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January 2005
6664 Core Mathematics C2
Mark Scheme

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)
	M1: Use of binomial leading to correct expression for x or x^2 term. $\binom{n}{r}$ is ok can be implied.	

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2.	(a) $(\frac{5+13}{2}, \frac{-1+11}{2}), = \underline{\underline{(9,5)}}$	M1, A1 (2)
	(b) $r^2 = (9-5)^2 + (5--1)^2 (= 52)$ Equation of circle: $(x-9)^2 + (y-5)^2 = 52$	M1 M1, A1$\surd$A1 (4)
		(6)
	(a) M1 for some use of correct formula. can be implied Use of $(\frac{1}{2}(x_A - x_B), \frac{1}{2}(y_A - y_B)) \rightarrow (4,6)$ is M0A0 (b) M1 attempt to find r or r^2. $\surd$ their (9,5) $r = AB = \sqrt{208}$ is M0 2nd M1 for $(x-9)^2 + (y-5)^2 =$ constant. ($\surd$ their (9,5) A1$\surd$ for $(x-9)^2 + (y-5)^2 =$ their r^2 .($\surd$their (9,5) and r^2) A1 for $(x-9)^2 + (y-5)^2 = 52$ only.	

Question Number	Scheme	Marks
3.	(a) $\log 3^x = \log 5$ $x = \dfrac{\log 5}{\log 3}$ $= 1.46$	M1 A1 A1 cao (3)
	(b) $\log_2\left(\dfrac{2x+1}{x}\right) = 2$ $\dfrac{2x+1}{x} = 2^2$ or 4 $2x+1 = 4x$ $x = \dfrac{1}{2}$ or 0.5	M1 M1 M1 A1 (4) (7)
	(a) M1 a correct attempt to take logs A1 an exact expression for x that can be evaluated on a calculator e.g. $x = \log_3 5$ scores M1 A0 (b) 1st M1 for use of $\log a (\pm) \log b$ rule 2nd M1 for getting out of logs 3rd M1 forming and solving a linear equation $\rightarrow x = \alpha$ A1 $\alpha = \dfrac{1}{2}$ or 0.5	

Question Number	Scheme	Marks
4.	(a) $5(1-\sin^2 x) = 3(1+\sin x)$ $5-5\sin^2 x = 3+3\sin x$ $\underline{\underline{0 = 5\sin^2 x + 3\sin x - 2}}$ *	M1 A1 cso (2)
	(b) $0 = (5\sin x - 2)(\sin x + 1)$ $\sin x = \frac{2}{5}$, -1 (both) $\sin x = \frac{2}{5} \Rightarrow x = \underline{\underline{23.6}}$ ($\alpha = 23.6$ or 156.4) , $\underline{\underline{156.4}}$ (180- α) $\sin x = -1 \Rightarrow x = \underline{\underline{270}}$	M1 A1 B1 M1 B1 (5) (7)
	(a) M1 for use of $\cos^2 x = 1-\sin^2 x$. Condone missing ( ) (b) 1st M1 for attempt to solve $\rightarrow \sin x =$ 1st B1 for correct solution, α to $\sin x = \frac{2}{5}$. Must be 1 d.p. 2nd M1 for 180-α, accept nearest degree or awrt. Answer only in (b) scores M0A0 but then could score B1M1B1 Incorrect factorisation probably only gets $\frac{2}{5}$.	

