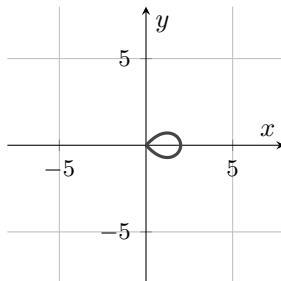
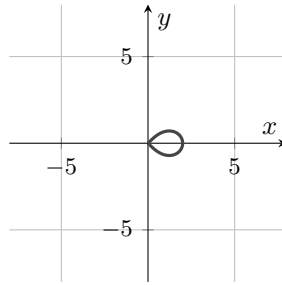


Question 6**Problem**

The curve $r^2 = 4 \cos 2\theta$ has two loops. Find its total area.



Question 6 – 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 uses $-\pi/4 \leq \theta \leq \pi/4$: $\text{area} = \frac{1}{2} \int 4 \cos 2\theta d\theta = 2$.
4. Doubling gives 4.