Question	Answer	Marks	Partial Marks
4(b)	$e^{4x} - 4e^{2x} + 3 = 0$ or $(e^{2x})^2 - 4e^{2x} + 3 = 0$ oe	**M1**	condone one error
	Factorises: $(e^{2x} - 1)(e^{2x} - 3)$ oe or solves $e^{4x} - 4e^{2x} + 3 = 0$ oe	**M1**	**FT** $a(e^{2x})^2 + be^{2x} + c[= 0]$
	$e^{2x} = 1, \quad e^{2x} = 3$	**A1**	
	$x = 0$, $x = \frac{1}{2}\ln 3$ or exact equivalent	**A1**	
5	$\frac{dV}{dr} = 4\pi r^2$ **oe and** $\left.\frac{dV}{dr}\right\|_{r=6} = 144\pi$	**B1**	
	$\frac{dr}{dt} = \frac{dV}{dt} \times \frac{dr}{dV}$ **soi**	**B1**	Not if chain rule for $\frac{dt}{dr}$ unless answer is inverted
	$\frac{24}{\text{their } 144\pi}$	**M1**	*their* 144π must come from an attempt at differentiation
	0.0531 or 0.05305[16….] rot to 4 or more sig figs	**A1**	
6(a)	$3\begin{pmatrix} x-8 \\ y-5 \end{pmatrix} = 2\begin{pmatrix} x-4 \\ y-7 \end{pmatrix}$ oe OR $\overrightarrow{QR} = \begin{pmatrix} x-8 \\ y-5 \end{pmatrix}$ and $\overrightarrow{PR} = \begin{pmatrix} x-4 \\ y-7 \end{pmatrix}$ and $3x - 24 = 2x - 8$ and $3y - 15 = 2y - 14$	**M1**	
	$x = 16$	**A1**	**dep** on vector method
	$y = 1$	**A1**	**dep** on vector method

Question	Answer	Marks	Partial Marks
6(b)(i)	$\mathbf{a} = -2.5\mathbf{i} - \frac{5\sqrt{3}}{2}\mathbf{j}$ isw	**B1**	
	$\mathbf{c} = -5\mathbf{i} + 5\sqrt{3}\,\mathbf{j}$ isw	**B1**	
6(b)(ii)	$\mathbf{b} = (-5 + 2.5)\mathbf{i} + \left(5\sqrt{3} + 2.5\sqrt{3}\right)\mathbf{j}$ oe soi	**B1**	
	$r = \sqrt{(-2.5)^2 + \left(7.5\sqrt{3}\right)^2}$	**M1**	**FT** *their* **b** of the form $x\mathbf{i} + y\mathbf{j}$ providing neither component is zero
	$[r =]$ 13.2 or 13.22875… rot to 4 or more sf	**A1**	**dep** on **B1**
	$\tan\alpha = \left(\frac{7.5\sqrt{3}}{2.5}\right)$ oe or awrt 79.1 or $\tan\beta = \left(\frac{2.5}{7.5\sqrt{3}}\right)$ oe or awrt 10.9	**M1**	**FT** *their* **b** of the form $x\mathbf{i} + y\mathbf{j}$
	349[.106…] rot to 3 or more sf	**A1**	**dep** on **B1**
	Alternative method		
	$[r^2 =] 10^2 + 5^2 - 2\times10\times5\times\cos120°$	**(M1)**	
	$[r =]$ 13.2 or 13.22875… rot to 4 or more sf	**(A1)**	
	$\frac{\sin\theta}{10} = \frac{\sin their 120}{their 5\sqrt{7}}$ or $\frac{\sin\phi}{5} = \frac{\sin their 120}{their 5\sqrt{7}}$	**(M1)**	**FT** consistent use of *their* 120 and *their r*
	$[\theta =]$ awrt 40.9 or $[\phi =]$ awrt 19.1	**(A1)**	
	349[.106…] rot to 3 or more sf	**(A1)**	

Question	Answer	Marks	Partial Marks
7(a)	$\left[\frac{6x^2}{2}-\frac{x^3}{3}\right]_0^5$	**B1**	
	Area under line: $0.5\times5\times5$ oe	**B1**	
	Fully actioned correct plan: $3(25)-\frac{5^3}{3}-\left(3(0)-\frac{0^3}{3}\right)-0.5\times5\times5$ oe	**M1**	
	$\frac{125}{6}$ oe isw	**A1**	**dep** on all previous marks
	Alternative method		
	$\int_0^5(5x-x^2)\mathrm{d}x$	**(B1)**	
	$\left[\frac{5x^2}{2}-\frac{x^3}{3}\right]_0^5$	**(B1)**	
	Correct use of correct limits $2.5(25)-\frac{5^3}{3}-\left(2.5(0)-\frac{0^3}{3}\right)$	**(M1)**	
	$\frac{125}{6}$ oe isw	**(A1)**	**dep** on all previous marks
7(b)(i)	$\frac{(2x-6)^{-2}}{-2\times2}+\sin x\ (+c)$ oe, isw	**3**	**B1** for sin$x$ **B2** for $\frac{(2x-6)^{-2}}{-2\times2}$ or **B1** for $\frac{(2x-6)^{-2}}{-2}$ soi
7(b)(ii)	$\frac{x^7}{2}+x^3+\frac{1}{2x}$ oe	**B1**	
	$\frac{x^8}{16}+\frac{x^4}{4}+\frac{1}{2}\ln x\,(+c)$ oe or $\frac{x^8}{16}+\frac{x^4}{4}+\frac{1}{2}\ln 2x\,(+c)$ oe	**B2**	**B1** for any two correct