3	**(a)**	**(i)**	$(x-3)^2+(y+4)^2=4\cos^2\theta+4\sin^2\theta$ $\Rightarrow (x-3)^2+(y+4)^2=4$ oe ISW	**M1** **A1** **[2]**	**3.1a** **2.1**	or $\left(\frac{x-3}{2}\right)^2+\left(\frac{y+4}{2}\right)^2=\cos^2\theta+\sin^2\theta$ or $\left(\frac{x-3}{2}\right)^2+\left(\frac{y+4}{2}\right)^2=1$ oe or $\cos^{-1}\left(\frac{x-3}{2}\right)=\sin^{-1}\left(\frac{y+4}{2}\right)$ M1A1 **ISW for all answers**	Condone sign errors or one arith slip or missing brackets for M1 or $y=-4+2\sqrt{1-(\frac{x-3}{2})^2}$ M1A1 or similar with $x=$ or $y=-4+2\sin(\cos^{-1}\frac{x-3}{2})$ M1A1 or similar with $x=$
3	**(a)**	**(ii)**	Centre (3, –4), radius 2	**B1f** **[1]**	**2.2a**	ft their (i) if both consistent with (i) But if absolutely correct, not ft: B1.	
3	**(b)**		**DR** **NB Allow decimals to 2 sf instead of surds thoughout, except answer to 3 sf** $\frac{dy}{dx}=\frac{dy}{dt}\div\frac{dx}{dt}$ $=-\frac{1}{2}\cot t$ or $-\frac{1}{2}\frac{\cos t}{\sin t}$ $t=\frac{\pi}{6}$: $\frac{dy}{dx}=-\frac{1}{2}\cot\frac{\pi}{6}$ oe or $-\frac{\sqrt{3}}{2}$ oe **Alternative methods for gradient** $\left(\frac{x}{4}\right)^2+\left(\frac{y}{2}\right)^2=1,\quad \frac{x}{8}+\frac{y}{2}\frac{dy}{dx}=0$ M1 $\frac{dy}{dx}=-\frac{x}{4y}$ A1 $t=\frac{\pi}{6}$: $\frac{dy}{dx}=-\frac{4\cos(\frac{\pi}{6})}{8\sin(\frac{\pi}{6})}$ or $-\frac{1}{2}\cot\frac{\pi}{6}$ or $-\frac{\sqrt{3}}{2}$ M1	**M1** **A1** **M1**	**3.1a** **1.1** **1.1**	Attempt diff x & y wrt t & find $\frac{dy}{dt}\div\frac{dx}{dt}$ soi Substitute $t=\frac{\pi}{6}$ in their $\frac{dy}{dx}$ Attempt cartesian equn & differentiation soi Substitute $t=\frac{\pi}{6}$ in x (and y) & their $\frac{dy}{dx}$	Allow sign error $\frac{d}{dx}(0.5(16-x^2)^{-0.5})$ or $\frac{dy}{dx}=\frac{1}{4}(16-x^2)^{-0.5}(-2x)$ oe

			Equn of L is $y - 2\sin\frac{\pi}{6} = -\frac{\sqrt{3}}{2}(x - 4\cos\frac{\pi}{6})$ oe	**M1**	**1.1**	or $y = -\frac{\sqrt{3}}{2}x + c$ **&** subst $(4\cos\frac{\pi}{6}, 2\sin\frac{\pi}{6})$	ft their grad (not -ve reciprocal) Must not involve t
			or $y - 1 = -\frac{\sqrt{3}}{2}(x - 2\sqrt{3})$ oe			or $y = -\frac{\sqrt{3}}{2}x + 4$ oe	This mark may be implied by next mark
			$0 - 1 = -\frac{\sqrt{3}}{2}x + 3$ oe	**M1**	**1.1**	or $0 = -\frac{\sqrt{3}}{2}x + 4$ oe	Subst $y = 0$ in their line equn, not involving t
			Cuts at $(\frac{8\sqrt{3}}{3}, 0)$ oe or (4.62, 0) (3 sf)	**A1**	**2.2a**	Allow just $\frac{8\sqrt{3}}{3}$ or 4.62 (3 sf)	Allow equivalents, eg $\frac{8}{\sqrt{3}}$
				[6]			