

Question	Answer	Marks	Guidance
1	Substitute $-1$ into $p(x)$ and equate to zero	<b>M1</b>	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	<b>A1</b>	
	Obtain $m = 3 - 4k$	<b>A1</b>	
		<b>3</b>	

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

Question	Answer	Marks	Guidance
3	Use quotient rule to find first derivative or equivalent	<b>*M1</b>	
	Obtain $\frac{dy}{dx} = \frac{3 \ln x - 3x \times \frac{1}{x}}{(\ln x)^2}$ or equivalent	<b>A1</b>	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	<b>DM1</b>	Must get as far as $x =$
	Obtain $x = e$	<b>A1</b>	Allow $e^1$
	Obtain $y = 3e$	<b>A1</b>	Allow $3e^1$ <b>SC1:</b> 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 <b>SC2:</b> If denominator incorrect and numerator correct/reversed/added then max marks M0A0M1A1A1 <b>SC3:</b> If numerator reversed then max marks M1A0M1A1A1
		<b>5</b>	

Question	Answer	Marks	Guidance
4(a)	Use identity $2 \cos^2 x = 1 + \cos 2x$	<b>B1</b>	
	Integrate to obtain form $x + \frac{1}{2} \sin 2x$	<b>B1</b>	
	Integrate to obtain $-2 \cos 2x$	<b>B1</b>	
	Apply limits correctly, retaining exactness	<b>M1</b>	Dependent on at least one B mark
	Obtain $4 + \frac{1}{2}\pi$ or similarly simplified equivalent	<b>A1</b>	
		<b>5</b>	
4(b)	Use $y$ values $\sqrt{\ln 3}$ , $\sqrt{\ln 6}$ , $\sqrt{\ln 9}$ or decimal equivalents	<b>B1</b>	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	<b>M1</b>	
	Obtain $\frac{1}{2} \times 3(\sqrt{\ln 3} + 2\sqrt{\ln 6} + \sqrt{\ln 9})$ and hence 7.81	<b>A1</b>	Allow greater accuracy
		<b>3</b>	

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

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 $t^2 = \dots$ and hence $t = \dots$	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 $\frac{dx}{dt} = 3 + 12e^{-2t}$	<b>B1</b>	
	Use product rule to find $\frac{dy}{dt}$	<b>M1</b>	
	Obtain $8te^{-t} - 4t^2e^{-t}$	<b>A1</b>	
	Divide correctly to obtain $\frac{dy}{dx}$	<b>M1</b>	
	Substitute value from part (ii) to obtain 0.31	<b>A1</b>	Allow greater accuracy
		<b>5</b>	

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

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