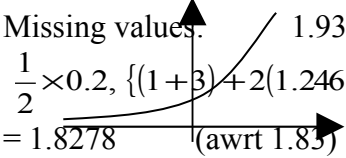


June 2006
6664 Core Mathematics C2
Mark Scheme

Question number	Scheme	Marks
1.	$(2+x)^6 = 64 \dots$ $+ (6 \times 2^5 \times x) + \left(\frac{6 \times 5}{2} \times 2^4 \times x^2 \right) \dots + 192x + 240x^2$	B1 M1, A1, A1 (4) Total 4 marks
2.	$\int (3x^2 + 5 + 4x^{-2}) dx = \frac{3x^3}{3} + 5x + \frac{4x^{-1}}{-1} \quad (= x^3 + 5x - 4x^{-1})$ $[x^3 + 5x - 4x^{-1}]_1^2 = (8 + 10 - 2) - (1 + 5 - 4), = 14$	M1 A1 A1 M1, A1 Total 5 marks
3.	(i) 2 (ii) $2 \log 3 = \log 3^2$ (or $2 \log p = \log p^2$) $\log_a p + \log_a 11 = \log_a 11p, = \log_a 99$ (Allow e.g. $\log_a (3^2 \times 11)$)	B1 (1) B1 M1, A1 (3) Total 4 marks

Question number	Scheme	Marks
4.	<p>(a) $f(-2) = 2(-2)^3 + 3(-2)^2 - 29(-2) - 60$ M: Attempt f(2) or f(-2) $= -16 + 12 + 58 - 60 = -6$</p> <p>(b) $f(-3) = 2(-3)^3 + 3(-3)^2 - 29(-3) - 60$ M: Attempt f(3) or f(-3) $(= -54 + 27 + 87 - 60) = 0 \quad \therefore (x + 3) \text{ is a factor}$</p> <p>(c) $(x + 3)(2x^2 - 3x - 20)$ $= (x + 3)(2x + 5)(x - 4)$</p>	<p>M1 A1 (2)</p> <p>M1 A1 (2)</p> <p>M1 A1 M1 A1 (4)</p> <p>Total 8 marks</p>
	<p>(a) Alternative (long division): Divide by $(x + 2)$ to get $(2x^2 + ax + b)$, $a \neq 0, b \neq 0$. [M1] $(2x^2 - x - 27)$, remainder = -6 [A1]</p> <p>(b) A1 requires zero and a simple conclusion (even just a tick, or Q.E.D.).</p> <p>(c) First M requires division by $(x + 3)$ to get $(2x^2 + ax + b)$, $a \neq 0, b \neq 0$. Second M for the attempt to factorise their quadratic. Usual rule: $(2x^2 + ax + b) = (2x + c)(x + d)$, where $cd = b$. Alternative (first 2 marks): $(x + 3)(2x^2 + ax + b) = 2x^3 + (6 + a)x^2 + (3a + b)x + 3b = 0$, then compare coefficients to find <u>values</u> of a and b. [M1] $a = -3, b = -20$ [A1] <u>Alternative:</u> Factor theorem: Finding that $f\left(-\frac{5}{2}\right) = 0 \therefore$ factor is, $(2x + 5)$ [M1, A1] Finding that $f(4) = 0 \therefore$ factor is, $(x - 4)$ [M1, A1] “Combining” all 3 factors is <u>not</u> required. If just one of these is found, score the <u>first 2 marks</u> M1 A1 M0 A0. <u>Losing a factor of 2:</u> $(x + 3)\left(x + \frac{5}{2}\right)(x - 4)$ scores M1 A1 M1 A0. <u>Answer only, one sign wrong:</u> e.g. $(x + 3)(2x - 5)(x - 4)$ scores M1 A1 M1 A0.</p>	

