January 2006
6663 Core Mathematics C1
Mark Scheme

Question number	Scheme	Marks
1.	$x(x^2-4x+3)$ Factor of x. (Allow $(x-0)$) $=x(x-3)(x-1)$ Factorise 3 term quadratic	M1 M1 A1 (3) **Total 3 marks**
2.	(a) $u_2=(-2)^2=4$ $u_3=1,\ u_4=4$ For u_3, ft $(u_2-3)^2$ (b) $u_{20}=4$	B1 B1ft, B1 (3) B1ft (1) **Total 4 marks**
3.	(a) $y=5-(2\times 3)=-1$ (or equivalent verification) (*) (b) Gradient of L is $\frac{1}{2}$ $y-(-1)=\frac{1}{2}(x-3)$ (ft from a changed gradient) $x-2y-5=0$ (or equiv. with integer coefficients)	B1 (1) B1 M1 A1ft A1 (4) **Total 5 marks**

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4.	(a) $\frac{dy}{dx} = 4x + 18x^{-4}$ M1: $x^2 \to x$ or $x^{-3} \to x^{-4}$	M1 A1 (2)
	(b) $\frac{2x^3}{3} - \frac{6x^{-2}}{-2} + C$ M1: $x^2 \to x^3$ or $x^{-3} \to x^{-2}$ or $+C$	M1 A1 A1 (3)
	$\left(= \frac{2x^3}{3} + 3x^{-2} + C\right)$ First A1: $\frac{2x^3}{3} + C$	
	Second A1: $-\frac{6x^{-2}}{-2}$	**Total 5 marks**

5.	(a) $3\sqrt{5}$ (or $a = 3$)	B1 (1)
	(b) $\frac{2(3+\sqrt{5})}{(3-\sqrt{5})} \times \frac{(3+\sqrt{5})}{(3+\sqrt{5})}$	M1
	$(3-\sqrt{5})(3+\sqrt{5}) = 9-5$ (= 4) (Used as or intended as denominator)	B1
	$(3+\sqrt{5})(p \pm q\sqrt{5}) = ...$ 4 terms $(p \neq 0, q \neq 0)$ (Independent)	M1
	or $(6+2\sqrt{5})(p \pm q\sqrt{5}) = ...$ 4 terms $(p \neq 0, q \neq 0)$	
	[Correct version: $(3+\sqrt{5})(3+\sqrt{5}) = 9+3\sqrt{5}+3\sqrt{5}+5$, or double this.]	
	$\frac{2(14+6\sqrt{5})}{4} = 7+3\sqrt{5}$ 1st A1: $b = 7$, 2nd A1: $c = 3$	A1 A1 (5)
		Total 6 marks

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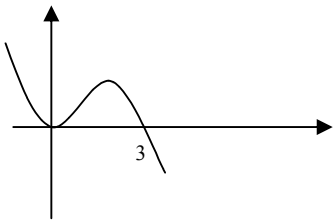
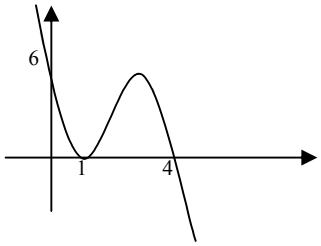
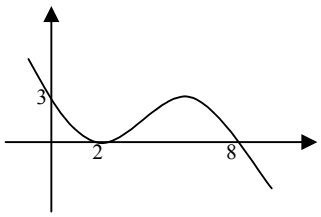
6.	(a)  (See below) Clearly through origin (or (0, 0) seen) 3 labelled (or (3, 0) seen)	M1 A1 A1 (3)
	(b)  Stretch parallel to *y*-axis 1 and 4 labelled (or (1, 0) and (4, 0) seen) 6 labelled (or (0, 6) seen)	M1 A1 A1 (3)
	(c)  Stretch parallel to *x*-axis 2 and 8 labelled (or (2, 0) and (8, 0) seen) 3 labelled (or (0, 3) seen)	M1 A1 A1 (3)
		Total 9 marks

