Question	Answer	Marks	Guidance
1	Substitute -1 into $\text{p}(x)$ and equate to zero	**M1**	Allow algebraic long division or the use of an identity with the remainder, in terms of m and k, equated to zero
	Obtain $-4+(k+1)+m+3k=0$ or equivalent	**A1**	
	Obtain $m=3-4k$	**A1**	
		3	

Question	Answer	Marks	Guidance
2(i)	State or imply non-modular equation $(4+2x)^2=(3-5x)^2$ or pair of linear equations	**B1**	
	Attempt solution of 3-term quadratic eqn or pair of linear equations	**M1**	
	Obtain $-\frac{1}{7}, \frac{7}{3}$	**A1**	**SC** B1 for $x=-\dfrac{1}{7}$ from one linear equation
		3	
2(ii)	Attempt correct process to solve $\text{e}^{3y}=k$ where $k>0$ from **(i)**	**M1**	
	Obtain 0.282 and no others	**A1**	
		2	

Question	Answer	Marks	Guidance
3	Use quotient rule to find first derivative or equivalent	*M1	
	Obtain $\frac{dy}{dx} = \frac{3\ln x - 3x \times \frac{1}{x}}{(\ln x)^2}$ or equivalent	A1	Condone lack of brackets in denominator unless specifically simplified to $2\ln x$
	Equate first derivative to zero and attempt value of x from $\ln x = k$ oe	DM1	Must get as far as $x =$
	Obtain $x = e$	A1	Allow e^1
	Obtain $y = 3e$	A1	Allow $3e^1$ **SC1**: If $3\ln x - 3x \times \frac{1}{x} = 0$ seen with no reference to $\frac{dy}{dx}$, then allow M1 A1 then following marks **SC2**: If denominator incorrect and numerator correct/reversed/added then max marks M0A0M1A1A1 **SC3**: If numerator reversed then max marks M1A0M1A1A1
		5	

Question	Answer	Marks	Guidance
4(a)	Use identity $2\cos^2 x = 1 + \cos 2x$	**B1**	
	Integrate to obtain form $x + \frac{1}{2}\sin 2x$	**B1**	
	Integrate to obtain $-2\cos 2x$	**B1**	
	Apply limits correctly, retaining exactness	**M1**	Dependent on at least one B mark
	Obtain $4 + \frac{1}{2}\pi$ or similarly simplified equivalent	**A1**	
		5	
4(b)	Use y values $\sqrt{\ln 3}$, $\sqrt{\ln 6}$, $\sqrt{\ln 9}$ or decimal equivalents	**B1**	Allow awrt 1.05, 1.34, 1.48, the correct level of accuracy may be implied by a correct answer
	Use correct formula, or equivalent, with $h = 3$, and three y values	**M1**	
	Obtain $\frac{1}{2} \times 3\left(\sqrt{\ln 3} + 2\sqrt{\ln 6} + \sqrt{\ln 9}\right)$ and hence 7.81	**A1**	Allow greater accuracy
		3	

Question	Answer	Marks	Guidance
5(i)	Carry out division to obtain quotient of form $x^2 + k$	**M1**	
	Obtain quotient $x^2 - 4$	**A1**	Allow use of an identity
	Obtain remainder 4	**A1**	
		3	**SC**: If only the remainder theorem is used to obtain 4 then B1

Question	Answer	Marks	Guidance
5(ii)	Integrate to obtain at least k_1x^3 and $k_2\ln(2x+1)$ terms using the result from **(i)**	***M1**	
	Obtain correct $\frac{1}{3}x^3-4x+2\ln(2x+1)$	**A1**	
	Apply limits and note or imply that constant k_3 can be written $\ln e^{k_3}$	**DM1**	
	Apply appropriate logarithm properties correctly	**M1**	
	Obtain $\ln(49e^{-3})$	**A1**	
		5	

Question	Answer	Marks	Guidance
6(i)	Equate $4t^2e^{-t}$ to 1, rearrange to $t^2=\ldots$ and hence $t=\ldots$	**M1**	Allow M1 for $t=\sqrt{\frac{1}{4}e^{-t}}$
	Confirm $t=\frac{1}{2}e^{\frac{1}{2}t}$ with necessary detail needed as answer is given	**A1**	
		2	
6(ii)	Use iterative process correctly at least once	**M1**	
	Obtain final answer $t=0.715$	**A1**	
	Show sufficient iterations to 5 sf to justify answer or show a sign change in the interval [0.7145, 0.7155]	**A1**	**SC**: M1A1 from iterations to 4sf resulting in 0.71
		3	

Question	Answer	Marks	Guidance
6(iii)	Obtain $\frac{dx}{dt} = 3 + 12e^{-2t}$	B1	
	Use product rule to find $\frac{dy}{dt}$	M1	
	Obtain $8te^{-t} - 4t^2e^{-t}$	A1	
	Divide correctly to obtain $\frac{dy}{dx}$	M1	
	Substitute value from part **(ii)** to obtain 0.31	A1	Allow greater accuracy
		5	

Question	Answer	Marks	Guidance
7(a)(i)	State $R = \sqrt{32}$ or equivalent or 5.657…	B1	
	Use appropriate trigonometry to find α	M1	
	Obtain $\alpha = 45$	A1	
		3	
7(a)(ii)	Carry out correct process to find one value of θ	M1	
	Obtain 17.1	A1	Ignore other positive values greater than 17.1
		2	

Question	Answer	Marks	Guidance
7(b)	Use or imply $\cot 2x = \dfrac{1}{\tan 2x}$	B1	
	Use identity of form $\tan 2x = \dfrac{\pm 2\tan x}{1 \pm \tan^2 x}$ to obtain equation in $\tan x$	M1	
	Obtain $6\tan^2 x + 10\tan x - 4 = 0$ or equivalent	A1	
	Attempt solution of 3-term quadratic equation for $\tan x$	M1	
	Obtain $\tan x = \frac{1}{3}$ and hence 0.32	A1	Allow greater accuracy
	Obtain $\tan x = -2$ and hence 2.03 and no others between 0 and π	A1	Allow greater accuracy
		6	