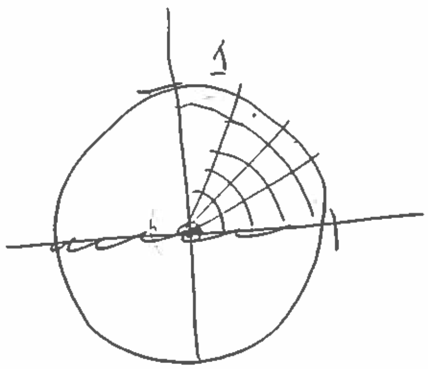
Polar Coordinates

(r, θ) $\quad$ r & θ



In rectangular

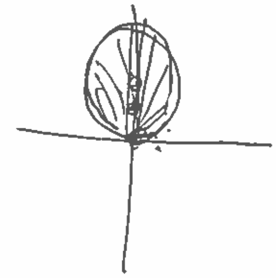
$$\int_{x=-1}^{1}\int_{y=-\sqrt{1-x^2}}^{\sqrt{1-x^2}} f(x,y)\,dA$$

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

$$\text{Area} = \iint_R 1\,dA$$

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

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



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

$$\underbrace{r^2\cos^2\theta + r^2\sin^2\theta} - 2r\sin\theta + \cancel{1} = \cancel{1}$$

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

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

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

θ	r
0	0
$\pi/2$	2
π	0

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