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January 2008
6666 Core Mathematics C4
Mark Scheme

Question Number	Scheme	Marks
1. (a)	$\begin{array}{c\|c\|c\|c\|c\|c} x & 0 & \frac{\pi}{4} & \frac{\pi}{2} & \frac{3\pi}{4} & \pi \\ \hline y & 0 & 1.844321332\ldots & 4.810477381\ldots & 8.87207 & 0 \end{array}$	
	awrt 1.84432 awrt 4.81048 or 4.81047	B1 B1 **[2]**
(b) **Way 1**	0 can be implied Area $\approx \frac{1}{2}\times\frac{\pi}{4};\times\underline{\left\{0+2\left(1.84432+4.81048+8.87207\right)+0\right\}}$ Outside brackets awrt 0.39 or $\frac{1}{2}\times$ awrt 0.79 or $\frac{1}{2}\times\frac{\pi}{4}$ or $\frac{\pi}{8}$ For structure of trapezium rule $\underline{\{\ldots\ldots\ldots\ldots\}}$; Correct expression inside brackets which all must be multiplied by their "outside constant". $=\frac{\pi}{8}\times 31.05374... = 12.19477518... = \underline{12.1948}$ (4dp) $\underline{12.1948}$	B1 M1$\surd$ A1$\surd$ A1 **cao** **[4]**
Aliter (b) **Way 2**	Area $\approx \frac{\pi}{4}\times\left\{\frac{0+1.84432}{2}+\frac{1.84432+4.81048}{2}+\frac{4.81048+8.87207}{2}+\frac{8.87207+0}{2}\right\}$ which is equivalent to: Area $\approx \frac{1}{2}\times\frac{\pi}{4};\times\underline{\left\{0+2\left(1.84432+4.81048+8.87207\right)+0\right\}}$ $=\frac{\pi}{4}\times 15.52687... = 12.19477518... = \underline{12.1948}$ (4dp) $\frac{\pi}{4}$ (or awrt 0.79) and a divisor of 2 on all terms inside brackets. One of first and last ordinates, two of the middle ordinates inside brackets ignoring the 2. Correct expression inside brackets if $\frac{1}{2}$ was to be factorised out. $\underline{12.1948}$	B1 M1$\surd$ A1$\surd$ A1 **cao** **[4]**
		6 marks

Note an expression like Area $\approx \frac{1}{2}\times\frac{\pi}{4}+2\left(1.84432+4.81048+8.87207\right)$ would score B1M1A0A0

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Question	Scheme	Marks
1. (a)	x: 0 | 0.4 | 0.8 | 1.2 | 1.6 | 2 y: e^0 | $e^{0.08}$ | $e^{0.32}$ | $e^{0.72}$ | $e^{1.28}$ | e^2 or y: 1 | 1.08329... | 1.37713... | 2.05443... | 3.59664... | 7.38906...	
	Either $e^{0.32}$ and $e^{1.28}$ or awrt 1.38 and 3.60 (or a mixture of e's and decimals)	B1 **[1]**
(b) **Way 1**	$\text{Area} \approx \frac{1}{2}\times 0.4 ;\times \underline{\left[e^0 + 2\left(e^{0.08} + e^{0.32} + e^{0.72} + e^{1.28}\right) + e^2 \right]}$	
	Outside brackets $\frac{1}{2}\times 0.4$ or 0.2	B1;
	For structure of trapezium rule $\underline{[\ \ldots\ldots\ldots\ldots\ ]}$;	M1$\surd$
	$= 0.2\times 24.61203164... = 4.922406... = \underline{4.922}$ (4sf)	A1 **cao** **[3]**
Aliter (b) **Way 2**	$\text{Area} \approx 0.4\times \left[\frac{e^0+e^{0.08}}{2} + \frac{e^{0.08}+e^{0.32}}{2} + \frac{e^{0.32}+e^{0.72}}{2} + \frac{e^{0.72}+e^{1.28}}{2} + \frac{e^{1.28}+e^2}{2} \right]$	
	0.4 and a divisor of 2 on all terms inside brackets.	B1
	which is equivalent to:	
	$\text{Area} \approx \frac{1}{2}\times 0.4 ;\times \underline{\left[e^0 + 2\left(e^{0.08} + e^{0.32} + e^{0.72} + e^{1.28}\right) + e^2 \right]}$	
	One of first and last ordinates, two of the middle ordinates inside brackets ignoring the 2.	M1$\surd$
	$= 0.2\times 24.61203164... = 4.922406... = \underline{4.922}$ (4sf)	A1 **cao** **[3]**
		4 marks

