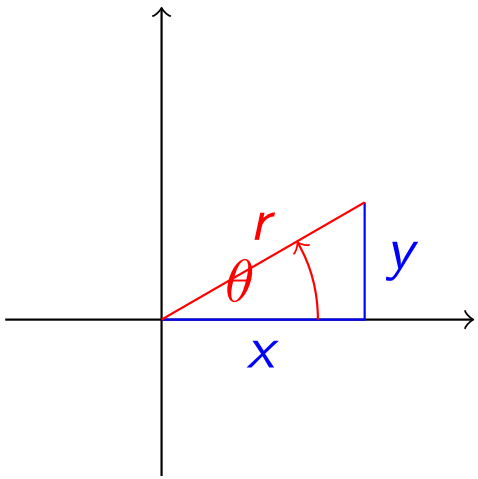
Polar Coordinates



Conversion from polar to cartesian (rectangular)

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

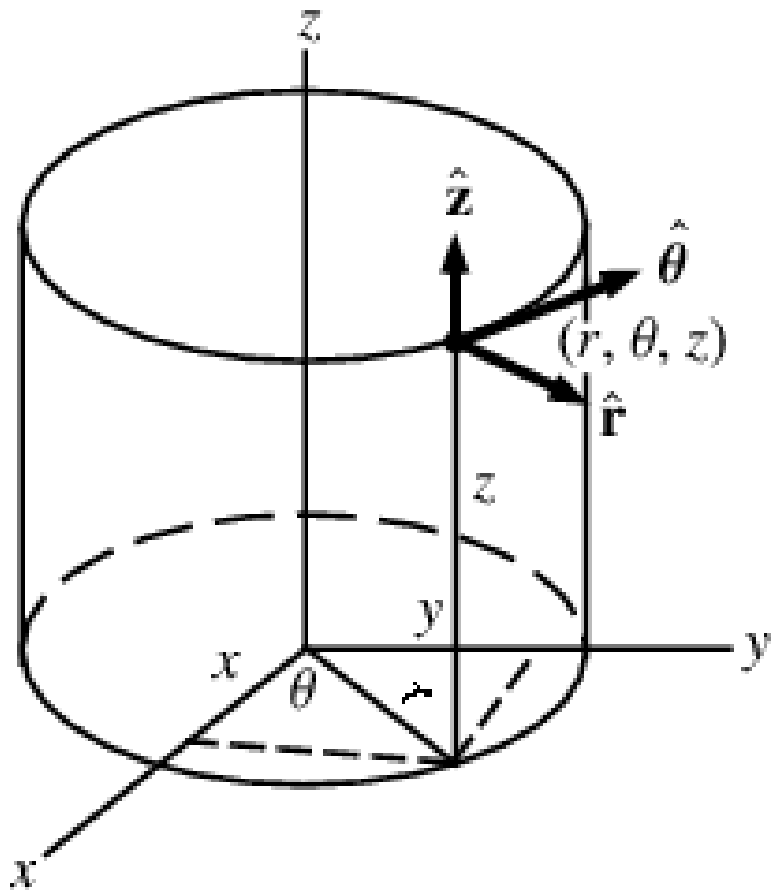
Conversion from cartesian to polar:

$$r = \sqrt{x^2 + y^2}$$

$$\cos\theta = \frac{x}{r} \quad \sin\theta = \frac{y}{r} \quad \tan\theta = \frac{y}{x}$$

Cylindrical Coordinates

Just add the vertical dimension



Conversion from cylindrical to cartesian (rectangular):

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

$$z = z$$

Conversion from cartesian to cylindrical:

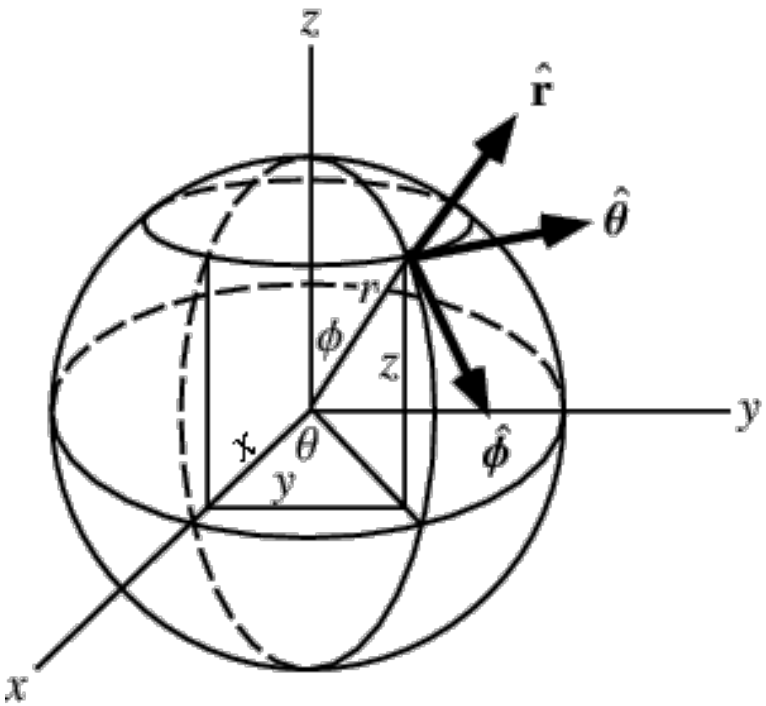
$$r = \sqrt{x^2 + y^2}$$

$$\cos\theta = \frac{x}{r} \qquad \sin\theta = \frac{y}{r} \qquad \tan\theta = \frac{y}{x}$$

$$z = z$$

Spherical Coordinates

like the earth, but not exactly



Note: In this picture, r should be ρ.

Conversion from spherical to cartesian (rectangular):

$$x = \rho \sin\varphi \cos\theta$$
$$y = \rho \sin\varphi \sin\theta$$
$$z = \rho \cos\varphi$$

Conversion from cartesian to spherical:

$$r = \sqrt{x^2 + y^2} \qquad \rho = \sqrt{x^2 + y^2 + z^2}$$
$$\cos\theta = \frac{x}{r} \qquad \sin\theta = \frac{y}{r} \qquad \tan\theta = \frac{y}{x}$$
$$\cos\varphi = \frac{z}{\rho}$$