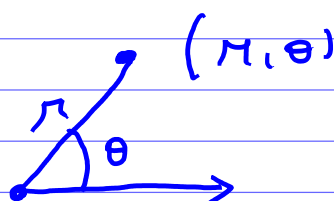
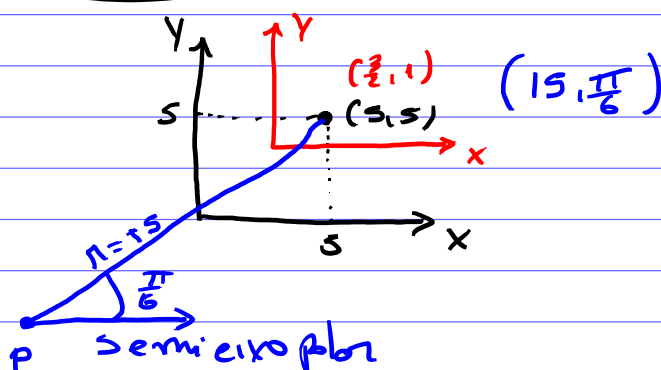
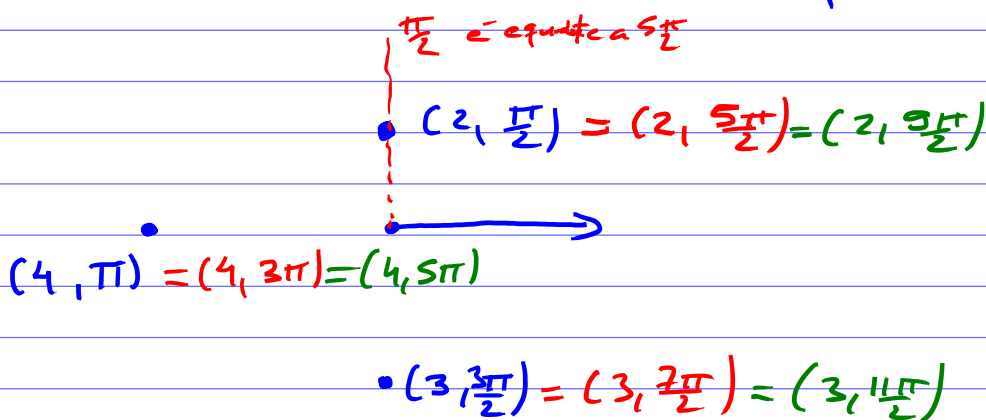


