

Name: _____

QUIZ 2

Find the area enclosed by one leaf of the rose $r = 6 \cos(3\theta)$.

See the [online figure](#) for a detailed look at the rose's plot. $r > 0$ when $\pi/2 < \theta < 5\pi/6$, and $r = 0$ when $\theta = \pi/2$ or $5\pi/6$, so one leaf is between these values. The area is

$$\begin{aligned} \int_{\pi/2}^{5\pi/6} \int_0^{6 \cos(3\theta)} r dr d\theta &= 18 \int_{\pi/2}^{5\pi/6} \cos^2(3\theta) d\theta = 6 \int_{3\pi/2}^{5\pi/2} \cos^2 u du \\ &= 3 \int_{3\pi/2}^{5\pi/2} (1 + \cos(2u)) du = 3 \left[u + \frac{1}{2} \sin(2u) \right]_{3\pi/2}^{5\pi/2} = 3\pi. \end{aligned}$$