Question Number	Scheme	Notes	Marks
	$\frac{x^2}{16}+\frac{y^2}{9}=1 \qquad P\left(4\cos\theta,\ 3\sin\theta\right)$		
6(a)	$\frac{\mathrm{d}y}{\mathrm{d}x}=-\frac{3\cos\theta}{4\sin\theta}$ or $\frac{2x}{16}+\frac{2y}{9}\frac{\mathrm{d}y}{\mathrm{d}x}=0\Rightarrow\frac{\mathrm{d}y}{\mathrm{d}x}=-\frac{18x}{32y}$ or $\frac{x^2}{16}+\frac{y^2}{9}=1\Rightarrow y=3\left(1-\frac{x^2}{16}\right)^{\frac{1}{2}}\Rightarrow\frac{\mathrm{d}y}{\mathrm{d}x}=\frac{3}{2}\left(1-\frac{x^2}{16}\right)^{-\frac{1}{2}}\times-\frac{2x}{16}$	Uses a correct method and finds an expression for $\frac{\mathrm{d}y}{\mathrm{d}x}$ of the correct form (sign and coefficient slips only)	M1
	$\frac{\mathrm{d}y}{\mathrm{d}x}=-\frac{3\cos\theta}{4\sin\theta}$ oe e.g. $-\frac{3}{4}\cot\theta$ oe	Any correct derivative in terms of θ only.	A1
	$y-3\sin\theta=-\frac{3\cos\theta}{4\sin\theta}\left(x-4\cos\theta\right)$ or or $y=-\frac{3\cos\theta}{4\sin\theta}x+c\Rightarrow 3\sin\theta=-\frac{3\cos\theta}{4\sin\theta}4\cos\theta+c$ $\Rightarrow c=\ldots\ \left\{\frac{12\sin^2\theta+12\cos^2\theta}{4\sin\theta}\right\}$	Applies correct straight line method using any gradient in terms of θ. If they use $y=mx+c$ they must substitute coordinates correctly and reach $c=\ldots$ M0 if use normal gradient	M1
	$\Rightarrow 4y\sin\theta-12\sin^2\theta=-3x\cos\theta+12\cos^2\theta$ or using $y=mx+c: y=-\frac{3\cos\theta}{4\sin\theta}x+\frac{3}{\sin\theta}\Rightarrow 4y\sin\theta=-3x\cos\theta+12$ $\Rightarrow 3x\cos\theta+4y\sin\theta\left\{=12(\cos^2\theta+\sin^2\theta)\right\}=12$ M1: Multiplies through to remove fraction to obtain an equation with trig expressions in sin and cos only. Allow this mark if they go straight to the given answer from a correct equation. Can score from use of a normal gradient and/or with coordinates wrongly placed but there must have been an attempt at a line. A1*: Correct equation from correct work. $\sin^2\theta$ and $\cos^2\theta$ must be seen somewhere in the working. Accept e.g., $\sin^2\theta+\cos^2\theta=1$ seen in side-working		M1 A1*
			(5)
(b)	$y-3\sin\theta=\frac{4\sin\theta}{3\cos\theta}\left(x-4\cos\theta\right)$ oe e.g., $4x\sin\theta-3y\cos\theta=7\sin\theta\cos\theta$ or $y=\frac{4\sin\theta}{3\cos\theta}x+c$ $\Rightarrow 3\sin\theta=\frac{4\sin\theta}{3\cos\theta}4\cos\theta+c\Rightarrow c=\ldots\ \left\{\frac{-7\sin\theta\cos\theta}{3\cos\theta}\right\}$	M1: Applies correct straight line method with the negative reciprocal of their tangent gradient. If $y=mx+c$ is used coordinates must be substituted correctly and $c=\ldots$ reached A1: Any correct equation	M1 A1
			(2)

Question Number	Scheme	Notes	Marks
6(c)	A is $\left(\dfrac{4}{\cos\theta}, 0\right)$	Any correct x-axis intercept of the tangent. Allow e.g., $\{x=\}\dfrac{12}{3\cos\theta}$, $4\sec\theta$ Could be on a diagram or implied by midpoint	B1
	$x=0 \Rightarrow y-3\sin\theta=-\dfrac{16}{3}\sin\theta \Rightarrow B$ is $\left(0, -\dfrac{7}{3}\sin\theta\right)$	Sets $x = 0$ in their **normal** equation (changed gradient) and finds y. Could be implied. Allow just $-\dfrac{7}{3}\sin\theta$ oe	M1
	So midpoint M of AB is $\left(\dfrac{2}{\cos\theta}, -\dfrac{7}{6}\sin\theta\right)$	Any correct midpoint. Accept any equivalents and as $x=\ldots,\ y=\ldots$	A1
	$\sin^2\theta+\cos^2\theta=1 \Rightarrow \left(-\dfrac{6}{7}y\right)^2+\left(\dfrac{2}{x}\right)^2=1$	Uses $\sin^2\theta+\cos^2\theta=1$ to obtain an equation in x and y only. May follow incorrect or no attempt at midpoint	M1
	$\Rightarrow \dfrac{36}{49}y^2+\dfrac{4}{x^2}=1 \Rightarrow 36x^2y^2+49\times4=49x^2$ $\Rightarrow x^2\left(49-36y^2\right)=196$	**d**M1: Rearranges to the form $x^2\left(p\pm qy^2\right)=r,\quad p,\ q,\ r\in\mathbb{Z}$ **Requires all previous M mark**s. A1: Correct equation	**d**M1 A1
			(6)
	Note that is possible to use e.g., $1+\tan^2\theta=\sec^2\theta$, for example: $M\left(2\sec\theta, \dfrac{-7\tan\theta}{6\sec\theta}\right) \Rightarrow \sec\theta=\dfrac{x}{2},\ y=\dfrac{-7\tan\theta}{3x} \Rightarrow \tan\theta=\dfrac{-3xy}{7} \Rightarrow 1+\dfrac{9x^2y^2}{49}=\dfrac{x^2}{4}$ (2nd M1) $\Rightarrow 1+\dfrac{9x^2y^2}{49}=\dfrac{x^2}{4} \Rightarrow 196+36x^2y^2=49x^2 \Rightarrow x^2\left(49-36y^2\right)=196$ (3rd M1, A1)		**Total 13**