Question	Answer	Marks	Guidance
1	*EITHER:* State or imply non-modular inequality $(5x+2)^2 > (4x+3)^2$ or corresponding equation or pair of linear equations	**(B1**	
	Attempt solution of 3-term quadratic equation or of 2 linear equations	**M1**	
	Obtain critical values $-\frac{5}{9}$ and 1	**A1**	And no others
	State answer $x < -\frac{5}{9}$, $x > 1$	**A1)**	
	OR: Obtain critical value $x = 1$ from graph, inspection, equation	**(B1**	
	Obtain critical value $x = -\frac{5}{9}$ similarly	**B2**	
	State answer $x < -\frac{5}{9}$, $x > 1$	**B1)**	
		4	

Question	Answer	Marks	Guidance
2	Differentiate using product rule	***M1**	Obtaining form $k_1 \sin\frac{1}{2}x + k_2 x \cos\frac{1}{2}x$
	Obtain correct $4\sin\frac{1}{2}x + 2x\cos\frac{1}{2}x$ or unsimplified equivalent	**A1**	
	Attempt equation of tangent with numerical value for gradient	**DM1**	Dependent on first **M1**
	Obtain $y = 4x$	**A1**	
		4	

Question	Answer	Marks	Guidance
3(i)	Use y-values $\ln 2, \quad \ln 4, \quad \ln 6, \quad \ln 8, \quad \ln 10$	**B1**	Or decimal equivalents
	Use correct formula, or equivalent, with $h = 2$ and five y-values	**M1**	
	Obtain 13.5	**A1**	
		3	
3(ii)	Recognise integrand as $6\ln(x+2)$	**B1**	
	Obtain 81 or 81.0 or 81.1	**B1**	
		2	

Question	Answer	Marks	Guidance
4(i)	Substitute $x = -3$ and simplify	**M1**	
	Obtain $-108 + 36 + 87 - 15 = 0$ or equivalent and conclude	**A1**	
		2	
4(ii)	Attempt either division by $x+3$ to reach at least partial quotient $4x^2 + kx$ or use of identity or inspection	**M1**	
	Obtain quotient $4x^2 - 8x - 5$	**A1**	
	Conclude $(x+3)(2x-5)(2x+1)$	**A1**	
		3	

Question	Answer	Marks	Guidance
4(iii)	Identify $2^u = \frac{5}{2}$	**B1**	Ignoring other values at this stage
	Apply logarithms and use power law for $2^u = c$ where $c > 0$	**M1**	
	Obtain $u = 1.32$	**A1**	And no other values
		3	

Question	Answer	Marks	Guidance
5(i)	Integrate to obtain $-2e^{-2x}$	**B1**	
	Apply limits correctly to integral of form ke^{-2x}	**M1**	
	Obtain $-2e^{-4a} + 2e^{2a} = 25$	**A1**	
	Rearrange to confirm $a = \frac{1}{2}\ln(12.5 + e^{-4a})$	**A1**	AG; necessary detail needed
		4	
5(ii)	Consider sign of $a - \frac{1}{2}\ln(12.5 + e^{-4a})$ or equivalent for 1.0 and 1.5	**M1**	
	Obtain -0.26 and 0.24 or equivalent and justify conclusion	**A1**	AG; necessary detail needed
		2	

Question	Answer	Marks	Guidance
5(iii)	Use iterative process correctly at least once	M1	
	Obtain final answer 1.263	A1	
	Show sufficient iterations to 6 sf to justify answer or show a sign change in the interval $(1.2625, 1.2635)$	A1	
		3	

Question	Answer	Marks	Guidance
6(i)	Express LHS in terms of $\sin 2x$ and $\cos 2x$ and attempt to express in terms of $\sin x$ and $\cos x$	*M1	
	Obtain correct $\dfrac{1}{2\sin x\cos x}+\dfrac{\cos^2 x-\sin^2 x}{2\sin x\cos x}$ or equivalent	A1	Perhaps using $\cos 2x = 2\cos^2 x - 1$ immediately
	Simplify as far as single terms involving x in numerator and denominator	DM1	Dependent on first M mark
	Confirm $\cot x$	A1	AG; necessary detail needed
		4	
6(ii)	Express in terms of $\sin\frac{1}{6}\pi$ and $\cos\frac{1}{6}\pi$ or $\sin\frac{1}{6}\pi$ and $\tan\frac{1}{6}\pi$	M1	
	Obtain $2+\sqrt{3}$	A1	
		2	

Question	Answer	Marks	Guidance
6(iii)	State $\int \sin 2x \cot 2x \, dx$	B1	Condoning absence of dx
	State $\int \cos 2x \, dx$	B1	Condoning absence of dx
	Obtain $\frac{1}{2}\sin 2x + c$	B1	
		3	

Question	Answer	Marks	Guidance
7(i)	Obtain expression for $\frac{dy}{dx}$ with numerator quadratic, denominator linear	M1	Or equivalent where separate derivatives evaluated first when $t = 3$
	Obtain $\frac{3t^2 - 6t}{2t + 4}$	A1	
	Identify $t = 3$ at P	B1	
	Obtain $\frac{9}{10}$ or equivalent	A1	
		4	
7(ii)	Equate first derivative to zero and obtain non-zero value of t	M1	
	Obtain $t = 2$	A1	
	Substitute to obtain $(12, -4)$	A1	
		3	

Question	Answer	Marks	Guidance
7(iii)	Equate expression for gradient to *m* and rearrange to confirm $3t^2-(2m+6)t-4m=0$	**B1**	AG; necessary detail needed
	Attempt solution of quadratic inequality or equation resulting from discriminant	**M1**	
	Obtain critical values $-\sqrt{72}-9$ and $\sqrt{72}-9$	**A1**	Or exact equivalents
	Conclude $m\leqslant-\sqrt{72}-9$, $m\geqslant\sqrt{72}-9$	**A1**	Or exact equivalents
		4	