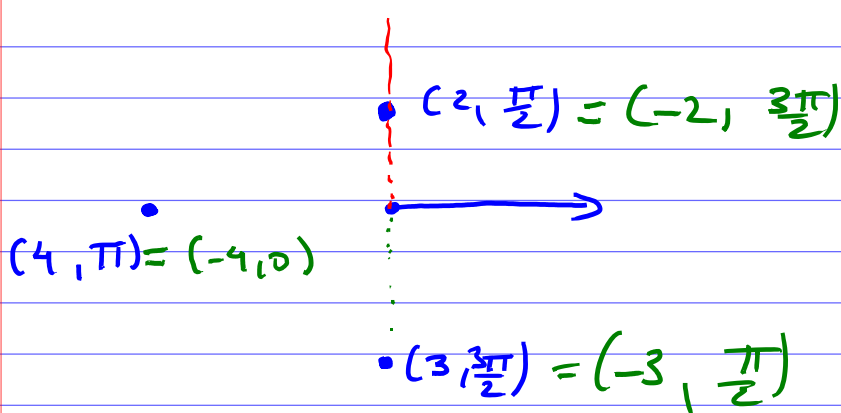
Coordenadas polares



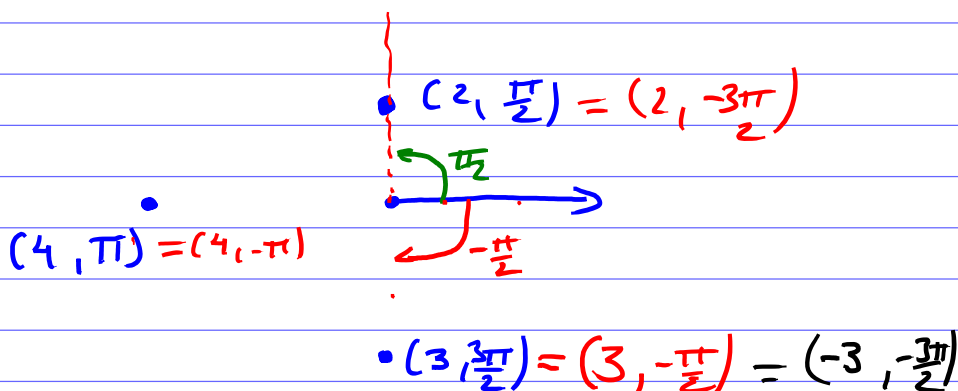
Multiplicação de endereços



θ pode ser negativo.

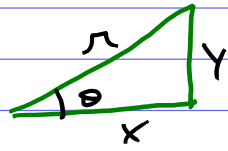
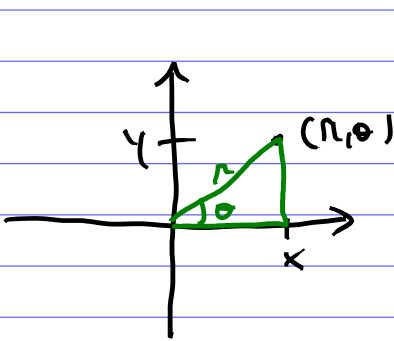


θ também pode ser negativo



Conversões

Polos para cartesianas



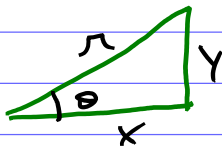
$$\cos \theta = \frac{x}{r} \therefore x = r \cos \theta$$

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

$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \end{cases}$$

Funções sempre!

Cartesianas para polos



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

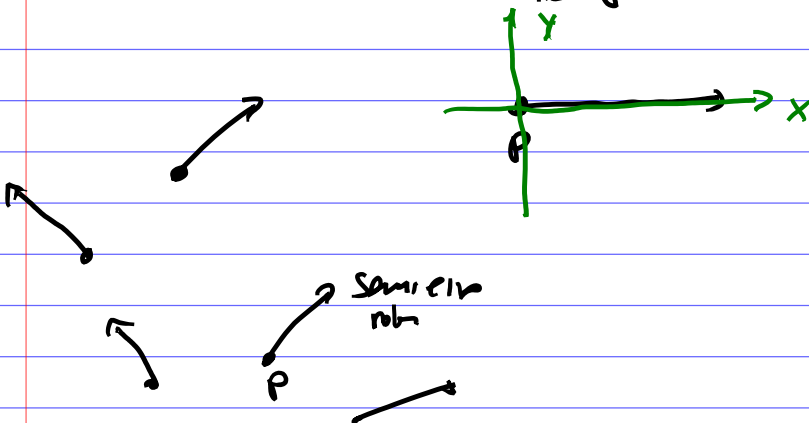
$$r = \sqrt{x^2 + y^2}$$

$$\tan \theta = \frac{y}{x} \therefore \theta = \arctan\left(\frac{y}{x}\right)$$

↗ Cuidado com esse arco.

Um alerta

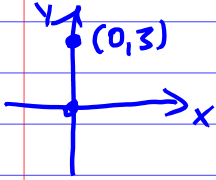
Usualmente a origem do sistema de coordenadas cartesianas é feita coincidir com o polo. E o semi eixo x com o semi eixo polar.



