Question	Answer	Marks	Guidance
1	Use subtraction or addition property of logarithms	*M1	
	Obtain $\frac{3x+1}{x+2}=\mathrm{e}$ or equivalent with no presence of logarithm	A1	
	Use correct process to solve equation	DM1	
	Obtain $\frac{2\mathrm{e}-1}{3-\mathrm{e}}$ or exact equivalent	A1	
		4	

Question	Answer	Marks	Guidance
2	Use $\cos 2\theta = 2\cos^2\theta - 1$	B1	
	Obtain $10\cos^3\theta = 4$ or equivalent	B1	
	Use correct process to find at least one value of θ from equation of form $k_1\cos^3\theta = k_2$	M1	
	Obtain 42.5	A1	
	Obtain 317.5 and no others between 0 and 360	A1	
		5	

Question	Answer	Marks	Guidance
3	Take logarithms of both sides and apply power law	**M1**	Condone incorrect inequality signs until final answer. The first 6 marks are for obtaining the correct critical values.
	Obtain $2x < \frac{\ln 80}{\ln 1.3}$ or equivalent using $\log_{10}$	**A1**	
	Obtain $x = 8.35...$	**A1**	
	State or imply non-modulus inequality $(3x-1)^2 > (3x-10)^2$ or corresponding equation or linear equation $3x-1 = -(3x-10)$	**B1**	
	Attempt solution of inequality or equation (obtaining 3 terms when squaring each bracket or solving linear equation with signs of $3x$ different)	**M1**	
	Obtain $x = \frac{11}{6}$ or $x = 1.83...$	**A1**	
	Conclude $1.83 < x < 8.35$	**A1**	
		7	

Question	Answer	Marks	Guidance
4(a)	Obtain integrand of form $a\sec^2\theta + b$	**M1**	
	Obtain correct $5\sec^2\theta - 1$	**A1**	
	Integrate to obtain form $a\tan\theta + b\theta$	**M1**	
	Obtain $5\tan\theta - \theta + c$	**A1**	
		4	
4(b)	Obtain integral of form $k\ln(3x+1)$	***M1**	
	Apply limits and obtain $\frac{2}{3}\ln(3a+1) = \ln 16$	**A1**	
	Obtain equation with no presence of ln	**DM1**	
	Obtain 21	**A1**	
		4	

Question	Answer	Marks	Guidance
5(i)	Substitute $x = -2$ and equate to zero	*M1	
	Substitute $x = \frac{1}{2}$ and equate to 40	*M1	
	Obtain $-8a + 4b - 64 = 0$ and $\frac{1}{8}a + \frac{1}{4}b = \frac{23}{2}$ or equivalents	A1	
	Solve a pair of simultaneous equations for a or for b	DM1	Needs at least one of the two previous M marks
	Obtain $a = 12$ and $b = 40$	A1	
		5	
5(ii)	Attempt division by $(x+2)$ or inspection at least as far as $kx^2 + mx$	M1	
	Obtain $12x^2 + 16x + 5$	A1	
	Conclude $(x+2)(2x+1)(6x+5)$	A1	
		3	

Question	Answer	Marks	Guidance
6(i)	Obtain $\frac{dx}{dt} = 4e^{2t} + 4e^{t}$	B1	
	Use product rule to find $\frac{dy}{dt}$	M1	
	Obtain $\frac{dy}{dx} = \frac{5e^{2t} + 10te^{2t}}{4e^{2t} + 4e^{t}}$ or equivalent	A1	
	Equate first derivative of the form $\frac{ae^{2t} + bte^{2t}}{ce^{2t} + de^{t}}$ to zero and solve to find t	M1	
	Obtain $t = -\frac{1}{2}$ from completely correct work	A1	
	Obtain $(3.16, -0.92)$	A1	
		6	

Question	Answer	Marks	Guidance
6(ii)	Identify $t = 0$	**B1**	
	Substitute $t = 0$ in expression for first derivative and find negative reciprocal	**M1**	
	Obtain $-\frac{8}{5}$ or equivalent	**A1**	
		3	

Question	Answer	Marks	Guidance
7(i)	Differentiate to obtain form $k_1x + k_2 + k_3 \sin\frac{1}{2}x$	***M1**	
	Obtain correct $2x + 3 - \frac{5}{2}\sin\frac{1}{2}x$ and deduce or imply gradient at P is 3	**A1**	
	Equate first derivative to their -3 and rearrange	**DM1**	
	Obtain $x = \frac{5}{4}\sin\frac{1}{2}x - 3$	**A1**	
		4	
7(ii)	Consider sign of their $2x + 6 - \frac{5}{2}\sin\frac{1}{2}x$ at -4.5 and -4.0 or equivalent	**M1**	
	Complete argument correctly for correct expression with appropriate calculations	**A1**	
		2	
7(iii)	Use iteration formula correctly at least once	**M1**	
	Obtain final answer -4.11	**A1**	
	Show sufficient iterations to justify accuracy to 3 sf or show sign change in interval $(-4.115, -4.105)$	**A1**	
		3	