- **Polar**

$$x = r\cos(\theta), y = r\sin(\theta)$$
$$r = \sqrt{x^2 + y^2}, \theta = \arctan(\frac{y}{c}).$$

Actually, the angle θ has to be found between $[0, 2\pi)$ by looking at signs of x, y.

- **Cylindrical** Same as polar, except there is a z coordinate which is same in both rectangular and cylindrical systems.

- **Spherical**

$$x = \rho\sin(\phi)\cos(\theta), y = \rho\sin(\phi)\sin(\theta), z = \rho\cos(\phi).$$

For reverse transformation,

$$\rho = \sqrt{x^2 + y^2 + z^2} = \sqrt{r^2 + z^2}, \ \theta \text{ is same as in polar and } \phi = \arccos(\frac{z}{\rho}).$$