Question	Answer	Marks	Guidance
1	Either		
	State or imply non-modular inequality $(3x-2)^2 < (x+5)^2$ 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 $-\frac{3}{4}$ and $\frac{7}{2}$	**A1**	
	State answer $-\frac{3}{4} < x < \frac{7}{2}$	**A1**	
	Or		
	Obtain critical value $\frac{7}{2}$ from graph, inspection, equation	**B1**	
	Obtain critical value $-\frac{3}{4}$ similarly	**B2**	
	State answer $-\frac{3}{4} < x < \frac{7}{2}$	**B1**	
		4	

Question	Answer	Marks	Guidance
2(i)	Differentiate to obtain form $\frac{k_1}{2x+9}-\frac{k_2}{x}$	M1	
	Obtain correct $\frac{6}{2x+9}-\frac{2}{x}$	A1	
	Equate first derivative to zero and attempt solution to $x=...$	M1	Dependent on previous M1
	Obtain $x=9$	A1	
		4	
2(ii)	Use appropriate method for determining nature of stationary point	M1	Second derivative or gradient or value of y
	Conclude minimum with no errors seen	A1	
		2	

Question	Answer	Marks	Guidance
3(i)	Carry out division and reach at least partial quotient of form x^2+kx	M1	
	Obtain quotient x^2-2x+2	A1	
	Obtain remainder 1	A1	AG; necessary detail needed and all correct
		3	

Question	Answer	Marks	Guidance
3(ii)	State equation as $(x^2+6)(x^2-2x+2)=0$	**B1 FT**	Following their 3-term quotient from part (i)
	Calculate discriminant of 3-term quadratic or equivalent	**M1**	
	Obtain -4 and state no root, also referring to no root from x^2+6 factor	**A1**	AG; necessary detail needed
		3	

Question	Answer	Marks	Guidance
4(i)	Use $2\ln(2x)=\ln(4x^2)$	**B1**	
	Use law for addition or subtraction of logarithms	**M1**	
	Obtain correct equation $\frac{4x^2}{x+3}=16$ or equivalent	**A1**	With no logarithms involved
	Solve 3-term quadratic equation	**M1**	Dependent on previous M1
	Conclude with $x=6$ and, finally, no other solutions	**A1**	
		5	
4(ii)	Apply logarithms and use power law for $2^u=k$ or $2^{u+1}=2k$ where $k>0$	**M1**	
	Obtain 2.585	**A1**	
		2	

Question	Answer	Marks	Guidance
5	Use product rule to differentiate first term obtaining form $k_1 y^2 \frac{dy}{dx}\sin 2x + k_2 y^3 \cos 2x$	M1	
	Obtain correct $3y^2 \frac{dy}{dx}\sin 2x + 2y^3 \cos 2x$	A1	
	State $3y^2 \frac{dy}{dx}\sin 2x + 2y^3 \cos 2x + 4\frac{dy}{dx} = 0$	A1	
	Identify $x = 0,\ y = 2$ as relevant point	B1	
	Find equation of tangent through $(0, 2)$ with numerical gradient	M1	Dependent on previous M1
	Obtain $y = -4x + 2$ or equivalent	A1	
		6	

Question	Answer	Marks	Guidance
6(i)	Rewrite integrand as $1+2e^{\frac{1}{2}x}+e^{x}$	B1	
	Integrate to obtain form $x+k_1e^{\frac{1}{2}x}+k_2e^{x}$	M1	
	Obtain $x+4e^{\frac{1}{2}x}+e^{x}$	A1	
	Use limits to obtain $a+4e^{\frac{1}{2}a}+e^{a}-5=10$	A1	
	Rearrange as far as $e^{\frac{1}{2}a}=\ldots$ including use of $4e^{\frac{1}{2}a}+e^{a}=e^{\frac{1}{2}a}(4+e^{\frac{1}{2}a})$	M1	
	Confirm $a=2\ln\left(\frac{15-a}{4+e^{\frac{1}{2}a}}\right)$	A1	AG; necessary detail needed
		6	
6(ii)	Consider sign of $a-2\ln\left(\frac{15-a}{4+e^{\frac{1}{2}a}}\right)$ for 1.5 and 1.6 or equivalent	M1	
	Obtain –0.08... and 0.06… or equivalents and justify conclusion	A1	
		2	
6(iii)	Use iterative process correctly at least once	M1	
	Obtain final answer 1.56	A1	
	Show sufficient iterations to 5 sf to justify answer or show sign change in interval $(1.555, 1.565)$	A1	
		3	

Question	Answer	Marks	Guidance
7(i)	Express $\operatorname{cosec}^2 2x$ as $\dfrac{1}{4\sin^2 x\cos^2 x}$	**B1**	
	Attempt to express LHS in terms of $\sin x$ and $\cos x$ only	**M1**	Must be using correct working for M1
	Obtain $\dfrac{2\times 2\sin^2 x}{4\sin^2 x\cos^2 x}$ or equivalent and hence $\sec^2 x$	**A1**	AG; necessary detail needed
		3	
7(ii)	Express equation as $1+\tan^2 x = \tan x + 21$	**B1**	
	Solve 3-term quadratic equation for $\tan x$	**M1**	
	Obtain $\tan x = 5$ and hence $x = 1.37$	**A1**	Or greater accuracy 1.3734…
	Obtain $\tan x = -4$ and hence $x = 1.82$	**A1**	Or greater accuracy 1.8157…
		4	
7(iii)	Use $x = 2y+1$	**B1**	
	Identify integral as of form $\int \sec^2(ay+b)\,\mathrm{d}y$	**M1**	Condone absence of or error with dy
	Obtain $\frac{1}{2}\tan(2y+1)+c$	**A1**	
		3	