Question			Answer	Marks	AO	Guidance	
12	(a)		Use $\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{\mathrm{d}y}{\mathrm{d}\theta}\div\frac{\mathrm{d}\theta}{\mathrm{d}x}$	M1	1.1a		
			Obtain $\frac{-3\cos\theta}{2\sin\theta}$	A1 [2]	1.1		
12	(b)		$(y-3\sin\theta)=\frac{-3\cos\theta}{2\sin\theta}(x-2\cos\theta)$	M1	3.1a	Attempt equation of straight line in any unsimplified form Accept *x*, *y* confusion	**OR** **M1** When $\theta=\theta_Q$, gradient of curve is given by $\frac{-3\cos\theta_Q}{2\sin\theta_Q}$
			$2y\sin\theta-6\sin^2\theta=-3x\cos\theta+6\cos^2\theta$	M1	1.1	Simplify their equation and use $\cos^2\theta+\sin^2\theta=1$	**M1** The gradient of the line through $(2,6)$ and $(2\cos\theta_Q, 3\sin\theta_Q)$ is $\frac{3\sin\theta_Q-6}{2\cos\theta_Q-2}$
			$2y\sin\theta+3x\cos\theta=6$	A1FT	1.1		**M1** Equate and clear fractions
			$12\sin\theta+6\cos\theta=6\Rightarrow 2\sin\theta+\cos\theta=1$	E1 [4]	2.1	Substitute (2, 6) and simplify to AG	**E1** Obtain AG
12	(c)		Use $R\sin(\theta+\alpha)$ on $2\sin\theta+\cos\theta$ $R\sin\alpha=1,\ R\cos\alpha=2$	M1	3.1a	Should go as far as finding R and α Allow alternative forms	**OR** **M1** Square and use $\sin^2\theta+\cos^2\theta=1$
			Obtain $\alpha=0.4636$ and $R=\sqrt{5}$	A1	1.1		**A1** $4\sin^2\theta+4\sin\theta(1-2\sin\theta)+(1-\sin^2\theta)=1$
			Use correct order of operations to solve $\sqrt{5}\sin(\theta+0.4636)=1$	M1	1.1	Attempt to solve their $R\sin(\theta+\alpha)$	**M1** Simplify and solve $5\sin^2\theta-4\sin\theta=0$
			Obtain 0	B1	2.2a		
			Obtain 2.21	A1 [5]	1.1	Or better (2.214345...)	