Question number		Scheme	Marks
1.	(a)	$x = -\frac{1}{2}$	B1
		$4 = 2^2$ and $\sqrt{2} = 2^{\frac{1}{2}}$ $y = 2\frac{1}{2}$	M1 A1 (3)
	(b)	$y - x = 3$ $2^3 = 8$ (or: $4\sqrt{2} \div \frac{1}{\sqrt{2}} = 8$)	M1 A1 (2)
			(5 marks)
2.	(a)	$(x^4 - 6x^2 + 9)$	M1
		$(x^4 - 6x^2 + 9) \div x^3 = x - 6x^{-1} + 9x^{-3}$ (*)	A1 (2)
	(b)	$f'(x) = 1 + 6x^{-2} - 27x^{-4}$ First A1: 2 terms correct (unsimplified)	M1 A1 A1 (3)
		Second A1: all 3 correct (simplified)	
			(5 marks)
3.	(a)	77 74	B1 B1 (2)
	(b)	$d = 74 - 77 = -3$	B1 (1)
	(c)	$S_{50} = \frac{1}{2}n\left[2a + (n-1)d\right] = 25\left[(2 \times 77) + (49 \times -3)\right]$	M1
		$= 175$	
		$= 175$	A1 (3)
			(6 marks)

Question number		Scheme	Marks
4.	(a)	$6x - 2x < 3 + 7$ $\quad x < 2\frac{1}{2}$	M1 A1 (2)
	(b)	$(2x - 1)(x - 5)$ $\quad$ Critical values $\frac{1}{2}$ and 5	M1 A1
		$\frac{1}{2} < x < 5$	M1 A1 ft (4)
	(c)	$\frac{1}{2} < x < 2\frac{1}{2}$	B1 ft (1)
			(7 marks)
5.	(a)	$b^2 - 4ac \geq 0$ $\quad (5k)^2 - 8k \geq 0$, $\quad k(25k - 8) \geq 0$ *	M1, A1 (2)
	(b)	Critical values: $\quad k = 0$, $\quad k = \frac{8}{25}$	B1 B1
		$k \leq 0$, $\quad k \geq \frac{8}{25}$ $\quad \longleftarrow\!\bullet_{k_1} \quad \bullet_{k_2}\!\longrightarrow$	M1 A1 ft (4)
		A1 requires ≤ and ≥	
	(c)	$k = 0$ $\quad k = \frac{8}{25}$ $\quad$ (Clearly seen as a soln. for (c))	B1 (1)
			(7 marks)

Question number	Scheme	Marks
6. (a)	$u_1 = 1.05 \times 500\,000 - 15\,000 = 510\,000$ $u_2 =$ 520 500 $u_3 =$ 531 525 The population is <u>increasing</u>	M1 A1 (all 3) B1 (3)
(b)	$\begin{pmatrix} u_1 = 425000 \\ u_2 = 346250 \\ u_3 = 263562.5 \\ u_4 = 176740.625 \end{pmatrix}$ $u_5 = 85577.64\ldots..$ $u_6 = -10143.46\ldots..$ $u_5 > 0$, $u_6 < 0$ so population died out during 6th year	M1 A1 B1 (3)
(c)	Require $u_1 = u_0$ i.e $1.05 \times 500000 - d = 500000$ i.e $d = 0.05 \times 500000$ i.e $d = 25000$	M1 A1 (2) **(8 marks)**

Question number	Scheme	Marks
7. (*a*)	(2, 0) (or $x = 2,\ y = 0$)	B1 (1)
(*b*)	$y^2 = 4\left(\frac{3y+12}{2} - 2\right)$ or $\left(\frac{2x-12}{3}\right)^2 = 4(x-2)$	M1
	$y^2 - 6y - 16 = 0$ or $x^2 - 21x + 54 = 0$ (or equiv. 3 terms)	A1
	$(y+2)(y-8) = 0$, $y =$…or $(x-3)(x-18) = 0$, $x =$… (3 term quad.)	M1
	$y = -2,\ y = 8$ or $x = 3,\ x = 18$	A1
	$x = 3,\ x = 18$ or $y = -2,\ y = 8$ (attempt <u>one</u> for M mark) (A1ft requires both values)	M1 A1ft (6)
(c)	Grad. of $AQ = \frac{8-0}{18-2}$, Grad. of $AP = \frac{0-(-2)}{2-3}$ (attempt <u>one</u> for M mark)	M1 A1ft
	$m_1 \times m_2 = \frac{1}{2} \times -2 = -1$, so $\angle PAQ$ is a right angle (A1 is c.s.o.)	M1 A1 (4)
	<u>Alternative:</u> Pythagoras: Find 2 lengths [M1]	
	$AQ = \sqrt{320}$, $AP = \sqrt{5}$, $PQ = \sqrt{325}$ (O.K. unsimplified) [A1ft]	
	(if decimal values only are given, with no working shown, require at least 1 d.p. accuracy for M1(implied) A1)	
	$AQ^2 + AP^2 = PQ^2$, so $\angle PAQ$ is a right angle [M1, A1]	
	M1 requires attempt to use Pythag. for right angle at A, and A1 requires correct <u>exact</u> working + conclusion.	**(11 marks)**

Question number	Scheme	Marks
8. (*a*)	Gradient of $AB = \frac{4}{8} = \frac{1}{2}$	M1 A1 (2)
(*b*)	Gradient of $BC = -2$, $\frac{4-2}{k-7} = -2$ (or full Pythag. Method)	M1
	$k = 6$	A1 (2)
(*c*)	$AB = \sqrt{(4^2 + 8^2)}$	
	$= \sqrt{80} = \sqrt{16}\,\sqrt{5} = 4\sqrt{5}$	A1 (3)
(*d*)	$BC = \sqrt{(1^2 + 2^2)} = \sqrt{5}$ (or $AC = \sqrt{(7^2 + 6^2)} = \sqrt{85}$)	B1 ft
	Area of $ABC = \frac{1}{2}(4\sqrt{5} \times \sqrt{5} = 10$	M1 A1 (3)
	Other exact methods can score M1 A2.	
	Non-exact methods score M1 A0 (but may gain the B1).	
(e)	$y - 2 = -2\,(x - 7)$	B1
	$2x + y - 16 = 0$	B1 (2)
		(12 marks)
9 (*a*)	Integrate: $y = x3 - 10x^2 + 29x\,(+C)$	M1 M1
	$6 = 8 - 40 + 58 + C \Rightarrow C = -20$ $(y = x^3 - 10x^2 + 29x - 20)$	M1 A1 (4)
(*b*)	Subs. $x = 4$: $64 - 160 + 116 - 20 = 0$	M1 A1 (2)
(*c*)	At $x = 2$, $\frac{dy}{dx} = 12 - 40 + 29 = 1$	B1
	Tangent: $y - 6 = x - 2$ $(y = x + 4)$	M1 A1 (3)
(*d*)	$\frac{dy}{dx} = 1$	M1
	$3x^2 - 20x + 28 = 0$	M1
	$(3x - 14)(x - 2) = 0$	M1 A1
	$x = \frac{14}{3}$	A1 (5)
		(14 marks)