

Question Number	Scheme	Marks
4(i)(a)	ay^3	B1 (1)
(i)(b)	$\frac{5}{(3a^{1-x})^{-2}} = \frac{45}{\dots}$ $(\dots a^{1-x})^{-2} = a^{-2} \times a^{2x}$ $= \frac{45a^2}{y^2}$	B1 M1 A1 (3)
(ii)(a)	e.g. $3^{4t+2} = (3^{2t})^2 \times 9 = 9p^2$ (see notes) $\Rightarrow 27 \times p^2 + 3 = 82 \times p \Rightarrow 27p^2 - 82p + 3 = 0$ *	M1 A1* (2)
(ii)(b)	Solves the quadratic $\Rightarrow 3, \frac{1}{27}$ <hr/> $(3^t)^2 = 3$ or $9^t = 3 \Rightarrow t = \frac{1}{2}$ or $(3^t)^2 = \frac{1}{27} \Rightarrow 3^t = \frac{1}{3\sqrt{3}} \Rightarrow t = -\frac{3}{2}$ or $9^t = \frac{1}{27} \Rightarrow t = -\frac{3}{2}$ <hr style="border-top: 1px dashed black;"/> $(t =) \frac{1}{2}, -\frac{3}{2}$	B1 M1 A1 (3)
		(9 marks)

Question Number	Scheme	Marks
2(a)	Gradient = $\frac{8-5}{7\sqrt{3}-(-2\sqrt{3})}$ o.e. e.g. $\Rightarrow \frac{3}{9\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}}{9}$	M1 A1 (2)
(b)	$\frac{1}{9}\sqrt{3} \rightarrow -\frac{9}{\sqrt{3}}$ $y-5 = "-\frac{9}{\sqrt{3}}"(x+2\sqrt{3})$ $y = -3\sqrt{3}x - 13$	B1ft M1 A1 (3)
		(5 marks)

Question	Scheme	Marks
2(a)	$2x + 2y = 350$	B1
		(1)
(b)	E.g. $xy = 7350, x \times y = 7350$	B1
		(1)
(c)	$x(175 - x) = 7350$ or $(175 - y)y = 7350$	M1
	E.g. $x^2 - 175x + 7350 = 0 \Rightarrow (x - 70)(x - 105) = 0 \Rightarrow x = \dots$	dM1
	$x = 70$ or 105	A1
	$(x > y \Rightarrow) x = 105, y = 70$	A1
		(4)
		(6 marks)

(ii)	$-a + 6a + 8 + a^2 = 32 \Rightarrow a^2 + 5a - 24 = 0$ $(a + 8)(a - 3) = 0$ $a = 3 \text{ or } a = -8 \text{ and chooses } a = 3 \text{ with reason } *$	M1 dM1 A1* cso
		(3)
	$3x^3 + 26x^2 - 9x = 0 \Rightarrow x(3x^2 + 26x - 9) = 0$ $x(3x - 1)(x + 9)$ $(x =) 0, \frac{1}{3}, -9$	M1 A1
	(2)	
(b)(i)	$(y =) 0$ $y^{\frac{1}{3}} = \frac{1}{3} \text{ or } y^{\frac{1}{3}} = -9 \Rightarrow y = \dots \quad (\text{or } (-9)^3 = \dots \text{ or } \left(\frac{1}{3}\right)^3 = \dots)$ $(y =) \frac{1}{27}, -729$	B1 M1 A1
	(3)	
(b)(ii)	$9^z = \frac{1}{3} \rightarrow z = \dots$ $(z =) -\frac{1}{2} \text{ only}$	M1 A1
	(2)	
		(10 marks)

Question Number	Scheme	Marks
2(a)	$P(-3,7), Q(9,11)$ and $R(12,2)$	
Way 1	$\text{grad } PQ = \frac{11-7}{9-(-3)} = \frac{1}{3}, \text{ grad } QR = \frac{11-2}{9-12} = -3$	M1 A1
	$\frac{1}{3} \times -3 = -1$ so angle $PQR = 90^\circ$	A1
		(3)
Way 2	$PQ^2 = (9-(-3))^2 + (11-7)^2 = 160$ $QR^2 = (12-9)^2 + (2-11)^2 = 90$ $PR^2 = (12-(-3))^2 + (2-7)^2 = 250$	M1 A1
	$PQ^2 + QR^2 = PR^2$ (or e.g. $90 + 160 = 250$) so angle $PQR = 90^\circ$ or e.g. $\cos \theta = \frac{160+90-250}{2\sqrt{160}\sqrt{90}} = 0 \Rightarrow \theta = 90^\circ$	A1
		(3)
Way 3	$\vec{PQ} = \begin{pmatrix} 9-(-3) \\ 11-7 \end{pmatrix} = \begin{pmatrix} 12 \\ 4 \end{pmatrix}, \vec{QR} = \begin{pmatrix} 12-9 \\ 2-11 \end{pmatrix} = \begin{pmatrix} 3 \\ -9 \end{pmatrix}$	M1A1
	$\vec{PQ} \cdot \vec{QR} = \begin{pmatrix} 12 \\ 4 \end{pmatrix} \cdot \begin{pmatrix} 3 \\ -9 \end{pmatrix} = 36 - 36 = 0$ so angle $PQR = 90^\circ$	A1
		(3)

Part (b)

(b)	E.g. $(-3,7) + (3,-9) = \dots$ or $(12,2) - (12,4) = \dots$	M1
	$(0,-2)$	A1
		(2)
ALT 1	$\text{grad } PQ = \frac{11-7}{9-(-3)} = \frac{1}{3} \Rightarrow \text{eqn } RS \text{ is } y-2 = \frac{1}{3}(x-12)$ $\text{grad } QR = \frac{11-2}{9-12} = -3 \Rightarrow \text{eqn } PS \text{ is } y-7 = -3(x+3)$ $\Rightarrow x = \dots, y = \dots$	M1
	$(0,-2)$	A1
ALT 2	Midpoint PR is $\left(\frac{9}{2}, \frac{9}{2}\right) \Rightarrow \frac{9+x}{2} = \frac{9}{2}, \frac{11+y}{2} = \frac{9}{2} \Rightarrow x = \dots, y = \dots$	M1
	$(0,-2)$	A1
		(5 marks)

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(b)	$\frac{1}{3^{x-2}} = \frac{1}{3^x \times 3^{-2}} = \frac{9}{y}$	M1 A1 (2)
(c)	$\frac{81}{9^{2-3x}} = \frac{9^2}{9^{2-(2-3x)}} = 9^{3x} = 3^{6x} = y^6$	M1 A1 (2)
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