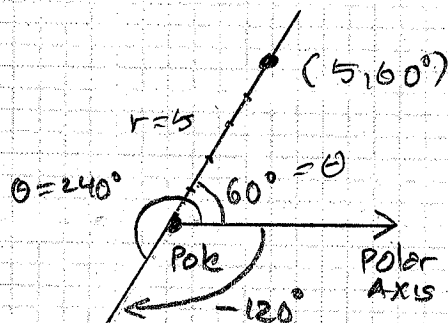
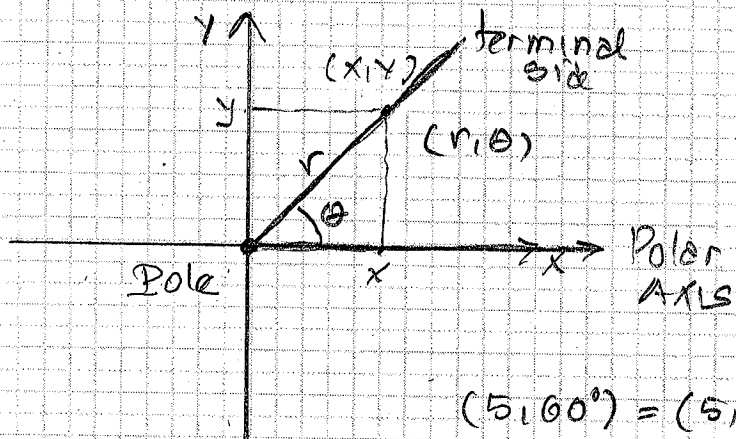
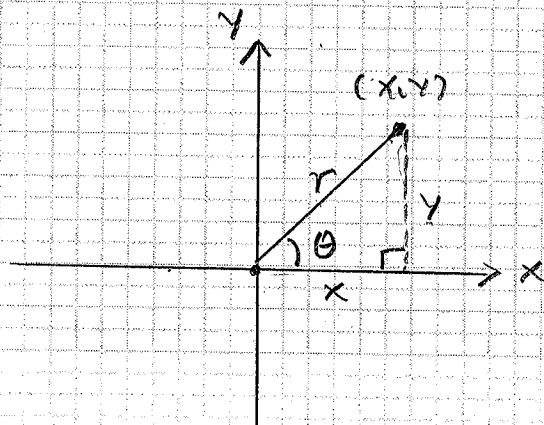


POLAR COORDINATES



$$\begin{aligned} (5, 60^\circ) &= (5, \pi/3) \\ &= (-5, 240^\circ) = (-5, \frac{4\pi}{3}) \\ &= (-5, -120^\circ) \end{aligned}$$



$$\sin \theta = \frac{y}{r} \Rightarrow y = r \sin \theta$$

$$\cos \theta = \frac{x}{r} \Rightarrow x = r \cos \theta$$

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

$$\theta = \tan^{-1} \left(\frac{y}{x} \right)$$

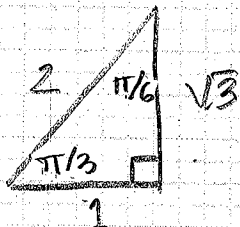
$$\theta = \sin^{-1} \left(\frac{y}{r} \right)$$

Example: Convert the polar coordinates $(3, \pi/3)$ to rectangular

$$r = 3 \quad \theta = \pi/3$$

$$x = 3 \cos(\pi/3) = 3 \cdot \frac{1}{2} = \frac{3}{2}$$

$$y = 3 \sin(\pi/3) = \frac{3\sqrt{3}}{2}$$



$$(x, y) = \left(\frac{3}{2}, \frac{3\sqrt{3}}{2} \right)$$

Example: Convert the rectangular coordinates $(-1, -\sqrt{3})$ to polar

$$x = r \cos \theta$$

$$y = r \sin \theta$$

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

$$\theta = \tan^{-1}\left(\frac{y}{x}\right)$$

$$\begin{aligned} r &= \sqrt{(-1)^2 + (-\sqrt{3})^2} = \\ &= \sqrt{1+3} = \sqrt{4} = 2 \end{aligned}$$

$$\boxed{r=2}$$

$$\begin{aligned} \cancel{\theta} &= \tan^{-1}\left(\frac{-\sqrt{3}}{-1}\right) = \tan^{-1}(\sqrt{3}) \\ &= \pi/3 = \cancel{60^\circ} \text{ WRONG} \end{aligned}$$

$$\theta = 60^\circ + 180^\circ = 240^\circ$$

$$(r, \theta) = (2, 240^\circ)$$

