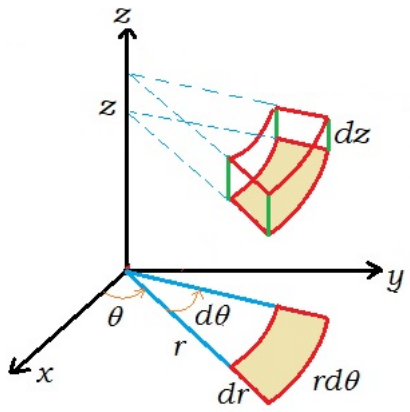
Integration with Cylindrical and Spherical Coordinates (HW #6)

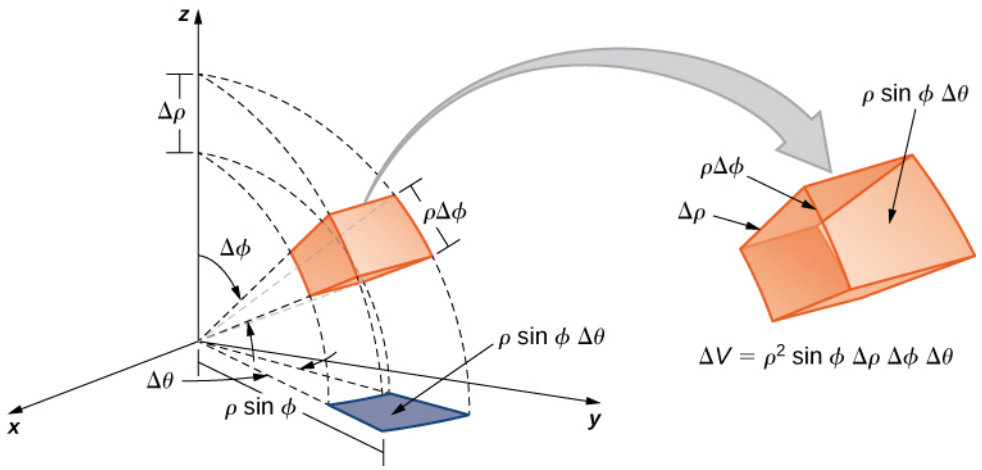
The cylindrical substitution is about the same as polar:

$$dV = r\,dr\,d\theta\,dz.$$



Find the mass of the solid region bounded by $x^2 + y^2 = 1$ and $x^2 + y^2 + z^2 = 2$ if $\delta(x, y, z) = |z|$.

We can find an expression for dV in terms of spherical coordinates by studying this picture:



$$dV = \rho^2 \sin(\phi)\, d\rho\, d\theta\, d\phi$$

Find I_0, the moment of inertia about the origin, for the solid E bounded by $z = r$ and the hemisphere $\rho = 1$ with $z > 0$ if the density is $\delta(x, y, z) = z$. How would the answer change if $\rho = 2$ instead? How do you know?

As time allows.
Find the average value of $f(x, y, z) = z$ over half of a polar cap, P, bounded by $z = 1$ and $\rho = 2$ with $y \geq 0$.