Question Number	Scheme	Marks
5.	(a) $f(2)=1 \Rightarrow 8-2\times4+2a+b=1$ $f(-1)=28 \Rightarrow -1-2-a+b=28$ 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) $f(3)=27-18+3a+b$ $=27-18-30+21=0$ $\therefore (x-3)$ is a factor	M1 A1 c.s.o (2) (8)
	(a) 1st two M marks attempting $f(\pm2)$ and $f(\pm1)$ A1 A1 for each correct, unsimplified equation 3rd M1 for solving two linear equations $\rightarrow a=$ or b= A1 both values (b) M1 Attempting $f(3)$ A1 = 0 with comment	

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) $a = \frac{7.2}{(a)}, = \underline{\underline{8}}$	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) $s_\infty = \frac{8}{1-0.9} (= 80)$ $s_\infty - s_{50} = 80 - (c) = 0.412$ (Awrt $3\,dp$)	M1 A1 $\surd$ (2) (8)
	(a) M1 for full method $\rightarrow r^2$ or r N.B. $ar^2 = 7.2, ar^4 = 5.832 \rightarrow r = 0.9$ scores M1A1 in part (a) but probably M0A0 in (b). (c) M1$\surd$ their $"a", "r"$ in s_{50} formula (d) M1$\surd$ their $"a", "r"$ in s_∞ A1$\surd$ for 80 – their (c) i.e.$\surd$ their (c) only	

Question Number	Scheme	Marks
7.	(a) $r\theta = 8\times 0.7, = 5.6(cm)$	M1, A1 (2)
	(b) $BC^2 = 8^2 + 11^2 - 2\times 8\times 11\times \cos 0.7$	M1
	$\Rightarrow$ $BC = 7.098$ or 7.10 (Awrt) or $\sqrt{(50.4)}$ or better	A1
	Perimeter = $(a) + (11-8) + BC, = 15.7(cm)$	M1, A1cao (4)
	(c) $\Delta = \frac{1}{2}ab\sin c =, \frac{1}{2}\times 11\times 8\times \sin 0.7$	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)
	(c) Final A1 accept 3sf or better (a) and (c) M1 for quoting and attempting to use correct formula (b) 1st M1 for attempting to use cosine rule (formula given)	

Question Number	Scheme	Marks
8.	(a) $x^2+6x+10=3x+20$	M1
	$\Rightarrow\ x^2+3x-10=0$	
	$(x+5)(x-2)=0$ so $x=,-5$ or 2	M1, A1
	sub for y in $y=3x+20, y=5$ or 26	M1, A1
		(5)
	(b) line – curve =, $10-3x-x^2$	M1, A1
	$\int(10-3x-x^2)dx=10x-\frac{3}{2}x^2-\frac{x^3}{3}$	M1 A2/1/0√
	$\left[10x-\frac{3}{2}x^2-\frac{x^3}{3}\right]_{-5}^{2}=(20-\frac{3}{2}\times4-\frac{8}{3})-(-50-\frac{3}{2}\times25+\frac{125}{3})$	M1
	$=11\frac{1}{3}--45\frac{5}{6}=\underline{\underline{57\frac{1}{6}}}$	A1
		(7)
		(12)
ALT (b)	$\int(x^2+6x+10)dx=\frac{x^3}{3}+3x^2+10x$	M1 A2
	use of limits $=(\frac{8}{3}+12+20)-(-\frac{125}{3}+75-50)=(108\frac{1}{2})$	M1
	Area of Trapezium $=\frac{1}{2}(5+26)(2--5)=(51\frac{1}{3})$	B1√
	Shaded area = Trapezium - $\int=108\frac{1}{2}-51\frac{1}{3}=57\frac{1}{6}$	M1 A1
		(7)
	(a) 1st M1 for putting curve = line 3rd M1 for obtaining at least one y value. Don't need A and B identified.	
	(b) 1st M1 for $\pm(10-3x-x^2)$ 3rd M1 (2nd on ALT) for using their limits, √ their x values from (a)	

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) $\frac{dA}{dx} = 80 - 2(2 + \frac{\pi}{2})x$	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
	$= \underline{\underline{448(m^2)}}$	A1 cao (2)
		(12)
	(b)2nd M1 for putting $\frac{dA}{dx} = 0$ and attempting $x = \cdots$	
	(c) M1 for attempting $\frac{d^2A}{dx^2}$ (or equivalent method)	
	A1 for a correct second derivative, < 0 and comment	