Question number	Scheme	Marks
5. (a)	Shape (0, 1), or just 1 on the y-axis, or seen in table for (b)	B1 B1 (2)
(b)	Missing values.  1.933, 2.408 (Accept awrt)	B1, B1 (2)
(c)	$\frac{1}{2} \times 0.2, \{(1+3) + 2(1.246 + 1.552 + 1.933 + 2.408)\}$ $= 1.8278$ (awrt 1.85)	B1, M1 A1ft A1 (4) Total 8 marks
6. (a)	$\tan \theta = 5$ $\tan \theta = k$ ($\theta = \tan^{-1} k$) $\theta = 78.7, 258.7$ (Accept awrt)	B1 (1) M1 A1, A1ft (3) Total 4 marks
7. (a)	Gradient of PQ is $-\frac{1}{3}$ $y - 2 = -\frac{1}{3}(x - 2)$ ($3y + x = 8$)	B1 M1 A1 (3)
(b)	$y = 1: 3 + x = 8$ $x = 5$ (*)	B1 (1)
(c)	$(5 - 2)^2 + (1 - 2)^2$ $(x - 5)^2 + (y - 1)^2 = 10$ M: Attempt PQ^2 or PQ M: $(x \pm a)^2 + (y \pm b)^2 = k$	M1 A1 M1 A1 (4) Total 8 marks
8. (a)	$r\theta = 2.12 \times 0.65$ 1.38 (m)	M1 A1 (2)
(b)	$\frac{1}{2} r^2 \theta = \frac{1}{2} \times 2.12^2 \times 0.65$ 1.46 (m ²)	M1 A1 (2)
(c)	$\frac{\pi}{2} - 0.65$ 0.92 (radians) (α)	M1 A1 (2)
(d)	$\Delta ACD : \frac{1}{2} (2.12)(1.86) \sin \alpha$ (With the value of α from part (c)) Area = "1.46" + "1.57", 3.03 (m ²)	M1 M1 A1 (3) Total 9 marks

Question number	Scheme	Marks
9.	<p>(a) $ar = 4$, $\frac{a}{1-r} = 25$ (These can be seen elsewhere) $a = 25(1-r)$ $25r(1-r) = 4$ M: Eliminate a $25r^2 - 25r + 4 = 0$ (*)</p> <p>(b) $(5r-1)(5r-4) = 0$ $r = \dots$, $\frac{1}{5}$ or $\frac{4}{5}$</p> <p>(c) $r = \dots \Rightarrow a = \dots$, 20 or 5</p> <p>(d) $S_n = \frac{a(1-r^n)}{1-r}$, but $\frac{a}{1-r} = 25$, so $S_n = 25(1-r^n)$ (*)</p> <p>(e) $25(1-0.8^n) > 24$ and proceed to $n = \dots$ (or $>$, or $<$) with no unsound algebra. $\left(n > \frac{\log 0.04}{\log 0.8} (=14.425 \dots) \right)$ $n = 15$</p>	<p>B1, B1</p> <p>M1</p> <p>A1cso (4)</p> <p>M1, A1 (2)</p> <p>M1, A1 (2)</p> <p>B1 (1)</p> <p>M1</p> <p>A1 (2)</p> <p>Total 11 marks</p>
10.	<p>(a) $\frac{dy}{dx} = 3x^2 - 16x + 20$ $3x^2 - 16x + 20 = 0$ $(3x-10)(x-2) = 0$ $x = \dots$, $\frac{10}{3}$ and 2</p> <p>(b) $\frac{d^2y}{dx^2} = 6x - 16$ At $x = 2$, $\frac{d^2y}{dx^2} = \dots$ -4 (or < 0, or both), therefore maximum</p> <p>(c) $\int (x^3 - 8x^2 + 20x) dx = \frac{x^4}{4} - \frac{8x^3}{3} + \frac{20x^2}{2} (+C)$</p> <p>(d) $4 - \frac{64}{3} + 40$ $\left(= \frac{68}{3} \right)$ $A: x = 2: y = 8 - 32 + 40 = 16$ (Maybe scored elsewhere) Area of $\Delta = \frac{1}{2} \left(\frac{10}{3} - 2 \right) \times 16$ $\left(\frac{1}{2} (x_B - x_A) \times y_A \right)$ $\left(= \frac{32}{3} \right)$ Shaded area = $\frac{68}{3} + \frac{32}{3} = \frac{100}{3}$ $\left(= 33 \frac{1}{3} \right)$</p>	<p>M1 A1</p> <p>dM1, A1 (4)</p> <p>M1</p> <p>A1ft (2)</p> <p>M1 A1 A1 (3)</p> <p>M1</p> <p>B1</p> <p>M1</p> <p>M1 A1 (5)</p> <p>Total 14 marks</p>