				9709 s14 ms 3		
	Paç	ge 4	Mark Scheme	Syllabus	Paper	_
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1	Use	law of the	logarithm of a quotient or product or $2 = \log 100$		M1	
1	Because logarithms and obtain $x + 9 = 100x$, or equivalent					
	Obta	in answer	$x = \frac{1}{11}$		A1	3
			11			-
2	State	e a correct	unsimplified version of the <i>x</i> or x^2 or x^3 term		M1	
	State	e correct fi	irst two terms $1 - x$		A1	
	Obtain the next two terms $2x^2 - \frac{14}{3}x^3$ All					
	[Syn	nbolic bin	omial coefficients, e.g. $\begin{pmatrix} -\frac{1}{3} \\ 3 \end{pmatrix}$ are not sufficient for the M man	k.]		
3	(i)	Use tan(A	$(\pm B)$ formula and obtain an equation in tan x		M1	
		Using tan	$60^\circ = \sqrt{3}$, obtain a horizontal equation in tan x in any correct	et form	A1	
		Reduce th	ne equation to the given form		A1	3
	(ii)	Solve the	given quadratic for tan x		M1	
	(11)	Obtain a o	correct answer, e.g. $x = 21.6^{\circ}$		Al	
		Obtain a s [Ignore an (0.377, 2.	second answer, e.g. $x = 128.4^{\circ}$, and no others newers outside the given interval. Treat answers in radians at 24).]	s a misread	A1	3
4	(i)	Consider Complete	sign of $x - 10/(e^{2x} - 1)$ at $x = 1$ and $x = 2$ the argument correctly with correct calculated values		M1 A1	2
	(ii)	State or in	mply $\alpha = \frac{1}{2} \ln(1 + 10/\alpha)$		B1	
		Rearrange	e this as $\alpha = 10/(e^{2\alpha} - 1)$ or work <i>vice versa</i>		B1	2
	(iii)	Use the it	erative formula correctly at least once		M1	
		Obtain fir	nal answer 1.14		A1	
		Show suffin the inte	ficient iterations to 4 d.p. to justify 1.14 to 2 d.p., or show th erval (1.135, 1.145)	ere is a sign chang	ge A1	3
5	Separate variables correctly and attempt integration of at least one side Obtain term in the form $a\sqrt{(2x+1)}$					
	Express $1/(\cos^2 \theta)$ as $\sec^2 \theta$					
	Obtain term of the form $k \tan \theta$					
	Evaluate a constant, or use limits $x = 0$, $\theta = \frac{1}{4}\pi$ in a solution with terms $a\sqrt{2x+1}$ and k tan θ					
	$ak \neq 0$					
	Obtain correct solution in any form, e.g. $\sqrt{(2x+1)} = \frac{1}{2} \tan \theta + \frac{1}{2}$					
	Rear	range and	obtain $x = \frac{1}{8}(\tan \theta + 1)^2 - \frac{1}{2}$, or equivalent		A1	7

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6	Oht	ain co	rrect	derivative of RHS in any form		B 1		
	Obt	tain co	rrect	derivative of LHS in any form		B1		
	Sat	dy		zono and obtain a harizantal aquation		M1		
	Set	$\frac{1}{dx}$ eq	luar ic	2 zero and obtain a nonzontal equation		111		
	Obt	tain a o	correc	t equation, e.g. $x^2 + y^2 = 1$, from correct work		A1		
	By	substi	tution	in the curve equation, or otherwise, obtain an equation in x	2 or y^{2}	M1		
	Obt	tain x =	$=\frac{1}{2}\sqrt{3}$			A1		
	Obt	tain v	$=\frac{1}{2}$			A1	7	
		J	2					
7	(a)	EITH	HER:	Multiply numerator and denominator by $1 - 4i$, or equivalent	ent, and use $i^2 = -1$	M1		
				Simplify numerator to $-17 - 17i$, or denominator to 17	,	A1		
				Obtain final answer –1 –i		A1		
		OR:		Using $i^2 = -1$, obtain two equations in x and y, and solve	for <i>x</i> or for <i>y</i>	M1		
				Obtain $x = -1$ or $y = -1$, or equivalent		A1	2	
				Obtain final answer $-1 - 1$		AI	3	
	(b)	(i)	Show	a point representing 2 + i in relatively correct position		B1		
			Show	a circle with centre $2 + i$ and radius 1		B1√ [°]		
			Show	the correct region	12	BI B1	4	
			Shaav			DI	-	
		(ii)	State	or imply that the angle between the tangents from the or	rigin to the circle is			
			requi	red		M1	2	
			Obtai	n answer 0.927 radians (or 55.1°)		AI	Z	
8	(i)	(i) Use a correct method for finding a constant				M1		
