June 2006
6664 Core Mathematics C2
Mark Scheme

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

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4. (a)	$f(-2)=2(-2)^3+3(-2)^2-29(-2)-60$ **M: Attempt f(2) or f(–2)**	**M1**
	= −16 + 12 + 58 − 60 = −6	**A1** (2)
(b)	$f(-3)=2(-3)^3+3(-3)^2-29(-3)-60$ **M: Attempt f(3) or f(–3)**	**M1**
	(= −54 + 27 + 87 − 60) = 0 $\therefore$ **(*x* + 3) is a factor**	**A1** (2)
(c)	$(x+3)(2x^2-3x-20)$	**M1 A1**
	$=(x+3)(2x+5)(x-4)$	**M1 A1** (4)
		Total 8 marks
(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]**	
(b)	**(b) A1 requires zero and a simple conclusion (even just a tick, or Q.E.D.).**	
(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 $\lvert cd\rvert=\lvert b\rvert$ **.** **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, (2*x* + 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.**	

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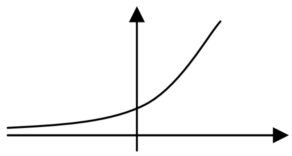
5. (a)	 Shape (0, 1), or just 1 on the *y*-axis, or seen in table for (b)	B1 B1 (2)
(b)	Missing values: 1.933, 2.408 (Accept awrt)	B1, B1 (2)
(c)	$\frac{1}{2}\times 0.2,\ \{(1+3)+2(1.246+1.552+1.933+2.408)\}$	B1, M1 A1ft
	= 1.8278 (awrt 1.83)	A1 (4) **Total 8 marks**
6. (a)	$\tan\theta = 5$	B1 (1)
	$\tan\theta = k$ $\left(\theta = \tan^{-1} k\right)$	M1
	$\theta = 78.7,\quad 258.7$ (Accept awrt)	A1, A1ft (3) **Total 4 marks**
7. (a)	Gradient of *PQ* is $-\frac{1}{3}$	B1
	$y-2=-\frac{1}{3}(x-2)$ $(3y+x=8)$	M1 A1 (3)
(b)	$y=1$: $3+x=8$ $x=5$ (*)	B1 (1)
(c)	$("5"-2)^2+(1-2)^2$ M: Attempt PQ^2 or PQ	M1 A1
	$(x-5)^2+(y-1)^2=10$ M: $(x\pm a)^2+(y\pm b)^2=k$	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)	ΔACD: $\frac{1}{2}(2.12)(1.86)\sin\alpha$ (With the value of α from part (c))	M1
	Area = "1.46" + "1.57", 3.03 (m^2)	M1 A1 (3) **Total 9 marks**

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