Question Number	Scheme	Notes	Marks
1(a)	$x=2\sec\theta,\ y=\sqrt{3}\tan\theta$ $\Rightarrow \dfrac{dy}{dx}=\dfrac{\sqrt{3}\sec^2\theta}{2\sec\theta\tan\theta}$	$\dfrac{x^2}{4}-\dfrac{y^2}{3}=1$ $\Rightarrow \dfrac{2x}{4}-\dfrac{2y}{3}\dfrac{dy}{dx}=0$	$y=\left(\dfrac{3x^2}{4}-3\right)^{\frac{1}{2}}$ $\dfrac{dy}{dx}=\dfrac{1}{2}\left(\dfrac{3x^2}{4}-3\right)^{-\frac{1}{2}}\left(\dfrac{6x}{4}\right)$	**B1**
	Any correct equation in $\dfrac{dy}{dx}$ or $\dfrac{dx}{dy}$ and award when first seen		
	$=\dfrac{\sqrt{3}\sec\theta}{2\tan\theta}$	$\Rightarrow \dfrac{dy}{dx}=\dfrac{3x}{4y}=\dfrac{\sqrt{3}\sec\theta}{2\tan\theta}$	$\dfrac{dy}{dx}=\dfrac{1}{2}\left(\dfrac{12\sec^2\theta}{4}-3\right)^{-\frac{1}{2}}(3\sec\theta)$ $=\dfrac{3\sec\theta}{2\sqrt{3\sec^2\theta-3}}=\dfrac{\sqrt{3}\sec\theta}{2\tan\theta}$	
	$\Rightarrow m_N=-\dfrac{2\tan\theta}{\sqrt{3}\sec\theta}$ oe e.g. $\Rightarrow m_N=-\dfrac{2\sqrt{3}}{3}\sin\theta$	Correct perpendicular gradient rule to obtain gradient of the normal in terms of θ Sight of this normal gradient scores B1M1 if it is clearly identified/used as m_N	**M1**
	$y-\sqrt{3}\tan\theta=-\dfrac{2\tan\theta}{\sqrt{3}\sec\theta}(x-2\sec\theta)$ or $\sqrt{3}\tan\theta=-\dfrac{2\tan\theta}{\sqrt{3}\sec\theta}2\sec\theta+c\Rightarrow c=\dfrac{7\sqrt{3}}{3}\tan\theta$	Correct straight-line method with their changed gradient in terms of θ	**M1**
	$\sqrt{3}y\sec\theta-3\tan\theta\sec\theta=-2x\tan\theta+4\tan\theta\sec\theta\Rightarrow 2x\tan\theta+\sqrt{3}y\sec\theta=7\tan\theta\sec\theta$ or $y=-\dfrac{2\tan\theta}{\sqrt{3}\sec\theta}x+\dfrac{7\sqrt{3}}{3}\tan\theta\Rightarrow 2x\tan\theta+\sqrt{3}y\sec\theta=7\tan\theta\sec\theta$ Obtains correct equation with $k=7$ with at least one line of intermediate working.		**A1**
			(4)
(b)	$2\sec\theta=4,\ \sqrt{3}\tan\theta=3$ $\Rightarrow\cos\theta=\dfrac{1}{2},\ \tan\theta=\sqrt{3}\Rightarrow\theta=\dfrac{\pi}{3}$	Correct value for θ Allow 60° **OR** States or uses $\sec\theta=2,\ \tan\theta=\sqrt{3}$	**B1**
	$2\sqrt{3}x+2\sqrt{3}y=14\sqrt{3}\ \{\Rightarrow y=7-x\}$	Substitutes their value for θ into their normal of the correct form **OR** Substitutes $\sec\theta=2,\ \tan\theta=\sqrt{3}$ into their normal of the correct form (scores B1M1)	**M1**
ALT for B1M1	$\dfrac{dy}{dx}=\dfrac{3x}{4y}=\dfrac{3\times4}{4\times3}=1\Rightarrow m_N=-1$	Correct <u>value</u> for the gradient of the normal	**B1**
	$y-3=-(x-4)\ \{\Rightarrow y=7-x\}$	Uses a correct line equation method to find the equation of the normal Sight of this equation scores B1M1	**M1**

	$\frac{x^2}{4}-\frac{(7-x)^2}{3}=1\Rightarrow 3x^2-4(49-14x+x^2)=12$ $\Rightarrow x^2-56x+208=0$ $(x-52)(x-4)=0\Rightarrow x=52$	Substitutes their normal equation into H and solves 3TQ (usual rules - no incorrect root if no working). Eliminating x leads to $y^2+42y-135=(y+45)(y-3)=0$	**M1**
	$(52,\ -45)$	Correct coordinates or values for x and y	**A1**
			(4)
			Total 8