

$$2. \quad p(x,y) = xy \quad 0 \leq x \leq 2$$

$$0 \leq y \leq \sqrt{4-x^2}$$

$$m = \int_{x=0}^{x=2} \int_{y=0}^{y=\sqrt{4-x^2}} (xy) dy dx$$



$$y = \sqrt{4-x^2}$$

$$y^2 = 4-x^2$$

$$x^2 + y^2 = 4$$

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

$$m = \int_{\theta=0}^{\theta=\frac{\pi}{2}} \int_{r=0}^{r=2} (r \cos \theta \cdot r \sin \theta) r dr d\theta$$

$$m = \int_{\theta=0}^{\theta=\frac{\pi}{2}} \int_{r=0}^{r=2} (r^3 \cos \theta \sin \theta) dr d\theta$$

$$m = \int_{\theta=0}^{\theta=\frac{\pi}{2}} \left[ \frac{1}{4} r^4 \cos \theta \sin \theta \right]_{r=0}^{r=2} d\theta$$

$$m = \frac{1}{4} \int_{\theta=0}^{\theta=\frac{\pi}{2}} \cos \theta \sin \theta [r^4]_{r=0}^{r=2} d\theta$$

$$m = \frac{1}{4} \int_{\theta=0}^{\theta=\frac{\pi}{2}} \cos \theta \sin \theta [2^4 - 0^4] d\theta$$

$$m = \frac{1}{4} \cdot 16 \int_{\theta=0}^{\theta=\frac{\pi}{2}} \cos \theta \sin \theta d\theta$$

$$u = \sin \theta \quad du = \cos \theta d\theta$$

$$m = 4 \int_{\theta=0}^{\theta=\frac{\pi}{2}} u du$$

$$m = 4 \cdot \left[ \frac{1}{2} u^2 \right]_{\theta=0}^{\theta=\frac{\pi}{2}}$$

$$m = 4 \cdot \frac{1}{2} \left[ \sin^2 \theta \right]_{\theta=0}^{\theta=\frac{\pi}{2}}$$

$$m = 2 [\sin^2(\frac{\pi}{2}) - \sin^2(0)]$$

$$m = 2 [1^2 - 0^2]$$

$$m = 2$$