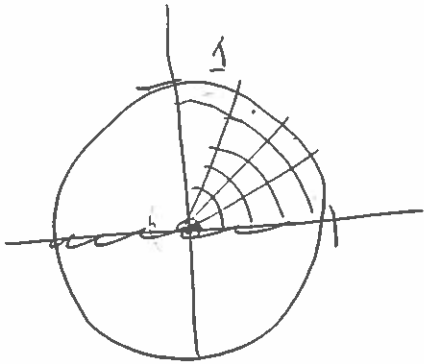


Polar Coordinates

$$(r, \theta) \quad r \neq \theta$$



In rectangular

$$\int_{x=-1}^1 \int_{y=-\sqrt{1-x^2}}^{\sqrt{1-x^2}} f(x,y) dA$$

Arrows point from the limits of the rectangular integral to the corresponding limits in the polar integral below.

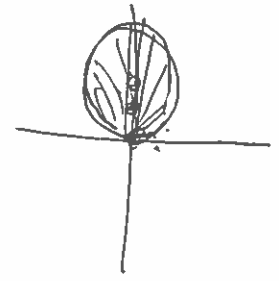
$$\int_{\theta=0}^{2\pi} \int_{r=0}^1 f(r \cos \theta, r \sin \theta) r dr d\theta$$

The area element dA is indicated by a small 'dA' under the $r dr d\theta$ term.

$$A_{\text{rea}} = \iint_R 1 dA$$

$$x^2 + y^2 = r^2$$

$$x^2 + (y-1)^2 = 1$$



$$(r \cos \theta)^2 + (r \sin \theta - 1)^2 = 1$$

$$r^2 \cos^2 \theta + r^2 \sin^2 \theta - 2r \sin \theta + 1 = 1$$

$$r^2 - 2r \sin \theta = 0$$

$$r(r - 2 \sin \theta) = 0$$

$$r = 0 \quad r = 2 \sin \theta$$

$$\int_{\theta=0}^{\pi} 2 \sin \theta$$

θ	r
0	0
$\frac{\pi}{2}$	2
π	0