Question	Scheme	Marks	AOs
5(a)	$\frac{dy}{dx}=\frac{-\lambda}{\sqrt{1-\beta x^2}}$ where $\lambda>0$ and $\beta>0$ and $\beta\neq 1$ Alternatively $2\cos y=x\Rightarrow\frac{dx}{dy}=\alpha\sin y\Rightarrow\frac{dy}{dx}=\frac{1}{\alpha\sin y}$	M1	1.1b
	$\frac{dy}{dx}=\frac{-\frac{1}{2}}{\sqrt{1-\frac{1}{4}x^2}}$ or $\frac{dy}{dx}=\frac{-1}{2\sqrt{1-\frac{1}{4}x^2}}$ o.e. or $\frac{dy}{dx}=-\frac{1}{2\sin y}$ or	A1	1.1b
	States that $\frac{dy}{dx}\neq 0$ therefore C has no stationary points. Tries to solve $\frac{dy}{dx}=0$ and ends up with a contradiction e.g. -1 = 0 therefore C has no stationary points. As cosec y > 1 therefore C has no stationary points.	A1	2.4
		(3)	
(b)	$\frac{dy}{dx}=\frac{-1}{2\sqrt{1-\frac{1}{4}\times 1^2}}=\left\{-\frac{1}{\sqrt{3}}\right\}$	M1	1.1b
	Normal gradient = $-\frac{1}{m}$ and $y-\frac{\pi}{3}=m_n(x-1)$ Alternatively $\frac{\pi}{3}=m_n(1)+c\Rightarrow c=...\left\{\frac{\pi}{3}-\sqrt{3}\right\}$ and then $y=m_nx+c$	M1	1.1b
	$y=0\Rightarrow 0-\frac{\pi}{3}=\sqrt{3}(x_A-1)\Rightarrow x_A=...\left\{1-\frac{\pi}{3\sqrt{3}} \text{ or } 1-\frac{\pi\sqrt{3}}{9}\right\}$ and $x=0\Rightarrow y_B-\frac{\pi}{3}=\sqrt{3}(0-1)\Rightarrow y_B=...\left\{\frac{\pi}{3}-\sqrt{3}\right\}$	M1	3.1a
	Area $=\frac{1}{2}\times x_A\times -y_B=\frac{1}{2}\left(1-\frac{\pi}{3\sqrt{3}}\right)\left(\sqrt{3}-\frac{\pi}{3}\right)$	M1	1.1b
	Area $\frac{1}{54}\left(27\sqrt{3}-18\pi+\sqrt{3}\pi^2\right)$ $(p=27, q=-18, r=1)$	A1	2.1
		(5)	
			(8 marks)

Notes:

(a)

M1: Finds the correct form for $\frac{dy}{dx}$

A1: Correct $\frac{dy}{dx}$

A1: States or shows that $\frac{dy}{dx} \neq 0$ and draws the required conclusion. This mark can be scored as long as the M mark has been awarded.

(b)

M1: Substitutes $x = 1$ into their $\frac{dy}{dx}$

M1: Finds the normal gradient and finds the equation of the normal using $y - \frac{\pi}{3} = m_n(x-1)$

M1: Finds where their normal cuts the x-axis and the y-axis.

M1: Finds the area of the triangle $OAB = \frac{1}{2} \times x_A \times -y_B$.

A1: Correct area

Special case: If finds the tangent to the curve, the x and y intercepts and the area of the triangle max score M1 M0 M1 M0 A0

Note common error

$\frac{dy}{dx} = \frac{-1}{\sqrt{1-\frac{1}{4}x^2}}$ In part (b) this leads to $\frac{dy}{dx} = \frac{-2}{\sqrt{3}}$ leading to normal gradient $\frac{\sqrt{3}}{2}$ and

$y = \frac{\sqrt{3}}{2}x - \frac{\sqrt{3}}{2} + \frac{\pi}{3}$ and $\left(0, \frac{\pi}{3} - \frac{\sqrt{3}}{2}\right)$ and $\left(1 - \frac{2\pi}{3\sqrt{3}}, 0\right)$ therefore area $= \frac{1}{2}\left(\frac{\pi}{3} - \frac{\sqrt{3}}{2}\right)\left(\frac{2\pi}{3\sqrt{3}} - 1\right)$

This can score M1 M1 M1 M1 A0