Question	Answer	Marks	Guidance
1	$y = \pm 3(x+2)(x+1)(x-4)$	**3**	**B1** for 3 **B1** for $(x+2)(x+1)(x-4)$ **B1** for $\pm$
2(a)	4	**B1**	
2(b)	1080° or 6π	**B1**	
2(c)		**3**	**B1** for shape, it must be symmetrical about the *y*-axis. **B1**for *y*-intercept of 5 **B1** for $(\pm 180^{\circ}, 3)$
3(a)	$a = \frac{3}{2}$ or $p^{\frac{3}{2}}$	**B1**	
	$b = \frac{10}{3}$ or $q^{\frac{10}{3}}$	**B1**	
	$c = -\frac{7}{3}$ or $r^{-\frac{7}{3}}$	**B1**	
3(b)	$\left(3x^{\frac{1}{3}} - 1\right)\left(2x^{\frac{1}{3}} - 1\right) = 0$	**M1**	For recognising as a quadratic in $x^{\frac{1}{3}}$ and attempt to solve to obtain $x^{\frac{1}{3}} = k$
	$x^{\frac{1}{3}} = \frac{1}{3}$, $x^{\frac{1}{3}} = \frac{1}{2}$ leading to $x = \frac{1}{27}$ or 0.0370 $x = \frac{1}{8}$ or 0.125	**2**	**Dep M1** for a valid method of solving $x^{\frac{1}{3}} = k$ where $k > 0$ **A1** for both
4(a)	$\frac{dy}{dx} = \frac{\sin x \times 3\sec^2 3x - \tan 3x \cos x}{\sin^2 x}$	**3**	**B1** for $3\sec^2 3x$ **M1** for differentiation of a quotient or equivalent product **A1** for all other terms apart from $3\sec^2 3x$ correct
	When $x = \frac{\pi}{3}$ $\frac{dy}{dx} = 2\sqrt{3}$	**A1**	
4(b)	$2\sqrt{3}h$	**B1**	**FT** on *their* answer to **(a)**

Question	Answer	Marks	Guidance
4(c)	$\frac{dy}{dx}\times\frac{dx}{dt}=\frac{dy}{dt}$ $2\sqrt{3}\times 3=\frac{dy}{dt}$	**M1**	For correct use of rates of change using *their* answer to **(a)**
	$\frac{dy}{dt}=6\sqrt{3}$	**A1**	
5(a)(i)	360	**B1**	
5(a)(ii)	Starts with 6: $1\times4\times3\times1\ \ =12$	**B1**	
	Starts with 7 or 9 : $=2\times4\times3\times2$ $=48$	**B1**	
	Total = 60	**B1**	
	Alternative		
	Ending in 4: $\frac{1}{6}\times360\times\frac{3}{5}=36$	**(B1)**	Allow unsimplified
	Ending in 6: $\frac{1}{6}\times360\times\frac{2}{5}=24$	**(B1)**	Allow unsimplified
	Total = 60	**(B1)**	
5(b)(i)	1287	**B1**	
5(b)(ii)	$1287-{}^{7}C_{5}$ or 1 doctor: 210 2 doctors: 525 3 doctors: 420 4 doctors: 105 5 doctors: 1	**M1**	For *their* **(b)(i)** $-{}^{7}C_{5}$ or listing all the other separate cases which must be evaluated, allow 1 error
	1266	**A1**	
5(b)(iii)	45	**B1**	
6(a)	Velocity vector = $\begin{pmatrix}-8\\6\end{pmatrix}$	**2**	**M1** for obtaining 5
	$\begin{pmatrix}30\\10\end{pmatrix}+\begin{pmatrix}-8\\6\end{pmatrix}t$	**B1**	**FT** for $\begin{pmatrix}30\\10\end{pmatrix}+(\textit{their}\text{ velocity vector})t$
6(b)	13	**B1**	