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Core Mathematics C2 (6664)

January 2005

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Mark Scheme

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Question Number	Scheme	Marks
1.	$(3+2x)^5 = (3^5) + \binom{5}{1}3^4 \cdot (2x) + \binom{5}{2}3^3(2x)^2 + \cdots$ $= \underline{\underline{243, +810x, +1080x^2}}$	M1 B1, A1, A1 (4)

Question Number	Scheme	Marks
2.	(a) $(\frac{5+13}{2}, \frac{-1+11}{2}), = \underline{\underline{(9,5)}}$	M1, A1 (2)
	(b) $r^2 = (9-5)^2 + (5--1)^2 (= 52)$ or $r^2 = (13-9)^2 + (11-5)^2 (= 52)$ (or equiv.) Equation of circle: $(x-9)^2 + (y-5)^2 = 52$ (or equiv.)	M1 M1, A1$\surd$A1 (4) (6)

Question Number	Scheme	Marks
3.	(a) $\log 3^x = \log 5$ $x = \dfrac{\log 5}{\log 3}$ or $x \log 3 = \log 5$ $= 1.46$	M1 A1 A1 cao (3)
	(a) $\log_2\left(\dfrac{2x+1}{x}\right) = 2$ $\dfrac{2x+1}{x} = 2^2$ or 4 $2x+1 = 4x$ $x = \dfrac{1}{2}$ or 0.5	M1 M1 M1 A1 (4) (7)

Question Number	Scheme	Marks
4.	(a) $5(1-\sin^2 x) = 3(1+\sin x)$	M1
	$5-5\sin^2 x = 3+3\sin x$	
	$\underline{\underline{0 = 5\sin^2 x + 3\sin x - 2}}$ *	A1 cso (2)
	(b) $0 = (5\sin x - 2)(\sin x + 1)$	M1
	$\sin x = \frac{2}{5}$, -1 (both)	A1 cso
	$\sin x = \frac{2}{5} \Rightarrow x = \underline{\underline{23.6}}$ ($\alpha = 23.6$ or 156.4)	B1
	, $\underline{\underline{156.4}}$ (180- α)	M1
	$\sin x = -1 \Rightarrow x = \underline{\underline{270}}$	B1 (5)
	(ignore extra solutions <u>outside</u> the range)	(7)

Question Number	Scheme	Marks
5.	(a) $f(2)=1 \Rightarrow 8-2\times 4+2a+b=1$ $f(-1)=28 \Rightarrow -1-2-a+b=28$ solving $\left.\begin{matrix}2a+b=1\\-a+b=31\end{matrix}\right\} \Rightarrow \underline{a=-10, b=21}$	M1 A1 M1 A1 M1 A1 (6)
	(b) $f(3)=27-18+3a+b$ $=27-18-30+21=0$ $\quad\therefore (x-3)$ is a factor	M1 A1 c.s.o (2) (8)

Question Number	Scheme	Marks
6.	(a) $ar = 7.2, ar^3 = 5.832 \Rightarrow r^2 = \frac{5.832}{7.2} (= 0.81)$ $r = 0.9$	M1 A1 (2)
	(b) $a = \frac{7.2}{(a)}, = \underline{8}$	M1, A1 (2)
	(c) $s_{50} = \frac{8(1-(0.9)^{50})}{1-0.9}$ $= \underline{\underline{79.588}}$ $(3dp)$	M1 A1 c.a.o (2)
	(d) $s_\infty = \frac{8}{1-0.9} (= 80)$ $s_\infty - s_{50} = 80 - (c) = 0.412$	M1 A1 $\surd$ (2) (8)

Question Number	Scheme	Marks
7.	(a) $r\theta = 8\times 0.7, = 5.6(cm)$	M1, A1 (2)
	(b) $BC^2 = 8^2 + 11^2 - 2\times 8\times 11\times \cos 0.7$ $\Rightarrow\ BC = 7.098$ $\Rightarrow$ Perimeter = $(a) + (11-8) + BC, = 15.7(cm)$	M1 A1 M1, A1cao (4)
	(c) $\Delta = \frac{1}{2}ab\sin c = \frac{1}{2}\times 11\times 8\times \sin 0.7, = \text{AWRT}\ \ 28.3$	M1, A1
	Sector $= \frac{1}{2}r^2\theta =, \frac{1}{2}\times 8^2\times 0.7$	M1, A1
	Area of $R = 28.345..... - 22.4 = 5.9455 = 5.95(cm^2)$	A1 (5)
		(11)

Question Number	Scheme	Marks
8.	(a) $x^2+6x+10=3x+20$ $\Rightarrow\ x^2+3x-10=0$ $(x+5)(x-2)=0$ so $x=,-5$ or 2 sub a value for x to obtain a value for y in $y=3x+20, y=5$ or 26	M1 M1, A1 M1, A1 (5)
	(b) line – curve =, $10-3x-x^2$ $\int(10-3x-x^2)dx=10x-\frac{3}{2}x^2-\frac{x^3}{3}$ $\left[10x-\frac{3}{2}x^2-\frac{x^3}{3}\right]_{-5}^{2}=(20-\frac{3}{2}\times4-\frac{8}{3})-(-50-\frac{3}{2}\times25+\frac{125}{3})$ $=11\frac{1}{3}--45\frac{5}{6}=\underline{\underline{57\frac{1}{6}}}$	M1, A1 M1 A2/1/0√ M1 A1 (7) (12)
ALT (b)	$\int(x^2+6x+10)dx=\frac{x^3}{3}+3x^2+10x$ (-1 each incorrect term) use of limits $=(\frac{8}{3}+12+20)-(-\frac{125}{3}+75-50)=(51\frac{1}{3})$ Area of Trapezium $=\frac{1}{2}(5+26)(2--5)=(108\frac{1}{2})$ or 46 - - 62.5 (from integration) Shaded area = Trapezium - $\int=108\frac{1}{2}-51\frac{1}{3}=57\frac{1}{6}$ or $\frac{343}{6}$ or $57.1\dot{6}$	M1 A2/1/0 M1 B1√ M1 A1 (7)

Question Number	Scheme	Marks
9.	(a) Perimeter $\Rightarrow 2x + 2y + \pi x = 80$	B1
	Area $\rightarrow A = 2xy + \frac{1}{2}\pi x^2$	B1
	$y = \frac{80 - 2x - \pi x}{2}$ and sub in to A	M1
	$\Rightarrow A = 80x - 2x^2 - \pi x^2 + \frac{1}{2}\pi x^2$	
	i.e. $A = 80x - (2 + \frac{\pi}{2})x^2$ *	A1 c.s.o (4)
	(b) $\frac{dA}{dx} = 80 - 2(2 + \frac{\pi}{2})x$ or $80 - 4x - \pi x$ (or equiv.)	M1, A1
	$\frac{dA}{dx} = 0 \Rightarrow 40 = (2 + \frac{\pi}{2})x$ so $x =, \frac{40}{2 + \frac{\pi}{2}}$ or $\frac{80}{4 + \pi}$ or Awrt 11.2	M1, A1 (4)
	(c) $\frac{d^2A}{dx^2} = -4 - \pi$	M1
	$< 0 \quad \therefore A$ is Max	A1 (2)
	(d) Max Area $= 80(b) - (2 + \frac{\pi}{2})(b)^2$	M1
	$= \underline{\underline{448(m^2)}}$ (448 only for A1)	A1 cao (2)
		(12)