

Question	Scheme	Marks	AOs
1	$\text{Area} = \frac{1}{2} \int_0^{\pi} r^2 d\theta = \frac{1}{2} \int_0^{\pi} 4(\sinh \theta + \cosh \theta) d\theta$	B1	1.1b
	$= 2 \left[ \cosh \theta + \sinh \theta \right]_0^{\pi}$	M1	1.1b
	$= 2(\cosh \pi + \sinh \pi - \cosh 0 - \sinh 0)$ $= 2 \left( \frac{e^{\pi} + e^{-\pi}}{2} + \frac{e^{\pi} - e^{-\pi}}{2} - 1 - 0 \right)$	M1	3.1a
	$= 2e^{\pi} - 2$	A1	2.1
		(4)	
	<b>(4 marks)</b>		

**Notes:**

**B1:** Correct area formula applied, including the  $\frac{1}{2}$

**M1:** Attempts the integration, cosh to sinh and vice versa, or in terms of exponentials.

**M1:** Applies the limits to the integral and uses exponential definitions to achieve answer in suitable form.

**A1:** Correct answer.