Exercícios

1. Converta os pontos que estão em coordenadas polares p/ Cartesianas.

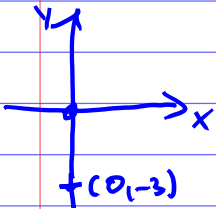
a) $(3, \frac{\pi}{2})$



$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \end{cases}$$

$$\begin{cases} x = 3 \cos \frac{\pi}{2} = 0 \\ y = 3 \sin \frac{\pi}{2} = 3 \end{cases} \\ (0, 3)$$

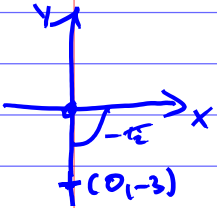
b) $(-3, \frac{\pi}{2})$



$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \end{cases}$$

$$\begin{cases} x = -3 \cos \frac{\pi}{2} = 0 \\ y = -3 \sin \frac{\pi}{2} = -3 \end{cases} \\ (0, -3)$$

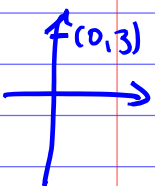
c) $(3, -\frac{\pi}{2})$



$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \end{cases}$$

$$\begin{cases} x = 3 \cos(-\frac{\pi}{2}) = 0 \\ y = 3 \sin(-\frac{\pi}{2}) = -3 \end{cases} \\ (0, -3)$$

d) $(-3, -\frac{\pi}{2})$



$$\begin{cases} x = r \cos \theta \\ y = r \sin \theta \end{cases}$$

$$\begin{cases} x = -3 \cos(-\frac{\pi}{2}) = 0 \\ y = -3 \sin(-\frac{\pi}{2}) = +3 \end{cases} \\ (0, 3)$$

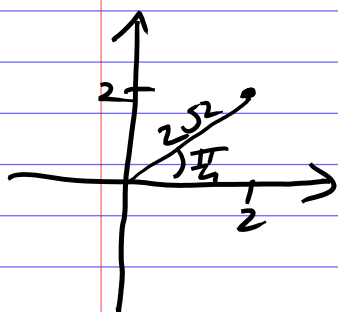
Em qual sistema é o ponto
 $(5, 5)$ $(3, \pi)$
 $(2, \frac{\pi}{2})$

Resposta: NÃO DA PARA SABER.
TEM QUE HAVER MAIS

Exercícios

Converte de cartesiano para polar

a) (2,2)



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

$$r = \sqrt{4 + 4}$$

$$r = 2\sqrt{2}$$

$$\theta = \arctan\left(\frac{y}{x}\right) = \arctan\left(\frac{2}{2}\right) = \arctan(1) = \frac{\pi}{4}$$

$$\left(2\sqrt{2}, \frac{\pi}{4}\right)$$

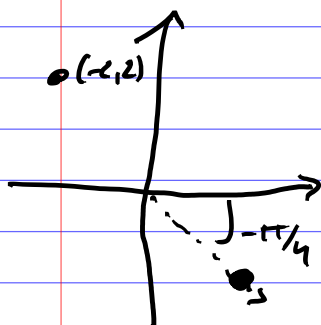
b) (-2,2)

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

$$r = \sqrt{4 + 4}$$

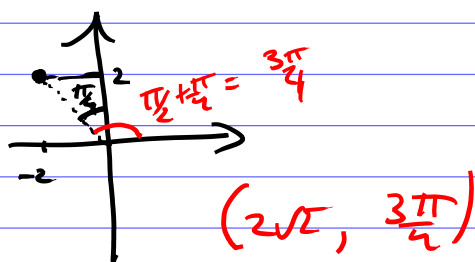
$$r = 2\sqrt{2}$$

$$\theta = \arctan\left(\frac{y}{x}\right) = \arctan\left(\frac{2}{-2}\right) = \arctan(-1) = -\frac{\pi}{4}$$



$$\left(2\sqrt{2}, -\frac{\pi}{4}\right)$$

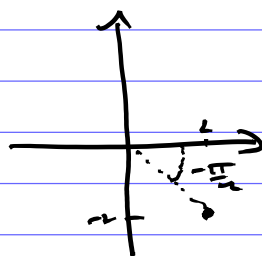
Sigmo desenhá!



