \frac{4}{9}$. m of normal $= -\frac{9}{4}$ B1 M1 B1 b1 b1 b1 for 18(2x + 3) Use of $m_1m_2 = -1$ Equation of normal $y = -\frac{9}{4}(x - 3)$ $\rightarrow 4y + 9x = 27$ M1 Correct method for co (answer was gifted) (ii) Normal meets y-axis at (0, 6 ³ /4) Curve meets y-axis at (0, 6 ³ /4) M1 A1 Needs to put $x = 0$ curve. co	Page 5Mark Scheme: Teachers' versionSyllabusGCE AS/A LEVEL - May/June 20109709 $x \mapsto 2 \sin^2 x - 3\cos^2 x$ M1 $(i) 2(1 - \cos^2 x) - 3\cos^2 x$ M1 $\rightarrow 2 - 5\cos^2 x$ ($a = 2, b = -5$)A1 $\rightarrow 2 - 5\cos^2 x = (a = 2, b = -5)$ A1 (ii) Values are -3 and 2 $[2]$ $[2i]$ $[1\sqrt{B1}\sqrt{B1}\sqrt{B1}\sqrt{B1}\sqrt{B1}\sqrt{B1}\sqrt{B1}B1$

					9709) s10 m
Page 6		Mark Scheme:	Teachers'	version	Syllabus	Pape
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			1	1		
(i)	<i>y</i> -step $\div x$	-step = 2	M1	Gradient = y -step -	$\div x$ step used	
	$\rightarrow m = 1$		A1	со		
			[2]			
		~				
(ii)	Eqn of AC	y + 2 = -2(x - 3)	MI AIV	Correct form of on	ie of lines. ∇ to h	1S <i>m</i>
	Eqn of BC	C y - 22 = (x - 15)	A1√	$\sqrt{1}$ to his <i>m</i>		
	Sim eqns	y + 2x = 4, $y = x + 7$				
	$\rightarrow C(-1,$, 6)	A1	со		
			[4]			
(iii)	M is (9, 1)	0)	B1	со		
	Perp grad	1ent 1s $-\frac{1}{2}$	MI	Use of $m_1m_2 = -1$		
	$\rightarrow 2y + y$	x = 29, y = x + 7	MI	Solve sim eqns for	their BC & perp.	DIS
	Sim eqns	$\rightarrow D(5, 12)$	Al	co		
			[4]			
(i)	$2x^2 - 12x$	$x+7 = 2(x-3)^2 - 11$	$3 \times B1$	B1 for each value	$- \operatorname{accept} \operatorname{if} a, b, c$	not
		a	[3]	specifically quotec	1.	
(ii)	Range of	$f \ge -11$	BI√	\vee to his "c". allow	$v > or \ge$.	
	a ² 10	5 01				
(111)	$2x^2 - 12x$	z + 7 < 21			2	
	$\rightarrow 2x^2 - 1$	12x - 14 or	M1	3-term quadratic to	$x = 0 \text{ or } 2(x-3)^2 < 3$	32
	$2(x-3)^2$	< 32				
	\rightarrow end-va	lues of 7 or -1	A1	Correct end-values	5	
	$\rightarrow -1 < x$	c < 7	A1			
			[3]			
(iv)	gf(x) = 2($(2x^2 - 12x + 7) + k = 0$	M1 A1	Puts f into g. co.		
	Use of b^2	-4ac	M1	M1 Used correctly with quadr		
	$\rightarrow 24^2 -$	16(14+k)	A 1			
	$\rightarrow k = 22$			co.		
			[4]			
OA	= i + 3 j + 3	$3\mathbf{k}, OC = 3\mathbf{i} - \mathbf{j} + \mathbf{k}.$				
(i)	$\overrightarrow{OB} = \overrightarrow{OA}$	$+ \overrightarrow{OC} = 4\mathbf{i} + 2\mathbf{j} + 4\mathbf{k}$	B1	со		
	Unit vecto	$pr = \frac{1}{4}(4i + 2i + 4k)$	M1 A1√	Divides by the mo	dulus $\sqrt{\text{on }\overrightarrow{OB}}$	
		6 (i i j i i j	[2]			
	→ —	→→	[3]			
(ii)	AC = OC	$C - OA = 2\mathbf{i} - 4\mathbf{j} - 2\mathbf{k}$	B1	со		
	\overrightarrow{AC} . \overrightarrow{OB} =	= 8 - 8 - 8 = -8	M1	Use of $x_1 x_2 + y_1 y_2$	$_{2} + z_{1} z_{2}$	

8

9

10

 $\left|\overrightarrow{OB}\right| = 6; \left|\overrightarrow{AC}\right| = \sqrt{24}$

 $-8 = 6 \times \sqrt{24} \times \cos \theta$

 $\theta = 105.8^{\circ} \rightarrow 74.2^{\circ}$

(iii) $OA = \sqrt{19}$ or $OC = \sqrt{11}$

Perimeter = $2(\sqrt{+\sqrt{}})$

 $\rightarrow 15.4$

11

[5]

[3]

M1

M1

A1

B1

M1 A1 Correct method for a modulus.

co (accept acute or obtuse)

Used as a length.

co (accept 15.3)

Connected correctly provided \overrightarrow{OB} , \overrightarrow{AC} used