Question	Answer	Marks	Guidance
1(i)	State or imply non-modular inequality $(2x-7)^2 < (2x-9)^2$ or corresponding equation or linear equation (with signs of $2x$ different)	**M1**	
	Obtain critical value 4	**A1**	
	State $x < 4$ only	**A1**	
		3	
1(ii)	Attempt to find n from $\ln n$ = *their* critical value from part **(i)**	**M1**	
	Obtain or imply $n < e^4$ and hence 54	**A1**	
		2	

Question	Answer	Marks	Guidance
2	Expand integrand to obtain $4e^{4x} - 4e^{2x} + 1$	**B1**	
	Integrate to obtain at least two terms of form $k_1e^{4x} + k_2e^{2x} + k_3x$	***M1**	
	Obtain correct $e^{4x} - 2e^{2x} + x$	**A1**	
	Apply both limits correctly to their integral	**DM1**	
	Obtain $e^8 - 3e^4 + 2e^2 + 1$	**A1**	
		5	

Question	Answer	Marks	Guidance
3	Use quotient rule (or product rule) to find first derivative	*M1	Must have correct u and v
	Obtain $-\frac{1}{x(1+\ln x)^2}$ or (unsimplified) equivalent	A1	
	Use $y=4$ to obtain $\ln x = -\frac{1}{2}$ or exact equivalent for x	B1	
	Substitute for x in their first derivative	DM1	
	Obtain $-4e^{\frac{1}{2}}$ or exact equivalent	A1	Must be simplified to contain a single exponential term
		5	

Question	Answer	Marks	Guidance
4(i)	Substitute $x=2$, equate to zero and attempt solution	M1	
	Obtain $a=4$	A1	
		2	
4(ii)	Divide by $x-2$ at least as far as the x term	M1	By inspection or use of identity
	Obtain $4x^2+12x+9$	A1	
	Conclude $(x-2)(2x+3)^2$	A1	Each factor must be simplified to integer form
		3	

Question	Answer	Marks	Guidance
4(iii)	Attempt correct process to solve $e^{\sqrt{y}} = k$ where $k > 0$	M1	For $y = (\ln k)^2$
	Obtain 0.48 and no others	A1	AWRT
		2	

Question	Answer	Marks	Guidance
5(i)	Integrate to obtain form $x^3 + k_1 \sin 2x + k_2 \cos x$	*M1	
	Obtain correct $x^3 + 2\sin 2x + \cos x$	A1	
	Apply limits correctly and equate to 2	DM1	
	Confirm given result	A1	AG; necessary detail needed
		4	
5(ii)	Consider sign of $a - \sqrt[3]{3 - 2\sin 2a - \cos a}$ or equivalent for 0.5 and 0.75	M1	
	Obtain –0.26 and 0.10 or equivalents and justify conclusion	A1	AG; necessary detail needed
		2	

Question	Answer	Marks	Guidance
5(iii)	Use iterative process correctly at least once	M1	Need to see a correct x_3, may be implied by $x_1 = 0.5$ so $x_3 = 0.65256$ or $x_1 = 0.75$ so $x_3 = 0.64897$ OE Must be working with radians
	Obtain final answer 0.651	A1	
	Show sufficient iterations to 5sf to justify answer or show a sign change in the interval [0.6505, 0.6515]	A1	
		3	

Question	Answer	Marks	Guidance
6(a)	Express equation as $\dfrac{1}{\cos\alpha \sin\alpha} = 7$	B1	OE; May be implied by subsequent work
	Attempt use of identity for $\sin 2\alpha$ or attempt to obtain a quadratic equation in terms of any one of the following: $\sin^2\alpha$, $\cos^2\alpha$, $\cot^2\alpha$ or $\tan^2\alpha$	M1	From equation of form $\sin 2\alpha = k$ where $0 < k < 1$ or from use of correct identities
	Obtain $\sin 2\alpha = \frac{2}{7}$ or a correct 3 term quadratic equation, equated to zero in any one of the following: $\sin^2\alpha$, $\cos^2\alpha$, $\cot^2\alpha$ or $\tan^2\alpha$	A1	
	Attempt correct process to find at least one correct value of α	M1	
	Obtain 8.3 and 81.7 and no others between 0 and 90	A1	
		5	

Question	Answer	Marks	Guidance
6(b)	Simplify left-hand side to obtain $2\sin\beta\cos 20°$	**B1**	
	Attempt to form equation where $\tan\beta$ is only variable, $\tan\beta \neq 3$	**M1**	
	Obtain $\tan\beta = \frac{3}{\cos 20°}$	**A1**	OE
	Obtain $\beta = 72.6$ and no others between 0 and 90	**A1**	
		5	

Question	Answer	Marks	Guidance
7(i)	Obtain $-4y - 4x\frac{dy}{dx}$ from use of the product rule	**B1**	
	Differentiate $-2y^2$ to obtain $-4y\frac{dy}{dx}$	**B1**	
	Obtain $2x$, $=0$ with no extra terms	**B1**	
	Rearrange to obtain expression for $\frac{dy}{dx}$ and substitute $x=-1$, $y=2$	**M1**	
	Obtain $\frac{dy}{dx} = \frac{2x-4y}{4x+4y}$ OE and hence $-\frac{5}{2}$	**A1**	
		5	

Question	Answer	Marks	Guidance
7(ii)	Equate numerator of derivative to zero to produce equation in x and y	M1	
	Substitute into equation of curve to produce equation in x or y	M1	
	Obtain $-6y^2 = 1$ or $-\frac{3}{2}x^2 = 1$ OE and conclude	A1	
		3	
7(iii)	Use denominator of derivative equated to zero with equation of curve to produce equation in x	M1	
	Obtain $3x^2 = 1$ and hence $x = \pm\frac{1}{\sqrt{3}}$	A1	OE
		2	