Note an expression like $\text{Area} \approx \frac{1}{2}\times 0.4 + e^0 + 2\left(e^{0.08} + e^{0.32} + e^{0.72} + e^{1.28}\right) + e^2$ would score B1M1A0

Allow one term missing (slip!) in the ( ) brackets for

The M1 mark for structure is for the material found in the curly brackets ie

$\underline{\left[\text{first } y\text{ordinate} + 2\left(\text{intermediate ft } y \text{ ordinate}\right) + \text{final } y \text{ ordinate} \right]}$

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Question Number	Scheme		Marks
Q2 (a)	1.14805	awrt 1.14805	B1 (1)
(b)	$A \approx \frac{1}{2} \times \frac{3\pi}{8}(\ldots)$		B1
	$= \ldots \left(3 + 2\left(2.77164 + 2.12132 + 1.14805\right) + 0\right)$	0 can be implied	M1
	$= \frac{3\pi}{16}\left(3 + 2\left(2.77164 + 2.12132 + 1.14805\right)\right)$	ft their (a)	A1ft
	$= \frac{3\pi}{16} \times 15.08202 \ldots = 8.884$	cao	A1 (4)
(c)	$\int 3\cos\left(\frac{x}{3}\right)\mathrm{d}x = \frac{3\sin\left(\frac{x}{3}\right)}{\frac{1}{3}}$		M1 A1
	$= 9\sin\left(\frac{x}{3}\right)$		
	$A = \left[9\sin\left(\frac{x}{3}\right)\right]_0^{\frac{3\pi}{2}} = 9 - 0 = 9$	cao	A1 (3)
			[8]

Question Number	Scheme	Marks
Q2	(a) 1.386, 2.291 awrt 1.386, 2.291	B1 B1 (2)
	(b) $A \approx \frac{1}{2} \times 0.5(\ ... \ )$	B1
	$= \ ... \ \left(0 + 2\left(0.608 + 1.386 + 2.291 + 3.296 + 4.385\right) + 5.545\right)$	M1
	$= \ 0.25\left(0 + 2\left(0.608 + 1.386 + 2.291 + 3.296 + 4.385\right) + 5.545\right)$ ft their (a)	A1ft
	$= 0.25 \times 29.477 \ ... \ \approx 7.37$ cao	A1 (4)
	(c)(i) $\int x \ln x \, dx = \frac{x^2}{2} \ln x - \int \frac{x^2}{2} \times \frac{1}{x} dx$	M1 A1
	$= \frac{x^2}{2} \ln x - \int \frac{x}{2} dx$	
	$= \frac{x^2}{2} \ln x - \frac{x^2}{4} \ (+C)$	M1 A1
	(ii) $\left[\frac{x^2}{2} \ln x - \frac{x^2}{4} \right]_1^4 = \left(8 \ln 4 - 4\right) - \left(-\frac{1}{4}\right)$	M1
	$= 8 \ln 4 - \frac{15}{4}$	
	$= 8\left(2 \ln 2\right) - \frac{15}{4}$ $\ln 4 = 2 \ln 2$ seen or implied	M1
	$= \frac{1}{4}\left(64 \ln 2 - 15\right)$ $a = 64, b = -15$	A1 (7)
		[13]

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Question Number	Scheme	Marks
1.	(a) $y\left(\frac{\pi}{6}\right)\approx 1.2247,\ y\left(\frac{\pi}{4}\right)=1.1180$ accept awrt 4 d.p.	B1 B1 **(2)**
	(b)(i) $I\approx\left(\frac{\pi}{12}\right)\left(1.3229+2\times 1.2247+1\right)$ B1 for $\frac{\pi}{12}$	B1 M1
	≈ 1.249 cao	A1
	(ii) $I\approx\left(\frac{\pi}{24}\right)\left(1.3229+2\times\left(1.2973+1.2247+1.1180\right)+1\right)$ B1 for $\frac{\pi}{24}$	B1 M1
	≈ 1.257 cao	A1 **(6)** **[8]**