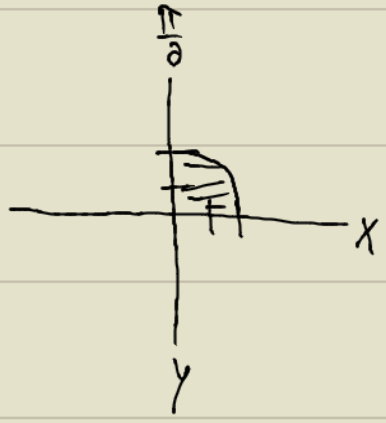
8. $z = 3xy$, $x^2 + y^2 = 4$, first octant



$x = r\cos\theta$

$y = r\sin\theta$

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

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

$$= 3 \int_{\theta=0}^{\theta=\frac{\pi}{2}} \left[\frac{1}{4} r^4 \cos\theta \sin\theta\right]_{r=0}^{r=2} d\theta$$

$$= 3 \cdot \frac{1}{4} \int_{\theta=0}^{\theta=\frac{\pi}{2}} \cos\theta \sin\theta \left[r^4\right]_{r=0}^{r=2} d\theta$$

$$= \frac{3}{4} \int_{\theta=0}^{\theta=\frac{\pi}{2}} \cos\theta \sin\theta \left[2^4 - 0^4\right] d\theta$$

$$= \frac{3}{4} \cdot 16 \int_{\theta=0}^{\theta=\frac{\pi}{2}} \cos\theta \sin\theta \, d\theta$$

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

$$= 12 \int_{\theta=0}^{\theta=\frac{\pi}{2}} u \, du$$

$$= 12 \left[\frac{1}{2} u^2\right]_{\theta=0}^{\theta=\frac{\pi}{2}}$$

$$= 12 \cdot \frac{1}{2} \left[\sin^2\theta\right]_{\theta=0}^{\theta=\frac{\pi}{2}}$$

$$= 6\left[\sin^2\left(\frac{\pi}{2}\right) - \sin^2(0)\right]$$

$$= 6\left[1^2 - 0^2\right]$$

$$= \boxed{6}$$