Question	Answer	Marks	Guidance
1	Take logarithms of both sides and apply power law to both sides	**M1**	Allow $y = \frac{\log 5}{4\log 3}$ for **M1 A1**
	Rearrange to the form $y = \frac{\ln 5}{4\ln 3}x$ or equivalent	**A1**	
	Obtain $m = 0.366$	**A1**	
	Total:	**3**	
2	State or imply non-modulus inequality $(4-x)^2 \leqslant (3-2x)^2$ or corresponding equation, pair of linear equations or linear inequalities	**M1**	
	Attempt solution of 3-term quadratic equation, of two linear equations or of two linear inequalities	**M1**	
	Obtain critical values -1 and $\frac{7}{3}$	**A1**	SR Allow **B1** for $x \leqslant -1$ only or $x \geqslant \frac{7}{3}$ only if first **M1** is not given
	State answer $x \leqslant -1, x \geqslant \frac{7}{3}$	**A1**	Do not accept $\frac{7}{3} \leqslant x \leqslant -1$ or $-1 \geqslant x \geqslant \frac{7}{3}$ for **A1**
	Total:	**4**	

Question	Answer	Marks	Guidance
3	Integrate to obtain form $ke^{\frac{1}{2}x+3}$ where k is constant not equal to 4	**M1**	
	Obtain correct $8e^{\frac{1}{2}x+3}$	**A1**	Allow unsimplified for **A1**
	Obtain $8e^{\frac{1}{2}a+3}-8e^{3}=835$ or equivalent	**A1**	
	Carry out correct process to find a from equation of form $ke^{\frac{1}{2}a+3}=c$	**M1**	
	Obtain 3.65	**A1**	If 3.65 seen with no actual attempt at integration, award **B1** if it is thought that trial and improvement with calculator has been used.
	Total:	**5**	
4(i)	Use iteration correctly at least once	**M1**	
	Obtain final answer 2.08	**A1**	
	Show sufficient iterations to 4 dp to justify answer or show sign change in interval $(2.075,\ 2.085)$	**A1**	
	Total:	**3**	
4(ii)	State or clearly imply equation $x=\dfrac{2x^2+x+9}{(x+1)^2}$ or same equation using α	**B1**	
	Carry out relevant simplification	**M1**	
	Obtain $\sqrt[3]{9}$	**A1**	
		3	

Question	Answer	Marks	Guidance
5(i)	State $R = 3$	**B1**	Allow marks for (i) if seen in (ii)
	Use appropriate trigonometric formula to find α	**M1**	
	Obtain 48.19 with no errors seen	**A1**	
	Total:	**3**	
5(ii)	Carry out evaluation of $\cos^{-1}\frac{1}{3}(=70.528...)$	**M1**	**M1** for $\cos^{-1}\left(\frac{1}{R}\right)$
	Obtain correct answer 118.7	**A1**	
	Carry out correct method to find second answer	**M1**	
	Obtain 337.7 and no others between 0 and 360	**A1**	
	Total:	**4**	
6(i)	State or imply correct y-values 0, $\tan\frac{1}{6}\pi$, $\tan\frac{2}{6}\pi$	**B1**	Some candidates have their calculator in degree mode when working out $\tan\frac{\pi}{6}$ etc. this gives 0.00915 and 0.0183. Allow **B1**.
	Use correct formula, or equivalent, with $h = \frac{1}{12}\pi$ and y–values	**M1**	Must be convinced they have considered 3 values for y for **M1**
	Obtain 0.378	**A1**	
	Total:	**3**	

Question	Answer	Marks	Guidance
6(ii)	State or imply $\pi\int\left(\sec^2 2x-1\right)\,\mathrm{d}x$	**B1**	
	Integrate to obtain $k_1\tan 2x+k_2x$, any non-zero constants including π or not	**M1**	
	Obtain $\frac{1}{2}\tan 2x-x$ or $\pi\left(\frac{1}{2}\tan 2x-x\right)$	**A1**	
	Obtain $\pi\left(\frac{1}{2}\sqrt{3}-\frac{1}{6}\pi\right)$ or equivalent	**A1**	
	Total:	**4**	
7(i)	Differentiate x and y and form $\frac{\mathrm{d}y}{\mathrm{d}x}$	**M1**	
	Obtain $\dfrac{4t^3-6t^2+8t-12}{3t^2+6}$	**A1**	First 2 marks may be implied by an attempt at division
	Carry out division at least as far as kt or equivalent	**M1**	For **M1**, it must be division by a quadratic factor. Allow attempt at factorisation with same conditions as for division
	Obtain $\frac{4}{3}t$	**A1**	
	Obtain $\frac{4}{3}t-2$ with complete division shown and no errors seen	**A1**	
	Total:	**5**	

Question	Answer	Marks	Guidance
7(ii)	State or imply gradient of straight line is $\frac{1}{2}$	**B1**	Allow **B1** if $y=\frac{1}{2}x+\frac{9}{2}$ is seen
	Attempt value of t from their $\frac{\mathrm{d}y}{\mathrm{d}x}$ = their negative reciprocal of gradient of line	**M1**	
	Obtain $t=0$ and hence $(1,5)$	**A1**	
	Total:	**3**	
8(i)	Apply product rule to find first derivative	***M1**	
	Obtain $6x\ln\left(\frac{1}{6}x\right)+3x$ or equivalent	**A1**	Allow unsimplified for **A1**
	Identify $x=6$ at P	**B1**	
	Substitute their value of x at P into attempt at first derivative	**DM1**	dep *M
	Obtain 18	**A1**	
	Total:	**5**	

Question	Answer	Marks	Guidance
8(ii)	Equate their first derivative to zero and attempt solution of equation of form $k\ln\left(\frac{1}{6}x\right)+m=0$	***M1**	
	Obtain x–coordinate of form $a_1e^{a_2}$	**DM1**	dep *M
	Obtain $x=6\mathrm{e}^{-\frac{1}{2}}$ or exact equivalent	**A1**	
	Substitute exact x–value in the form $a_1e^{a_2}$ and attempt simplification to remove ln	**M1**	
	Obtain $-54\mathrm{e}^{-1}$ or exact equivalent	**A1**	
	Total:	**5**	