Cylindrical and Spherical Coordinates

↳ different coordinate systems for $\mathbb{R}^3$, suited to drawing different figures.

Prefact: In $\mathbb{R}^2$, eqn for circle of radius r and center (a,b):

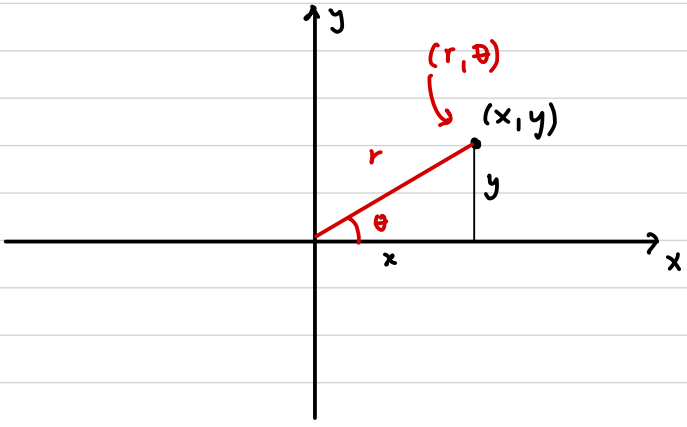
$$(x-a)^2 + (y-b)^2 = r^2$$

In $\mathbb{R}^3$, eqn for ~~circle~~ sphere radius r and center (a,b,c):

$$(x-a)^2 + (y-b)^2 + (z-c)^2 = r^2$$

Recall:

Polar Coordinates for $\mathbb{R}^2$



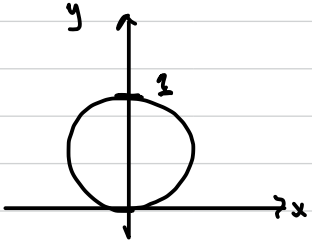
$x = r\cos\theta$

$y = r\sin\theta$

$r^2 = x^2 + y^2$

If we restrict $r \geq 0$ and $0 \leq \theta < 2\pi$, then all points have a unique address except: origin. ($r = 0$, θ ?)

Ex What shape is $r = \sin\theta$, $0 \leq \theta \leq \pi$?



* $\times$ mult through by r

$r^2 = r\sin\theta$

$x^2 + y^2 = y \rightsquigarrow x^2 + (y^2 - y + 1/4) = 1/4$

$x^2 + (y - 1/2)^2 = (1/2)^2$ ← circle, radius $1/2$, center $(0, 1/2)$