		Obta Obta	in one	e of A = 3, B = 3, C = 0		A1		
		Obtain a second value Obtain a third value				A1 A1	4	
		(ii) Integrate and obtain term $-3\ln(2-r)$				D1∱	•	
	(11)	Integ		1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 + 1 +				
		Integ	grate a	and obtain term of the form $k \ln(2 + x^{-})$		MI		
		Obtain term $\frac{3}{2}\ln(2+x^2)$				A1√		
		Subs	titute	limits correctly in an integral of the form $a \ln(2-x) + b \ln(2-x)$	$(2+x^2)$, where $ab \neq 0$) M1		
		Obta	in giv	ren answer after full and correct working		A1	5	
9	(i)	Subs	titute	for x and dx throughout using $u = \sin x$ and $du = \cos x dx$. or	r equivalent	M1		
-	Obtain int		in int	egrand e^{2u}	1	A1		
		Obta	in ind	lefinite integral $\frac{1}{2}e^{2u}$		A1		
		Use	limits	u = 0, u = 1 correctly, or equivalent		M1		
		Obta	in ans	swer $\frac{1}{2}(e^2 - 1)$, or exact equivalent		A1	5	
		2.2.00		2			-	

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(;;)	Use choir	rule or product rule	· · · ·	M1	
(II)		The of product fulle	$2\sin x$ $\sin x$		
	Ubtain co	Obtain correct terms of the derivative in any form, e.g. $2\cos x e^{-\sin x} \cos x - e^{-\sin x} \sin x$ Al			
	Equate de	term quadratic and obtain a value of r		M1	
	Obtain an	swer 0 896		A1	6
					U
10 (i)	Express g	general point of <i>l</i> in component form, e.g. $(1+3\lambda, 2-2\lambda, -1)$	+2λ)	B1	
	Substitute	e in given equation of p and solve for λ		M1	
	Obtain fii	nal answer $-\frac{1}{2}\mathbf{i} + 3\mathbf{j} - 2\mathbf{k}$, or equivalent, from $\lambda = -\frac{1}{2}$		A1	3
(ii)	State or in	mply a vector normal to the plane, e.g. $2\mathbf{i} + 3\mathbf{j} - 5\mathbf{k}$		B1	
	Using the	e correct process, evaluate the scalar product of a direction	on vector for <i>l</i> and a	a	
	normal fo	or p		M1	
	Using the	e correct process for the moduli, divide the scalar product l	by the product of the	9	
	moduli ar	nd find the inverse sine or cosine of the result		Ml	
	Obtain an	iswer 23.2° (or 0.404 radians)		Al	4
(iii)	EITHER:	State $2a + 3b - 5c = 0$ or $3a - 2b + 2c = 0$		B1	
		Obtain two relevant equations and solve for one ratio, e.g.	a : b	M1	
		Obtain $a:b:c=4:19:13$, or equivalent		A1	
		Substitute coordinates of a relevant point in $4x + 19y + 13$	z = d, and evaluate d	/ M1	
	OD1.	Obtain answer $4x + 19y + 13z = 29$, or equivalent	cont vicatora o a	AI	
	OK1:	Attempt to calculate vector product of relev $(2i + 2i - 5k) \times (2i - 2k)$	ant vectors, e.g	M1	
		$(2\mathbf{I} + 5\mathbf{J} - 5\mathbf{K}) \times (5\mathbf{I} - 2\mathbf{J} + 2\mathbf{K})$ Obtain two correct components of the product		A1	
		Obtain correct product $e g -4i - 19i - 13k$		A1	
		Substitute coordinates of a relevant point in $4x + 19y + 13$	z = d	M1	
		Obtain answer $4x + 19y + 13z = 29$, or equivalent		A1	
	<i>OR</i> 2:	Attempt to form a 2-parameter equation with relevant vec	tors	M1	
		State a correct equation, e.g. $\mathbf{r} = \mathbf{i} + 2\mathbf{j} - \mathbf{k} + \lambda(2\mathbf{i} + 3\mathbf{j} - 5\mathbf{k})$	$\mathbf{x}) + \mu(3\mathbf{i} - 2\mathbf{j} + 2\mathbf{k})$	A1	
		State 3 equations in x, y, z, λ and μ		A1	
		Eliminate λ and μ		M1	
		Obtain answer $4x + 19y + 13z = 29$, or equivalent		A1	
	OR3:	Using a relevant point and relevant direction vectors,	form a determinan	t	
		equation for the plane		MI	
		$\begin{vmatrix} x-1 & y-2 & z+1 \end{vmatrix}$			
		State a correct equation, e.g. $\begin{vmatrix} 2 & 3 & -5 \end{vmatrix} = 0$		A1	
		Attempt to expand the determinant		M1	
		Obtain correct values of two cofactors		A1	
		Obtain answer $4x + 19y + 13z = 29$, or equivalent		A1	5