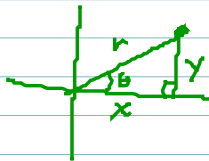
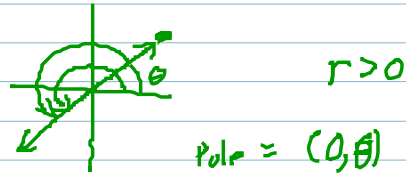


$$(r, \theta) = (r, \theta + 2\pi k) \quad k \in \mathbb{Z}$$

$$= (-r, \theta + (2k+1)\pi) \quad k \in \mathbb{Z}$$



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

$$\tan(\theta) = \frac{y}{x} \leftarrow$$

$$\sin(\theta) = \frac{y}{r} \leftarrow$$

$$\cos(\theta) = \frac{x}{r} \leftarrow$$

Rectangular  $\rightarrow$  Polar

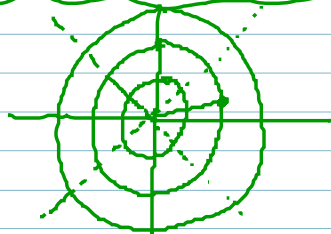
$$x^2 + y^2 = r^2 \rightarrow r = \pm \sqrt{x^2 + y^2} \rightarrow \boxed{r = \sqrt{x^2 + y^2}}$$

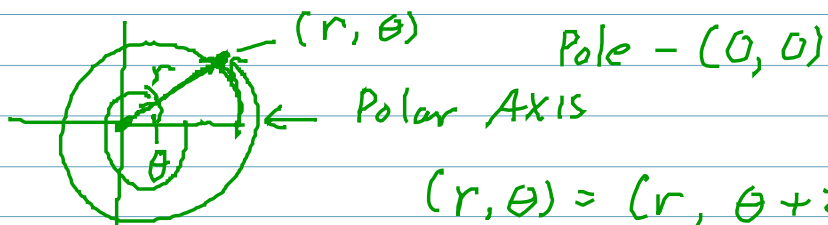
$$\tan(\theta) = \frac{y}{x} \rightarrow \boxed{\theta_R = \tan^{-1}\left(\frac{y}{x}\right)}$$

Polar  $\rightarrow$  Rectangular

$$\sin(\theta) = \frac{y}{r} \rightarrow \boxed{y = r \sin(\theta)}$$

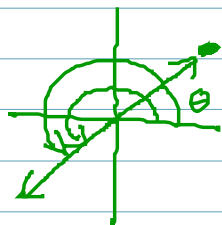
$$\cos(\theta) = \frac{x}{r} \rightarrow \boxed{x = r \cos(\theta)}$$





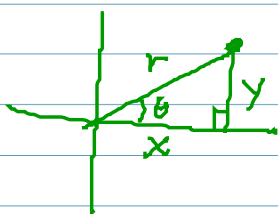
$$(r, \theta) = (r, \theta + 2\pi k) \quad k \in \mathbb{Z}$$

$$= (-r, \theta + (2k+1)\pi) \quad k \in \mathbb{Z}$$



$$r > 0$$

$$\text{Pole} = (0, \theta)$$



$$x^2 + y^2 = r^2 \quad \leftarrow$$

$$\tan(\theta) = \frac{y}{x} \quad \leftarrow$$

$$\sin(\theta) = \frac{y}{r} \quad \leftarrow$$

$$\cos(\theta) = \frac{x}{r} \quad \leftarrow$$

Rectangular  $\rightarrow$  Polar

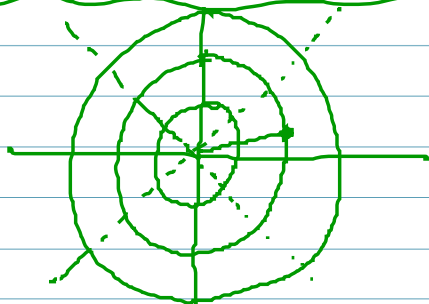
$$x^2 + y^2 = r^2 \rightarrow r = \pm \sqrt{x^2 + y^2} \rightarrow \boxed{r = \sqrt{x^2 + y^2}}$$

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

Polar  $\rightarrow$  Rectangular

$$\sin(\theta) = \frac{y}{r} \rightarrow \boxed{y = r \sin(\theta)}$$

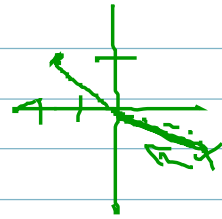
$$\cos(\theta) = \frac{x}{r} \rightarrow \boxed{x = r \cos(\theta)}$$



$$(-2, -\frac{\pi}{6})_P \rightarrow (-\sqrt{3}, 1)_R$$

$$y = -2 \sin(-\frac{\pi}{6}) = -2(-\frac{1}{2}) = 1$$

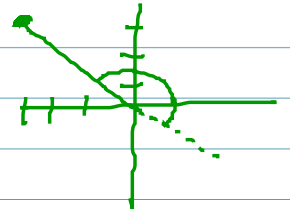
$$x = -2 \cos(-\frac{\pi}{6}) = -2(\frac{\sqrt{3}}{2}) = -\sqrt{3}$$



$$(-3, 3)_R \rightarrow (3\sqrt{2}, \frac{3\pi}{4})_P$$

$$r = \sqrt{(-3)^2 + 3^2} = \sqrt{9+9} = \sqrt{18} = 3\sqrt{2}$$

$$\tan(\theta) = \frac{3}{-3} = -1 \quad \theta_R = \tan^{-1}(-1) = -\frac{\pi}{4}$$



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

$$r^2 = r \cos(\theta)$$

$$r = \cos(\theta)$$

$$y = -3$$

$$r \sin(\theta) = -3 \quad \rightarrow \quad r = \frac{-3}{\sin(\theta)} = -3 \operatorname{csc}(\theta)$$

$$r = \sin(\theta)$$

$$r^2 = r \sin(\theta)$$

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

$$y = r \sin(\theta) \quad \rightarrow \quad \frac{y}{r} = \sin(\theta)$$

$$\frac{y}{\sqrt{x^2 + y^2}} = \sin(\theta)$$

$$r = \frac{3}{3 - \cos(\theta)} \quad \rightarrow \quad r(3 - \cos(\theta)) = 3$$

$$3r - r \cos(\theta) = 3$$

$$3\sqrt{x^2 + y^2} - x = 3$$

$$3\sqrt{x^2 + y^2} = 3 + x$$

$$9(x^2 + y^2) = 9 + 6x + x^2$$

$$9x^2 + 9y^2 =$$

$$9y^2 = -8x^2 + 6x + 9$$