

9(a)

$$\frac{dy}{dx} = \frac{\frac{dy}{d\theta}}{\frac{dx}{d\theta}}$$

M1

At least one of,

M1

$$\frac{dy}{d\theta} = 4 \cos \theta \text{ or } \frac{dx}{d\theta} = -2 \sin \theta$$

$$\frac{dy}{dx} = \frac{4 \cos \theta}{-2 \sin \theta} = -\frac{2}{\tan \theta}$$

M1

Begins process to find equation,

M1

$$\text{e.g. } y - 4 \sin \alpha = -\frac{2}{\tan \alpha} (x - 2 \cos \alpha)$$

Begins process to rearrange to desired form,

M1

$$y \sin \alpha - 4 \sin^2 \alpha = -2x \cos \alpha + 4 \cos^2 \alpha$$

Full process resulting in desired form,

B1

$$\text{e.g. } y \sin \alpha + 2x \cos \alpha = 4(\sin^2 \alpha + \cos^2 \alpha)$$

$$y \sin \alpha + 2x \cos \alpha = 4$$

[6]

9(b)

$$A = \left(0, \frac{4}{\sin \alpha}\right) \text{ and } B = \left(\frac{2}{\cos \alpha}, 0\right)$$

$$\text{Area of triangle } OAB = \frac{1}{2} \times \frac{4}{\sin \alpha} \times \frac{2}{\cos \alpha} = \frac{8}{\sin 2\alpha}$$

$$\frac{8}{\sin 2\alpha} < 16$$

As α is acute, $\sin 2\alpha > 0$

$$\frac{1}{2} < \sin 2\alpha$$

$$2\alpha = \frac{\pi}{6}$$

$$2\alpha = \frac{5\pi}{6}$$

$$\alpha = \frac{\pi}{12}$$

$$\alpha = \frac{5\pi}{12}$$

$$\frac{\pi}{12} < \alpha < \frac{5\pi}{12}$$

M1
Or vice versa

M1

M1

M1

B1 Must have
both for mark

B1 Must have
both for mark

B1

[7]

[13 marks]