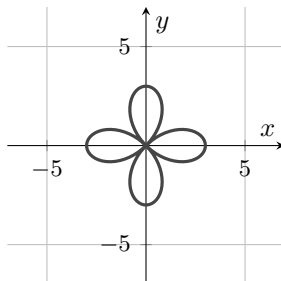
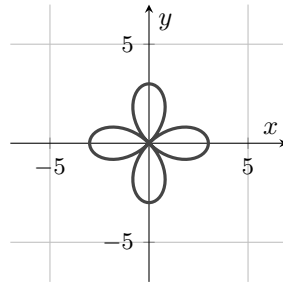


Question 2**Problem**

Find the length of one petal of $r = 3 \cos 2\theta$.



Question 2 – Solution

**Solution**

1. Differentiate the polar radius to obtain $r' = dr/d\theta$ and choose an interval that traces the requested arc exactly once.
2. Use the polar arc-length formula

$$L = \int_a^b \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2} d\theta.$$

Simplify the expression under the square root before evaluating or reporting the integral.

3. On $[-\pi/4, \pi/4]$, speed is $3\sqrt{\cos^2 2\theta + 4\sin^2 2\theta}$.

4. Thus $L = 3 \int_{-\pi/4}^{\pi/4} \sqrt{1 + 3\sin^2 2\theta} d\theta$; it is an elliptic integral.