

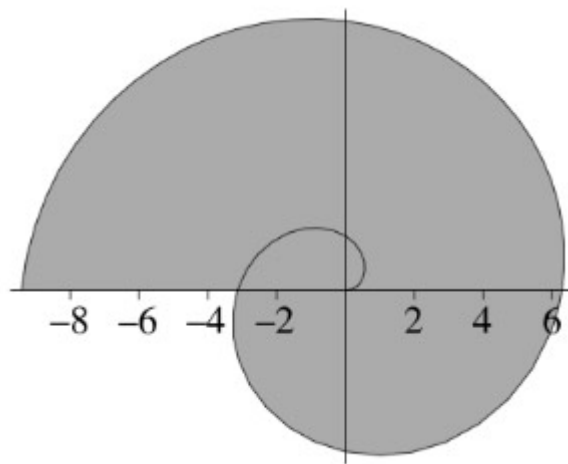
[12.4] - Double Integrals in Polar Coordinates

1. Integrate $f(x, y) = x^2 + y^2$ over the domain $D = \{(x, y) : 1 \leq (x^2 + y^2) \leq 4\}$ using polar coordinates.

2. Sketch the region of integration and evaluate by changing to polar coordinates.

$$\int_0^3 \int_{x=0}^{\sqrt{9-y^2}} \sqrt{x^2 + y^2} \, dx \, dy \quad (1)$$

3. Find the shaded area of the region inside the curve $r = \theta$, $0 \leq \theta \leq 3\pi$. *Hint:* Make sure you're not double-counting any areas.



4. Rewrite $\int_{-2}^2 \int_{y=0}^{\sqrt{4-x^2}} e^{-x^2-y^2} dy dx$ as a polar integral, and evaluate it.