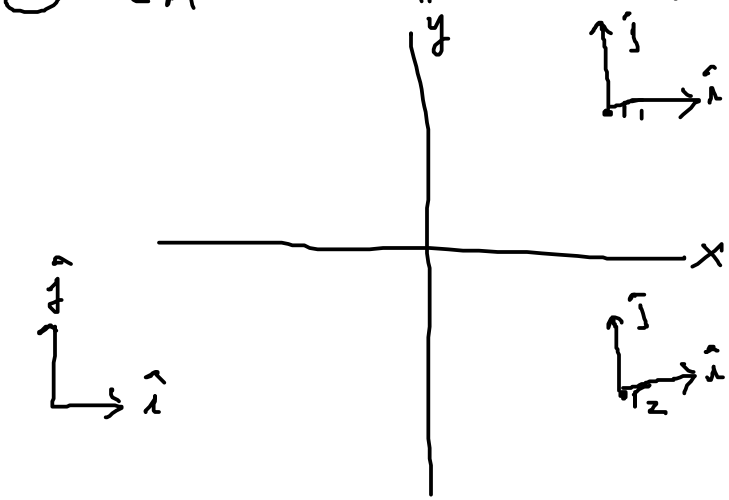
TAM 212 Class # 2: Basis Vectors, Cartesian and Polar Coords.

① CARTESIAN COORDINATE SYSTEM



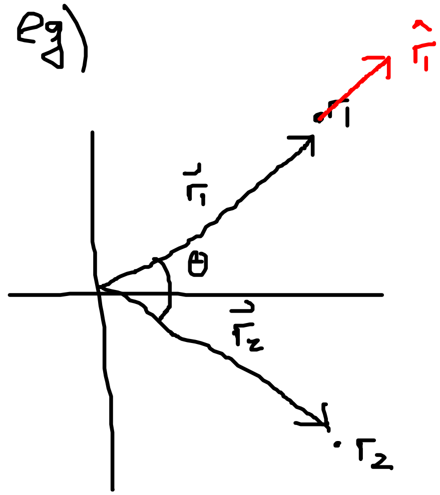
at r_1: $x = 3$, $y = 4$

at r_2: $x = +3$, $y = -4$

NOTATION:

- vectors $\vec{a}$
- unit vector $\hat{a}$
- magnitude of $\vec{a}$: $\|\vec{a}\|$ or a
- CAN WRITE: $\underline{\vec{a}} = \underline{a}\,\underline{\hat{a}}$

eg)



a vector from origin to pt r_1 is

$$\vec{r}_1 = 3\hat{i} + 4\hat{j}$$

$$\|\vec{r}_1\| = \sqrt{3^2+4^2} = 5$$

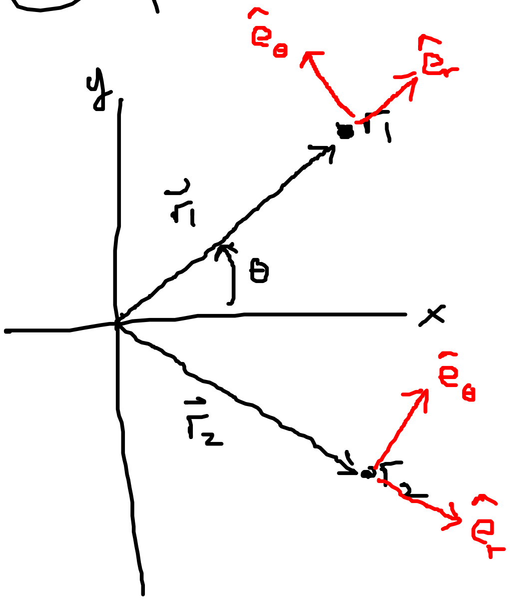
$$\hat{r}_1 = \frac{\vec{r}_1}{\|\vec{r}_1\|} = \underbrace{\tfrac{1}{5}(3\hat{i}+4\hat{j})}$$

$$\vec{r}_1 = \|\vec{r}_1\|\,\hat{r}_1 = 5 \cdot \tfrac{1}{5}(3\hat{i}+4\hat{j})$$

To find the angle between: use dot product

$$\vec{r}_1 \cdot \vec{r}_2 = \|\vec{r}_1\|\,\|\vec{r}_2\| \cos\theta$$

② POLAR COORDINATES : (r, θ)



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

$$\theta = \tan^{-1}(y/x)$$

$$x = r\cos\theta$$

$$y = r\sin\theta$$

Basis Vectors $\hat{e}_r$ and $\hat{e}_\theta$

example : fill out table

	cartesian basis	polar basis
$\vec{r}_1$	$\vec{r}_1 = 3\hat{i} + 4\hat{j}$	$\vec{r}_1 = r\hat{e}_r$
$\vec{r}_2$	$\vec{r}_2 = 3\hat{i} - 4\hat{j}$	$\vec{r}_2 = r\hat{e}_r$

☆ position vector is always $\vec{r} = r\hat{e}_r$