7.	(a) $500 + (500 + 200) = 1200$ or $S_2 = \frac{1}{2}2\{1000 + 200\} = 1200$ (*)	B1 (1)
	(b) Using $a = 500$, $d = 200$ with $n = 7$, 8 or 9 $a + (n-1)d$ or "listing" $500 + (7 \times 200) = $ (£)1900	M1 A1 (2)
	(c) Using $\frac{1}{2}n\{2a + (n-1)d\}$ or $\frac{1}{2}n\{a + l\}$, or listing and "summing" terms	M1
	$S_8 = \frac{1}{2}8\{2 \times 500 + 7 \times 200\}$ or $S_8 = \frac{1}{2}8\{500 + 1900\}$, or all terms in list correct	A1
	= (£) 9600	A1 (3)
	(d) $\frac{1}{2}n\{2 \times 500 + (n-1) \times 200\} = 32000$ M1: General S_n, equated to 32000	M1 A1
	$n^2 + 4n - 320 = 0$ (or equiv.) M1: Simplify to 3 term quadratic	M1 A1
	$(n + 20)(n - 16) = 0$ $n = ...$ M1: Attempt to solve 3 t.q.	M1
	$n = 16$, Age is 26	A1cso,A1cso (7)
		Total 13 marks

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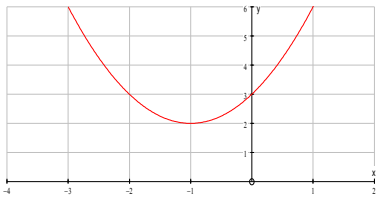
8.	$\dfrac{5x^2+2}{x^{\frac{1}{2}}} = 5x^{\frac{3}{2}} + 2x^{-\frac{1}{2}}$ M1: One term correct. A1: Both terms correct, and no extra terms.	M1 A1
	$f(x) = 3x + \dfrac{5x^{\frac{5}{2}}}{\left(\frac{5}{2}\right)} + \dfrac{2x^{\frac{1}{2}}}{\left(\frac{1}{2}\right)}$ $(+C)$ (+ C not required here)	M1 A1ft
	$6 = 3 + 2 + 4 + C$ Use of $x = 1$ and $y = 6$ to form eqn. in C	M1
	$C = -3$	A1cso
	$3x + 2x^{\frac{5}{2}} + 4x^{\frac{1}{2}} - 3$ (simplified version required)	A1 (ft C)
	[or: $3x + 2\sqrt{x^5} + 4\sqrt{x} - 3$ or equiv.]	(7)
		Total 7 marks

9.	(a) -2 (P), 2 (Q) (± 2 scores B1 B1)	B1, B1 (2)
	(b) $y = x^3 - x^2 - 4x + 4$ (May be seen earlier) Multiply out, giving 4 terms	M1
	$\dfrac{dy}{dx} = 3x^2 - 2x - 4$ (*)	M1 A1cso (3)
	(c) At $x = -1$: $\dfrac{dy}{dx} = 3(-1)^2 - 2(-1) - 4 = 1$	
	Eqn. of tangent: $y - 6 = 1(x - (-1))$, $y = x + 7$ (*)	M1 A1cso (2)
	(d) $3x^2 - 2x - 4 = 1$ (Equating to "gradient of tangent")	M1
	$3x^2 - 2x - 5 = 0$ $(3x - 5)(x + 1) = 0$ $x = \ldots$	M1
	$x = \dfrac{5}{3}$ or equiv.	A1
	$y = \left(\dfrac{5}{3} - 1\right)\left(\dfrac{25}{9} - 4\right)$, $= \dfrac{2}{3} \times \left(-\dfrac{11}{9}\right) = -\dfrac{22}{27}$ or equiv.	M1, A1 (5)
		Total 12 marks

Question number	Scheme	Marks
10.	(a) $x^2 + 2x + 3 = (x+1)^2,\ +2$ $\quad (a = 1,\ \ b = 2)$	B1, B1 (2)
	(b)  "U"-shaped parabola	M1
	Vertex in correct quadrant (ft from $(-a, b)$)	A1ft
	$(0, 3)$ (or 3 on y-axis)	B1 (3)
	(c) $b^2 - 4ac = 4 - 12 = -8$	B1
	Negative, so curve does not cross x-axis	B1 (2)
	(d) $b^2 - 4ac = k^2 - 12$ (May be within the quadratic formula)	M1
	$k^2 - 12 < 0$ (Correct inequality expression in any form)	A1
	$-\sqrt{12} < k < \sqrt{12}$ (or $-2\sqrt{3} < k < 2\sqrt{3}$)	M1 A1 (4)
		Total 11 marks