Remember:

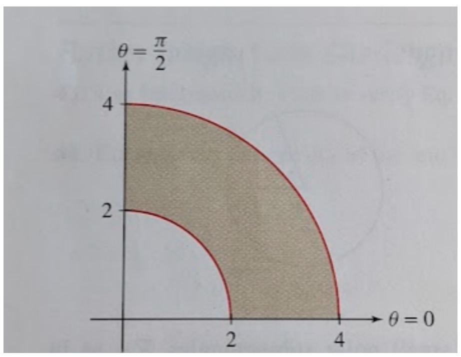
$x = r\cos\theta \qquad\qquad y = r\sin\theta$

Double Integral in Polar Coordinates For a continuous function f on the domain

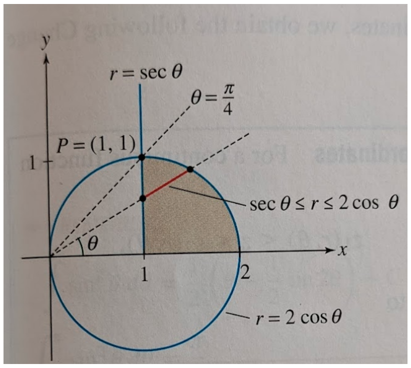
$$D:\ \theta_1 \le \theta \le \theta_2,\ \ r_1(\theta) \le r \le r_2(\theta)$$

$$\iint_D f(x, y)\,dA = \int_{\theta_1}^{\theta_2} \int_{r=r_1(\theta)}^{r=r_2(\theta)} f(r\cos\theta,\ r\sin\theta)\,r\,dr\,d\theta$$

1. Compute $\iint_D (x + y)\,dA$, where D is the quarter annulus in the figure below:



2. Calculate $\iint_D (x^2 + y^2)^{-2}\, dA$ for the shaded domain D in the figure below:

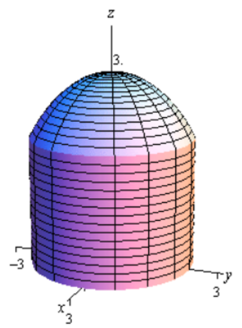


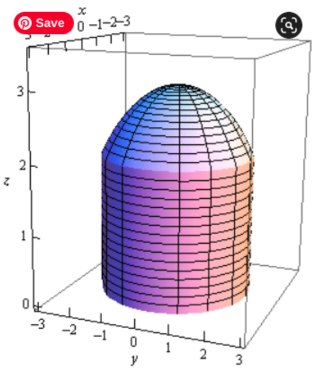
3. Evaluate $\iint_D 2xy\,dA$, D is the portion of the region between the circles of radius 2 and radius 5 centered at the origin that lies in the first quadrant.

4. Evaluate $\iint_D e^{x^2+y^2}\,dA$, D is the unit disk centered at the origin.

5. Determine the area of the region that lies inside $r = 3 + 2\sin\theta$ and outside $r = 2$

6. Determine the volume of the region that lies under the sphere $x^2 + y^2 + z^2 = 9$, above the plane $z = 0$ and inside the cylinder $x^2 + y^2 = 5$





7. Find the volume of the region that lies inside $z = x^2 + y^2$ and below the plane $z = 16$