

January 2005
6664 Core Mathematics C2
Mark Scheme

Question Number	Scheme	Marks
1.	$(3+2x)^5 = (3^5) + \binom{5}{1}3^4 \cdot (2x) + \binom{5}{2}3^3(2x)^2 + \dots$ $= \underline{\underline{243+810x+1080x^2}}$	M1 B1, A1, A1 (4) (4 marks)
2.	(a) $\left(\frac{5+13}{2}, \frac{-1+11}{2}\right), = \underline{\underline{(9,5)}}$ (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, A1 (2) M1 M1 A1ft A1 (4) (6 marks)
3.	(a) $\log 3^x = \log 5$ $x = \frac{\log 5}{\log 3}$ or $x \log 3 = \log 5$ $= \underline{\underline{1.46}}$ (a) $\log_2\left(\frac{2x+1}{x}\right) = 2$ $\frac{2x+1}{x} = 2^2$ or 4 $2x+1 = 4x$ $x = \frac{1}{2}$ or 0.5	M1 A1 A1 cao (3) M1 M1 M1 A1 (4) (7)
4.	(a) $5(1 - \sin^2 x) = 3(1 + \sin x)$ $5 - 5 \sin^2 x = 3 + 3 \sin x$ $0 = \underline{\underline{5 \sin^2 x + 3 \sin x - 2}}$ * (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) $\phantom{\sin x = \frac{2}{5} \Rightarrow x = \underline{\underline{23.6}}}, \underline{\underline{156.4}}$ ($180 - \alpha$) $\sin x = -1 \Rightarrow x = \underline{\underline{270}}$	M1 A1 cso (2) M1 A1 cso B1 M1 B1 (5) (7) (ignore extra solutions <u>outside</u> the range)

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5.	<p>(a) $f(2) = 1 \Rightarrow 8 - 2 \times 4 + 2a + b = 1$ $f(-1) = 28 \Rightarrow -1 - 2 - a + b = 28$ solving $\begin{cases} 2a + b = 1 \\ -a + b = 31 \end{cases} \Rightarrow \underline{a = -10, b = 21}$</p> <p>(b) $f(3) = 27 - 18 + 3a + b$ $= 27 - 18 - 30 + 21 = 0$ $\therefore (x - 3)$ is a factor</p>	M1 A1 M1 A1 M1 A1 (6) M1 A1 c.s.o (2) (8)
6.	<p>(a) $ar = 7.2, ar^3 = 5.832 \Rightarrow r^2 = \frac{5.832}{7.2} (= 0.81)$ $r = 0.9$</p> <p>(b) $a = \frac{7.2}{(a)}, = \underline{8}$</p> <p>(c) $s_{50} = \frac{8(1 - (0.9)^{50})}{1 - 0.9}$ $= \underline{79.588} \text{ (3dp)}$</p> <p>(d) $s_{\infty} = \frac{8}{1 - 0.9} (= 80)$ $s_{\infty} - s_{50} = 80 - (c) = 0.412$</p>	M1 A1 (2) M1, A1 (2) M1 A1 c.a.o (2) M1 A1 (2) (8)
7.	<p>(a) $r\theta = 8 \times 0.7, = 5.6(\text{cm})$</p> <p>(b) $BC^2 = 8^2 + 11^2 - 2 \times 8 \times 11 \times \cos 0.7$ $\Rightarrow BC = 7.098$ $\Rightarrow \text{Perimeter} = (a) + (11 - 8) + BC, = 15.7(\text{cm})$</p> <p>(c) $\Delta = \frac{1}{2}ab \sin c = \frac{1}{2} \times 11 \times 8 \times \sin 0.7, = \text{AWRT } 28.3$ Sector $= \frac{1}{2}r^2\theta =, \frac{1}{2} \times 8^2 \times 0.7$ Area of $R = 28.345 \dots - 22.4 = 5.9455 = 5.95(\text{cm}^2)$</p>	M1, A1 (2) M1 A1 M1, A1cao (4) M1, A1 M1, A1 A1 (5) (11)

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8.	<p>(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</p> <p>(b) line - curve =, $10 - 3x - x^2$ $\int (10 - 3x - x^2) dx = 10x - \frac{3}{2}x^2 - \frac{x^3}{3}$ $\left[10x - \frac{3}{2}x^2 - \frac{x^3}{3} \right]_{-5}^2 = \left(20 - \frac{3}{2} \times 4 - \frac{8}{3} \right) - \left(-50 - \frac{3}{2} \times 25 + \frac{125}{3} \right)$ $= 11\frac{1}{3} - -45\frac{5}{6} = \underline{\underline{57\frac{1}{6}}}$</p>	<p>M1 M1, A1 M1, A1 (5)</p> <p>M1, A1 M1 A2/1/0\checkmark</p> <p>M1 A1 (7)</p> <p>(12)</p>
ALT (b)	<p>$\int (x^2 + 6x + 10) dx = \frac{x^3}{3} + 3x^2 + 10x$ (-1 each incorrect term)</p> <p>use of limits = $\left(\frac{8}{3} + 12 + 20 \right) - \left(-\frac{125}{3} + 75 - 50 \right) = 51\frac{1}{3}$</p> <p>Area of Trapezium = $\frac{1}{2} (5 + 26)(2 - -5) = 108\frac{1}{2}$ or $46 - - 62.5$ (from integration)</p> <p>Shaded area = Trapezium - $\int = 108\frac{1}{2} - 51\frac{1}{3} = 57\frac{1}{6}$ or $\frac{343}{6}$ or $57.1\dot{6}$</p>	<p>M1 A2/1/0</p> <p>M1</p> <p>B1\checkmark</p> <p>M1 A1 (7)</p>

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