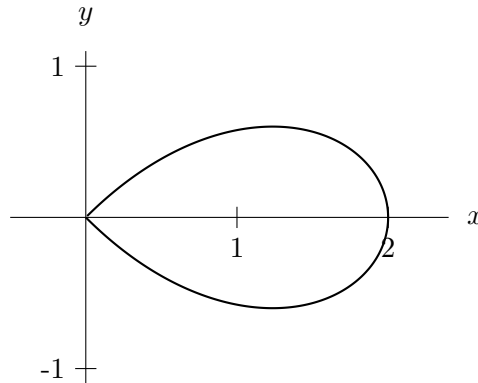


11. [6 points] Jane is trying to make a spaceship in the shape of the region enclosed by the polar curve

$$r = \frac{2 \cos(2\theta)}{\cos \theta}$$

where r is measured in meters and θ is measured in radians. The region is graphed below.



- a. [4 points] Find values of θ that trace out the boundary of the region exactly once.

Solution: There are many options here, we give two. If you take $-\frac{\pi}{4} \leq \theta \leq \frac{\pi}{4}$, the curve will be traced exactly once. You can also take $0 \leq \theta \leq \frac{\pi}{4}$ and $\frac{7\pi}{4} \leq \theta \leq 2\pi$.

- b. [2 points] Write an expression involving integrals that give the area of the region. Do not evaluate your integral.

Solution: The area of the region is given by

$$\frac{1}{2} \int_{-\pi/4}^{\pi/4} \frac{4 \cos^2(2\theta)}{\cos^2(\theta)} d\theta$$