	Give 1 mark for each •	Illustration(s) for awarding each mark
1(a)	**ans:** $a = 1;\ b = 4,\ c = -29$ **(4 marks)**	
	•1 finds gradient of BD •2 finds gradient of AC •3 subs into $y - b = m(x - a)$ and rearranges •4 states values of a, b and c	•1 $m_{BD} = 4$ [from equation] •2 $m_{AC} = -\frac{1}{4}$ •3 $y - 8 = -\frac{1}{4}(x+3);\ x + 4y - 29 = 0$ •4 $a = 1;\ b = 4,\ c = -29$
(b)	**ans:** E(5, 6) **(3 marks)**	
	•1 knows to use system of equations •2 solves for x and y •3 states coordinates of E	•1 evidence of equating one variable •2 $x = 5;\ y = 6$ •3 E(5, 6)
(c)	**ans:** C(13, 4) **(2 marks)**	
	•1 appropriate method •2 answer	•1 evidence of 'stepping out' or other method •2 C(13, 4)
2(a)	**ans:** **proof** **(3 marks)**	
	•1 knows to substitute •2 substitutes correctly •3 clearly simplifies to answer	•1 evidence of sub. one function in other •2 $f\left(\frac{1}{x-1}\right) = \frac{4}{x-1} + 1$ •3 $\frac{4 + x - 1}{x - 1} = \frac{x+3}{x-1}$
(b)	**ans:** $p = 2$ **(4 marks)**	
	•1 substitute for x •2 knows to multiply by conjugate surd •3 multiplies and simplifies •4 states value of p	•1 $\frac{\sqrt{5}+3}{\sqrt{5}-1}$ •2 $\frac{\sqrt{5}+3}{\sqrt{5}-1} \times \frac{\sqrt{5}+1}{\sqrt{5}+1}$ •3 $\frac{5 + 4\sqrt{5} + 3}{4} = \frac{8 + 4\sqrt{5}}{4} = 2 + \sqrt{5}$ •4 $p = 2$

	Give 1 mark for each •	Illustration(s) for awarding each mark
3(a)	**ans:** P(1, 0); Q(– 2, 27) **(5 marks)**	
	•[1] knows derivative = 0 at S.P. •[2] takes derivative and factorises •[3] solves for x and chooses appropriate value •[4] substitutes to find y – coordinate •[5] states coordinates of P and Q	•[1] $f'(x) = 0$ at SP [stated or implied] •[2] $6x^2 + 6x - 12 = 0$; $6(x+2)(x-1) = 0$ •[3] $x = -2$ or 1 •[4] $f(-2) = 2(-2)^3 + 3(-2)^2 - 12(-2) + 7 = 27$ •[5] P(1, 0); Q(– 2, 27)
(b)	**ans:** 40·5 units^2 **(4 marks)**	
	•[1] sets up integral •[2] integrates expression •[3] substitutes values •[4] evaluates	•[1] $\int_{-2}^{1} 2x^3 + 3x^2 - 12x + 7\, dx$ •[2] $\left[\frac{x^4}{2} + x^3 - 6x^2 + 7x\right]_{-2}^{1}$ •[3] $\left(\frac{(1)^4}{2} + (1)^3 - 6(1)^2 + 7(1)\right) - \left(\frac{(-2)^4}{2} + (-2)^3 - 6(-2)^2 + 7(-2)\right)$ •[4] 40·5 units^2
4	**ans:** 19·5°, 90°, 160·5°, 270° **(5 marks)**	
	•[1] subs for sin $2x^0$ •[2] multiplies and simplifies •[3] factorises •[4] finds two solutions •[5] finds further two solutions	•[1] $15(2\sin x^\circ \cos x^\circ)$..... •[2] $30\sin x^\circ \cos x^\circ - 10\cos x^\circ = 0$ •[3] $10\cos x^\circ(3\sin x^\circ - 1) = 0$ •[4] $\sin x^\circ = \frac{1}{3}$; $x = 19\cdot5^\circ, 160\cdot5^\circ$ •[5] $\cos x^\circ = 0$; $x = 90^\circ, 270^\circ$

	Give 1 mark for each •	Illustration(s) for awarding each mark
5(a)	**ans:** proof **(2 marks)**	
	•[1] substitutes U_0 and finds U_1	•[1] $U_1 = \frac{a}{4} \times 16 + 12 = 4a + 12$
	•[2] substitutes U_1 and finds U_2	•[2] $U_1 = \frac{a}{4}(4a+12) + 12 = a^2 + 3a + 12$
(b)	**ans:** $a = 3$ **(3 marks)**	
	•[1] equates U_2 to 30	•[1] $a^2 + 3a + 12 = 30$
	•[2] collects terms to LHS and factorises	•[2] $a^2 + 3a - 18 = 0; (a+6)(a-3) = 0$
	•[3] solves for x and discards	•[3] $a = -6, 3;\ a = 3$
(c)	**ans:** 48 **(3 marks)**	
	•[1] knows condition for limit	•[1] limit exists since $-1 < \frac{3}{4} < 1$
	•[2] knows how to find limit	•[2] $L = \frac{12}{1 - 0 \cdot 75} = \frac{12}{0 \cdot 25}$
	•[3] answer	•[3] 48
6(a)	(a) •[1] $y = ax^2 + bx + c$	
	•[2] $(0, 40) \Rightarrow c = 40$	
	•[3] symmetry $\Rightarrow b = 0$	
	•[4] $(20, 0) \Rightarrow a = -\frac{1}{10}$	
(b)	(b) •[5] strategy: find equ of line and solve with parabola	
	•[6] e.g. gradient of left line = 2	
	•[7] $y = 2x + 50$	
	•[8] $2x + 50 = 40 - \frac{1}{10}x^2$	
	•[9] $x^2 + 20x + 100 = 0$	
	•[10] $b^2 - 4ac = 0$ or $(x - 10)^2 = 0$	
	•[11] equal roots so line is tangent to parabola	

	Give 1 mark for each •	Illustration(s) for awarding each mark
7(a)	**ans:** $k = 2$ **(3 marks)** •1 knows to use synthetic division •2 makes remainder = 0 •3 solves for k	•1 evidence •2 $8 - 4k = 0$ •3 $k = 2$
(b)	**ans:** $p = -3$ **(3 marks)** •1 equates function to 35 •2 collect terms to LHS and equates to 0 •3 uses synthetic division to find root	•1 $p^3 - 2p^2 - 16p + 32 = 35$ •2 $p^3 - 2p^2 - 16p - 3 = 0$ •3 $p = -3$
(c)	**ans:** 98^0 **(2 marks)** •1 finds gradient of AB •2 takes $\tan^{-1}$ and states angle	•1 $m_{AB} = \dfrac{35 - 0}{-3 - 2} = -7$ •2 $\tan^{-1}(7) = 82°$; angle = 98^0
8	**ans:** $a = 3$ **(4 marks)** •1 evaluates integral •2 finds derivative •3 makes integral = derivative •4 factorises and solves	•1 $\left[x^2\right]_0^a = a^2$ •2 $\dfrac{d}{da} = 6a - 9$ •3 $a^2 = 6a - 9$; $a^2 - 6a + 9 = 0$ •4 $(a-3)(a-3) = 0$; $a = 3$

Total: ~~60~~ 61 marks