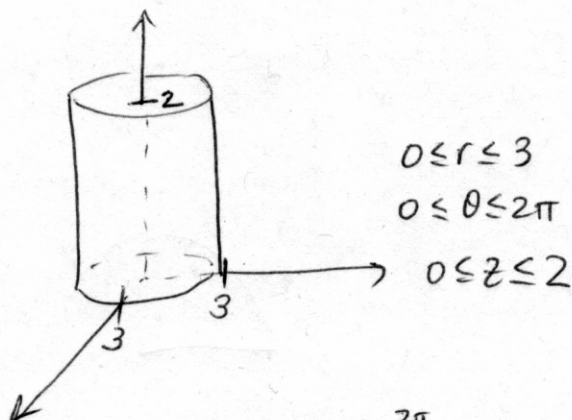


4. [20 points] Consider the solid cylinder bounded by  $x^2 + y^2 = 9$ ,  $z = 0$  and  $z = 2$ . If its density is given by  $\rho(x, y, z) = z$ , set up all the integrals needed to find the mass and center of mass of the solid using CYLINDRICAL COORDINATES.



$$\text{mass} = \int_0^2 \int_0^{2\pi} \int_0^3 z r dr d\theta dz$$

$$\bar{x} = \frac{1}{\text{mass}} \iiint_{\text{cylinder}} x z dV$$

$$= \frac{1}{\text{mass}} \int_0^2 \int_0^{2\pi} \int_0^3 r^2 \cos\theta z dr d\theta dz$$

$$\bar{y} = \frac{1}{\text{mass}} \int_0^2 \int_0^{2\pi} \int_0^3 r^2 \sin\theta z dr d\theta dz$$

$$\bar{z} = \frac{1}{\text{mass}} \int_0^2 \int_0^{2\pi} \int_0^3 z^2 r dr d\theta dz$$