Question number	Scheme	Marks
1. (a) $u_2 = \sqrt{\left(\dfrac{3}{2}+\dfrac{20}{3}\right)}$ $= 2.85773\ldots$ $= 2.86$		M1
$u_3 = $ $2.90300\ldots$ $= 2.90$		A1 c.a.o
$\underline{u_4} = $ $2.88806\ldots$ $= 2.89$		A1 c.a.o
[If $u_3 = $ AWRT 2.90 and $u_4 = $ AWRT 2.89 penalise once only]		(3)
(b) (*i*) $3 = \sqrt{\left(\dfrac{3}{2}+\dfrac{a}{3}\right)}$ or $9 = \dfrac{3}{2}+\dfrac{a}{3}$		M1
$\dfrac{a}{3} = 9-\dfrac{3}{2}$ or $a = 3\left(9-\dfrac{3}{2}\right)$		M1
$a = 22.5$		A1 (3)
(ii) (If $u_1 = u_2,$ then $u_2 = u_{3\ldots\ldots}$) $u_5 = 3$		B1 (1)
		(7 marks)
2. (a) $b^2 - 4ac \geq 0$ $(5k)^2 - 8k \geq 0,$ $k(25k-8) \geq 0$ *		M1 A1 (2)
(b) Critical values: $k = 0,$ $k = \frac{8}{25}$		B1 B1
$k \leq 0,$ $k \geq \frac{8}{25}$ (A1 requires $\leq$ and $\geq$)		M1 A1 ft (4)
(c) $k = 0,$ $k = \frac{8}{25}$ (Clearly seen as a soln. for (C))		B1 (1)
		(7 marks)
3. (a) $3^x = 3^{2(y-1)}$ $x = 2\,(y-1)$ (*)		M1 A1 (2)
(b) $(2y-2)^2 = y^2 + 7,$ $3y^2 - 8y - 3 = 0$		M1, A1
$(3y+1)(y-3) = 0, \; y = \ldots$ (or correct substitution in formula)		M1
$y = -\dfrac{1}{3}, \qquad y = 3$		A1
$x = -\dfrac{8}{3}, \qquad x = 4$		M1 A1ft (6)
		(8 marks)

Question number	Scheme	Marks
4. (a)	$\sqrt{8} = 2\sqrt{2}$ seen or used somewhere (possibly implied).	B1
	$\dfrac{12}{\sqrt{8}} = \dfrac{12\sqrt{8}}{8}$ or $\dfrac{12}{2\sqrt{2}} = \dfrac{12\sqrt{2}}{4}$	
	Direct statement, e.g. $\dfrac{6}{\sqrt{2}} = 3\sqrt{2}$ (no indication of method) is M0.	M1
	At $x = 8$, $\dfrac{dy}{dx} = 3\sqrt{8} + \dfrac{12}{\sqrt{8}} = 6\sqrt{2} + 3\sqrt{2} = 9\sqrt{2}$ (*)	A1 (3)
(b)	Integrating: $\dfrac{3x^{3/2}}{(3/2)} + \dfrac{12x^{1/2}}{(1/2)} (+C)$ (*C* not required)	M1 A1 A1
	At (4, 30), $\dfrac{3 \times 4^{3/2}}{(3/2)} + \dfrac{12 \times 4^{1/2}}{(1/2)} + C = 30$ (*C* required)	M1
	$(\mathrm{f}(x) =)\ 2x^{3/2} + 24x^{1/2}, -34$	A1, A1 (6)
		(9 marks)
5. (a)	$m = \dfrac{2-6}{12-4}\left(= -\dfrac{1}{2}\right)$	M1 A1
	$y - 6 = (\text{their } m)(x - 4)$ $\qquad$ $x + 2y = 16$	M1 A1 (4)
(b)	$y = -4x$	B1 (1)
(c)	$x + 2(-4x) = 16$ $\qquad$ $-7x = 16$ $\qquad$ $x = -\dfrac{16}{7}$	M1 A1
	$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad y = \dfrac{64}{7}$	A1 ft
	$A\,(4, 6),\ C\left(-\dfrac{16}{7}, \dfrac{64}{7}\right): \left(\dfrac{x_1 + x_2}{2}, \dfrac{y_1 + y_2}{2}\right) \rightarrow \left(\dfrac{6}{7}, \dfrac{53}{7}\right)$	M1 A1 ft (5)
		(10 marks)

Question number	Scheme	Marks
6. (a)	9	B1 (1)
(b)	Shape Position of max. 5 on *y*-axis −1 and 5 on *x*-axis	B1 B1 B1 M1 A1 (5)
(c)	Gradient: $\dfrac{8-(-7)}{3-(-2)}$ $y - 8 = \text{"gradient"}\,(x - 3)$ $y = 3x - 1$	M1 A1 M1 A1 (4)
(d)	Where $y = 0$, $x = \dfrac{1}{3}$	M1 A1ft (2)
(e)	Mid point: $\left(\dfrac{-7+8}{2}, \dfrac{-2+3}{2}\right) = \left(\dfrac{1}{2}, \dfrac{1}{2}\right)$ $k = 1$	M1 A1 (2)
		(14 marks)
7. (a)	$\dfrac{\mathrm{d}y}{\mathrm{d}x} = 4x^3 - 16x$	M1 A1 (2)
(b)	$4x^3 - 16x = 0$ $4x(x^2 - 4) = 0$ $x = 0,\ 2,\ -2$ $y = 3,\ -13,\ -13$	M1 A2 (1, 0) M1 A1 (5)
		(7 marks)
8. (a)	$(x^4 - 6x^2 + 9)$ $(x^4 - 6x^2 + 9) \div x^3 = x - 6x^{-1} + 9x^{-3}$ (*)	M1 A1 (2)
(b)	$\mathrm{f}'(x) = 1 + 6x^{-2} - 27x^{-4}$ First A1: 2 terms correct (unsimplified) Second A1: all 3 correct (simplified)	M1 A1 A1 (3) **(5 marks)**