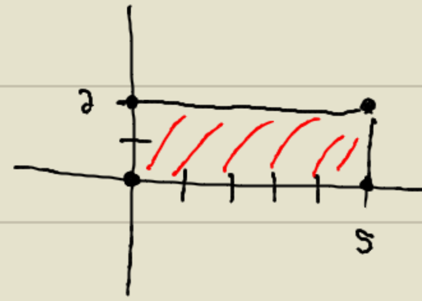
3. $f(x,y) = 4 - x^2$

$f_x = -2x$

$f_y = 0$




$$S = \int_{x=0}^{x=5} \int_{y=0}^{y=2} \sqrt{1 + (-2x)^2 + 0^2} \, dy \, dx$$

$$S = \int_{x=0}^{x=5} \int_{y=0}^{y=2} \sqrt{1 + 4x^2} \, dy \, dx$$

$$S = \int_{x=0}^{x=5} \Big[ y\sqrt{1+4x^2} \Big]_{y=0}^{y=2} dx$$

$$= \int_{x=0}^{x=5} \Big[ 2\sqrt{1+4x^2} - 0\sqrt{1+4x^2} \Big] dx$$

$$= 2\int_{x=0}^{x=5} \sqrt{(1)^2 + (2x)^2} \, dx$$

$u = 2x \quad du = 2\,dx \quad a = 1$

NOTE: $\int \sqrt{u^2+a^2}\,du$

$$= \frac{1}{2}\left( u\sqrt{u^2+a^2} + \ln\left|u + \sqrt{u^2+a^2}\right| \right)$$

$$= 2 \cdot \frac{1}{2} \int_{x=0}^{x=5} 2\sqrt{(2x)^2 + (1)^2} \, dx$$

$$= \int_{x=0}^{x=5} \sqrt{u^2+a^2} \, du$$

$$= \left[ \frac{1}{2}\left( u\sqrt{u^2+a^2} + \ln\left|u + \sqrt{u^2+a^2}\right| \right) \right]_{x=0}^{x=5}$$

$$= \frac{1}{2}\Big[ 2x\sqrt{4x^2+1} + \ln\left(2x + \sqrt{4x^2+1}\right) \Big]_{x=0}^{x=5}$$

$$= \frac{1}{2}\Big[ 2(5)\sqrt{4(5)^2+1} + \ln\left(2\cdot 5 + \sqrt{4(5)^2+1}\right) - \left(2(0)\sqrt{4(0)^2+1} + \ln\left(2\cdot 0 + \sqrt{4(0)^2+1}\right)\right) \Big]$$

$$= \frac{1}{2}\Big[ 10\sqrt{101} + \ln\left(10 + \sqrt{101}\right) - \ln\sqrt{1} \Big]$$

$$= \frac{1}{2}\Big[ 10\sqrt{101} + \ln\left(10 + \sqrt{101}\right) - 0 \Big]$$

$$= \boxed{5\sqrt{101} + \frac{1}{2}\ln\left(10 + \sqrt{101}\right)}$$