	Give 1 mark for each •	Illustration(s) for awarding each mark
1(a)	**ans: 3y – x =4**	
	•[1] finds gradient	•[1] m_{BC}= -3 therefore m(altitude) = $\frac{1}{3}$
	•[2] finds equation of altitude	•[2] y – 2 = $\frac{1}{3}$(x – 2)
(b)	**ans: x = 4**	
	•[1] states equation of median	•[1] from mid-point (4,3) states x=4
(c)	**ans: (4 , $\frac{8}{3}$)**	
	•[1] subs x=4 into altitude to find y	•[1] y = $\frac{8}{3}$
	•[2] states coords of intersection	•[2] (4 , $\frac{8}{3}$)
2(a)	**ans: proof** **(3 marks)**	
	•[1] subs one function into the other	•[1] $f(x-3)=(x-3-1)^2=(x-4)^2$
	•[2] multiplies inner bracket	•[2] $h(x)=[x^2-8x+16]x^2$
	•[3] multiplies to answer	•[3] x^4-8x^3+16
(b)	**ans: A(2, 16)** **(5 marks)**	
	•[1] knows to make $\frac{dy}{dx}=0$	•[1] $\frac{dy}{dx}=0$
	•[2] differentiates	•[2] $\frac{dy}{dx}=4x^3-24x^2+32x=0$ at SP
	•[3] solves for *x*	•[3] $4x(x-4)(x-2)=0;\ x=2,4$
	•[4] chooses correct values & subs to find *y*	•[4] $y=(2)^4-8(2)^3+16(2)^2=16$
	•[5] states coordinates of A	•[5] A(2, 16)
3(a)	**ans: *p* = 0·5** **(4 marks)**	
	•[1] gives expression for both limits	•[1] $L=\frac{6}{1-p};\ L=\frac{9}{1-p^2}$
	•[2] equates limits	•[2] $\frac{6}{1-p}=\frac{9}{1-p^2}$
	•[3] starts to solve	•[3] $6-6p^2=9-9p;\ 6p^2-9p+3=0$
	•[4] solves and discards	•[4] $3(2p-1)(p-1)=0;\ p=0\cdot5$ or $p=1$
(b)	**ans: 22** **(3 marks)**	
	•[1] finds 1st term for one RR	•[1] $U_1=\frac{1}{2}(100)+6=56$
	•[2] finds 1st term for other RR	•[2] $U_1=(\frac{1}{2})^2(100)+6=34$

	●[3] calculates difference in terms	●[3] $56 - 34 = 22$

	Give 1 mark for each ●	**Illustration(s) for awarding each mark**
4	**ans: $y = x^3 + x^2 + 3$ (4 marks)**	
	●[1] knows to integrate	●[1] $y = x^3 + x^2$
	●[2] answer	●[2] $y = x^3 + x^2 + c$
	●[3] subs for x and y to solve for c	●[3] $c = 3$
	●[4] Equation	●[4] $y = x^3 + x^2 + 3$
5(a)	**ans: P(–2, 0) (3 marks)**	
	●[1] equates function to 0	●[1] $x^3 + 6x^2 + 12x + 8 = 0$ at P
	●[2] solves using suitable strategy	●[2] suitable strategy leading to $x = -2$
	●[3] states coordinates of P	●[3] P(–2, 0)
(b)	**ans: 4 square units (4 marks)**	
	●[1] knows how to find area	●[1] $\int_{-2}^{0} x^3 + 6x^2 + 12x + 8 \, dx$
	●[2] integrates	●[2] $\left[\frac{x^4}{4} + 2x^3 + 6x^2 + 8x\right]_{-2}^{0}$
	●[3] subs values	●[3] $0 - \left(\frac{(-2)^4}{4} + 2(-2)^3 + 6(-2)^2 + 8(-2)\right)$
	●[4] evaluates	●[4] 4 square units
6(a)	**ans: y + x = 3 (3 marks)**	
	●[1] finds gradient of CP	●[1] $m_{tangent} = -1$ so $m_{radius} = 1$
	●[2] Subs into straight line equation	●[2] $y - 7 = -1(x + 4)$
(b)	●[1] Subs (2 ,k) into CP	●[1] $k = 1$
(c)	**ans: $(x - 2)^2 + (y - 1)^2 = 18$ (3 marks)**	
	●[1] finds midpoint of CP	●[1] Q(–1, 4)
	●[2] finds radius (length of CQ)	●[2] $r^2 = 3^2 + 3^2 = 18$
	●[3] subs into general equation of circle	●[3] $(x - 2)^2 + (y - 1)^2 = 18$

	Give 1 mark for each •	Illustration(s) for awarding each mark
7(a)	**ans: proof** **(3 marks)**	
	•[1] gives expression for length and breadth	•[1] $(30-2x)$
	•[2] subs into formula and starts to simplify	•[2] $x(30-2x)^2$
	•[3] completes simplification to answer	•[3] $x(900-120x+4x^2)$
(b)	**ans:** $\boldsymbol{x}$ **= 5** **(5 marks)**	
	•[1] knows to make derivative = 0	•[1] $V\,'(x)=0$
	•[2] takes derivative	•[2] $12x^2-240x+900=0$
	•[3] factorises and solves	•[3] $12(x-5)(x-15)=0$
	•[4] discards	•[4] $x = 5$
	•[5] justifies answer	•[5] nature table or 2nd derivative
(c)	**ans: 2 litres** **(1 mark)**	
	•[1] calculates volume	•[1] $20 \times 20 \times 5 = 2000\text{cm}^3 = 2$ litres
8	**ans:** $\boldsymbol{\frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}}$ **radians** **(5 marks)**	
	•[1] factorises	•[1] (2sinx – 1)(sinx + 1) = 0
	•[2] begins to solve	•[2] 2sinx = 1 **and** sinx = -1
	•[3] solves sinx = $\frac{1}{2}$	•[3] x= $\frac{\pi}{6}$ radians
	•[4]	•[4] x= $\frac{5\pi}{6}$ radians
	•[5] solves sinx = -1	•[5] **x =** $\boldsymbol{\frac{3\pi}{2}}$ radians

	Give 1 mark for each •	Illustration(s) for awarding each mark
9(a)	**ans: proof** **(3 marks)**	
	•[1] states expression for both distances	•[1] $\frac{3}{k-x}$ and $\frac{4x}{k}$
	•[2] equates	•[2] $\frac{3}{k-x} = \frac{4x}{k}$
	•[3] rearranges to answer	•[3] $3k = 4x(k-x)$; $3k = 4xk - 4x^2$ ....
(b)	**ans: $k = 3$** **(3 marks)**	
	•[1] knows discriminant = 0 for equal roots	•[1] $b^2 - 4ac = 0$ for equal roots
	•[2] finds discriminant	•[2] $b^2 - 4ac = (-4k)^2 - 4.4.3k = 0; 16k^2 - 48k = 0$
	•[3] solves and discards	•[3] $16k(k-3) = 0$; $k = 3$
(c)	**ans: $x = \frac{3}{2}$** **(2 marks)**	
	•[1] subs value for k and rewrites expression	•[1] $4x^2 - 12x + 9 = 0$
	•[2] factorises and solves	•[2] $(2x-3)^2 = 0$; $x = \frac{3}{2}$
		Total: 59 marks