c) (2,-2)

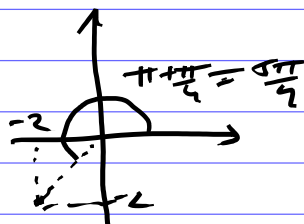
$$\left(2\sqrt{2}, -\frac{\pi}{4}\right)$$

$$\left(2\sqrt{2}, \frac{3\pi}{2} + \frac{\pi}{4}\right)$$



d) (-2,-2)

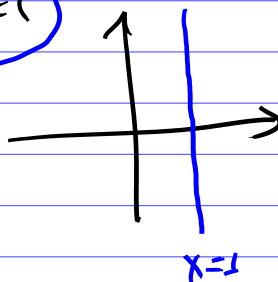
$$\left(2, \frac{5\pi}{4}\right)$$



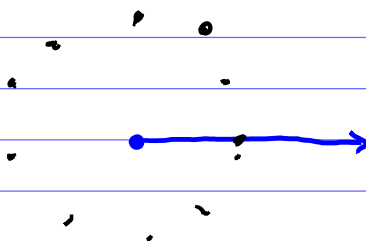
Equações em Coordenadas Polares

$X=1$
 $\left\{ \begin{array}{l} \text{Cartesiana 1D} = \text{Ponto} \\ \text{" 2D} = \text{Reta} \\ \text{" 3D} = \text{Plano} \end{array} \right.$

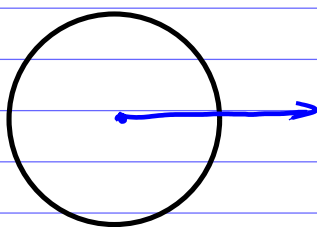
2D $X=1$



$\Pi=1$ — Polar 2D

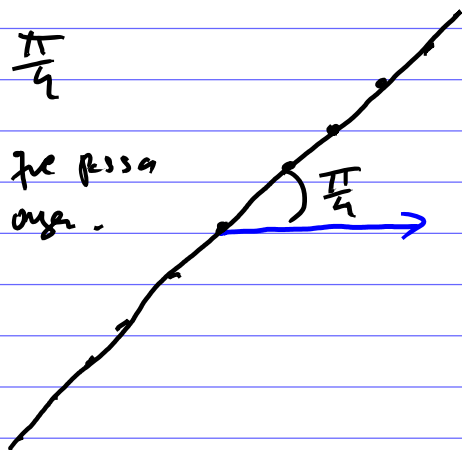


$\Pi=1$ É a eq de um círculo
centrado no pólo.



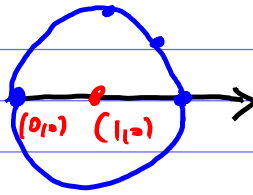
$$\theta = \frac{\pi}{4}$$

reta que passa
no orig.



$$\rho = 2 \cos \theta$$

θ	ρ
0	2
$\frac{\pi}{4}$	$\sqrt{3}$
$\frac{\pi}{2}$	$\sqrt{2}$
$\frac{3\pi}{4}$	0



Círculo centrado em $(1,0)$
de raio 1.

Outro modo...

$$\rho = 2 \cos \theta$$

$$\rho^2 = 2\rho \cos \theta$$

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

$$x^2 - 2x + y^2 = 0$$

$$x^2 - 2x + 1 - 1 + y^2 = 0$$

$$\underbrace{(x-1)^2 + y^2 = 1}$$

Eq. de um círculo
de raio 1 centrado em
 $(1,0)$

Eq. do círculo

$$(x-x_0)^2 + (y-y_0)^2 = R^2$$

Centro (x_0, y_0)
c/ raio R .