Question	Scheme	Marks	AOs
14(a)	$x=\dfrac{\pi\sqrt{3}}{12}$ **or** $y=\dfrac{2}{3}$	B1	1.1b
	$x=\dfrac{\pi\sqrt{3}}{12}$ **and** $y=\dfrac{2}{3}$	B1	1.1b
		(2)	
(b)	$\dfrac{dx}{d\theta}=\dfrac{1}{2}\sin\theta+\dfrac{1}{2}\theta\cos\theta$	M1	1.1b
	Area under C = $\displaystyle\int y\frac{dx}{d\theta}d\theta=\int\frac{1}{3}\sec\theta\left(\frac{1}{2}\sin\theta+\frac{1}{2}\theta\cos\theta\right)d\theta$	M1 A1	2.1 1.1b
	Area required is $\dfrac{\pi\sqrt{3}}{12}\times\dfrac{2}{3}-\dfrac{1}{6}\displaystyle\int(\tan\theta+\theta)d\theta$	ddM1	3.1a
	$=\dfrac{1}{18}\pi\sqrt{3}-\dfrac{1}{6}\displaystyle\int_0^{\frac{\pi}{3}}(\tan\theta+\theta)d\theta$	A1	2.1
		(5)	
(c)	$\displaystyle\int(\tan\theta+\theta)d\theta=\ln(\sec\theta)+\frac{\theta^2}{2}(+c)$	B1	2.2a
	Area $=\dfrac{1}{18}\pi\sqrt{3}-\dfrac{1}{6}\left[\ln(\sec\theta)+\dfrac{\theta^2}{2}\right]_0^{\frac{\pi}{3}}$ $=\dfrac{1}{18}\pi\sqrt{3}-\dfrac{1}{6}\left(\ln\left(\sec\dfrac{\pi}{3}\right)+\dfrac{\pi^2}{18}-(0)\right)$	M1	2.1
	$=\dfrac{1}{18}\pi\sqrt{3}-\dfrac{1}{6}\ln 2-\dfrac{\pi^2}{108}$	A1	1.1b
		(3)	
		(10 marks)	

Notes

(a)

B1: One correct coordinate

B1: Both correct coordinates

(b)

M1: Applies the product rule to the x parameter to obtain $\dfrac{dx}{d\theta}=\alpha\sin\theta+\beta\theta\cos\theta$

M1: Applies $\displaystyle\int y\frac{dx}{d\theta}d\theta$ for the area under the curve

A1: Correct integral

ddM1: Fully correct strategy for the area of R.

A1: Fully correct expression in the form required

(c)

B1: Deduces the correct expression for $\displaystyle\int(\tan\theta+\theta)d\theta$

M1: Completes the problem by applying the correct limits

A1: Correct expression