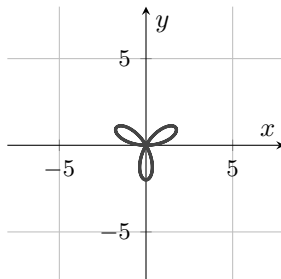
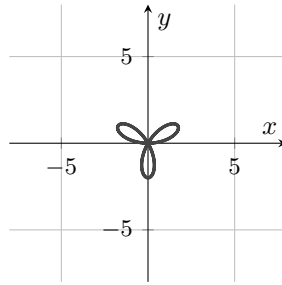


Question 9**Problem**

Find the area enclosed by one loop of $r = 2 \sin 3\theta$ and explain why multiplying by six is wrong for total area.



Question 9 – Solution



Solution

1. Determine an interval of angles that sweeps out the requested region exactly once, using symmetry when it simplifies the work.
2. For a polar boundary $r = f(\theta)$, use

$$A = \frac{1}{2} \int_a^b r^2 d\theta.$$

For a region between two curves, subtract the inner squared radius from the outer squared radius before integrating.

3. One loop area is $\frac{1}{2} \int_0^{\pi/3} 4 \sin^2 3\theta d\theta = \pi/3$.
4. The rose has three petals, not six, because negative radii retrace opposite petals; total area is $\boxed{\pi}$.