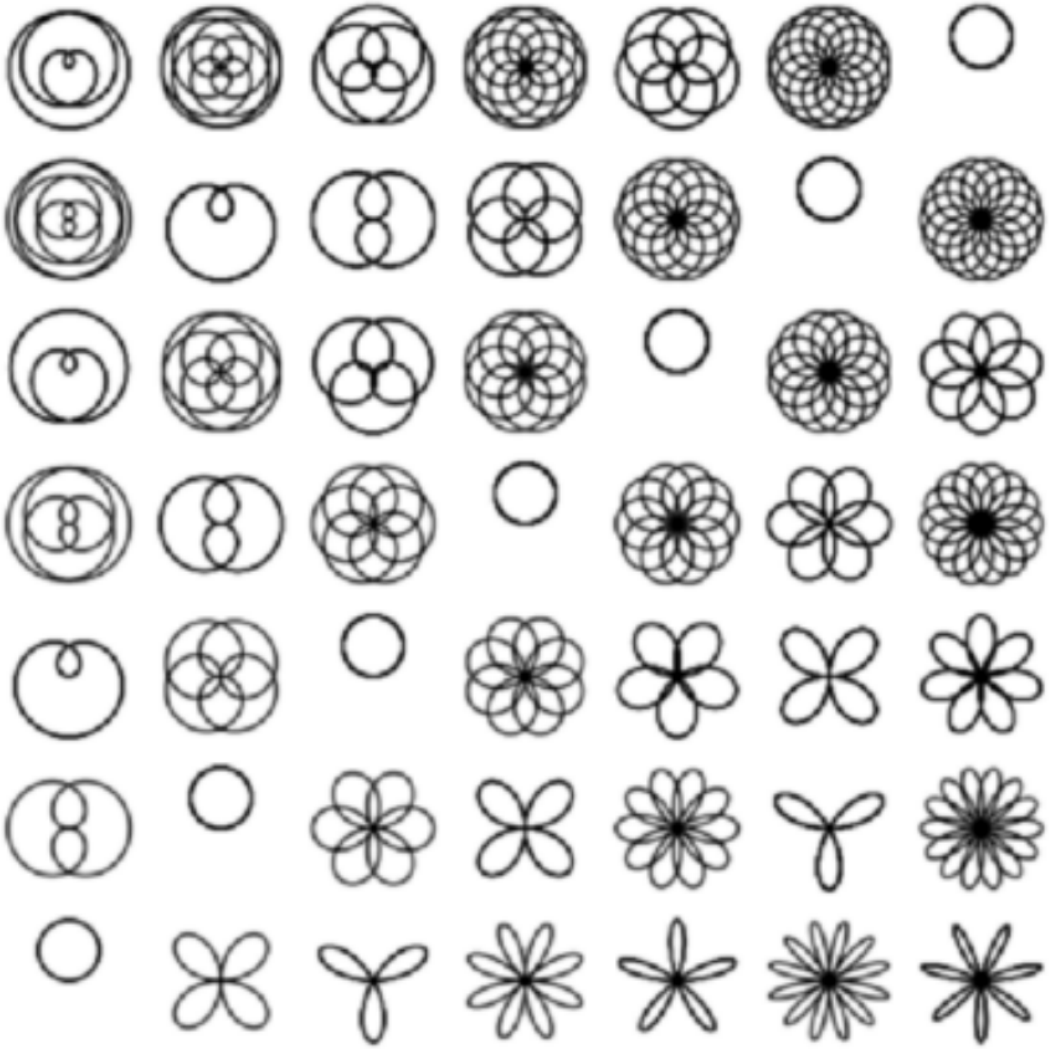
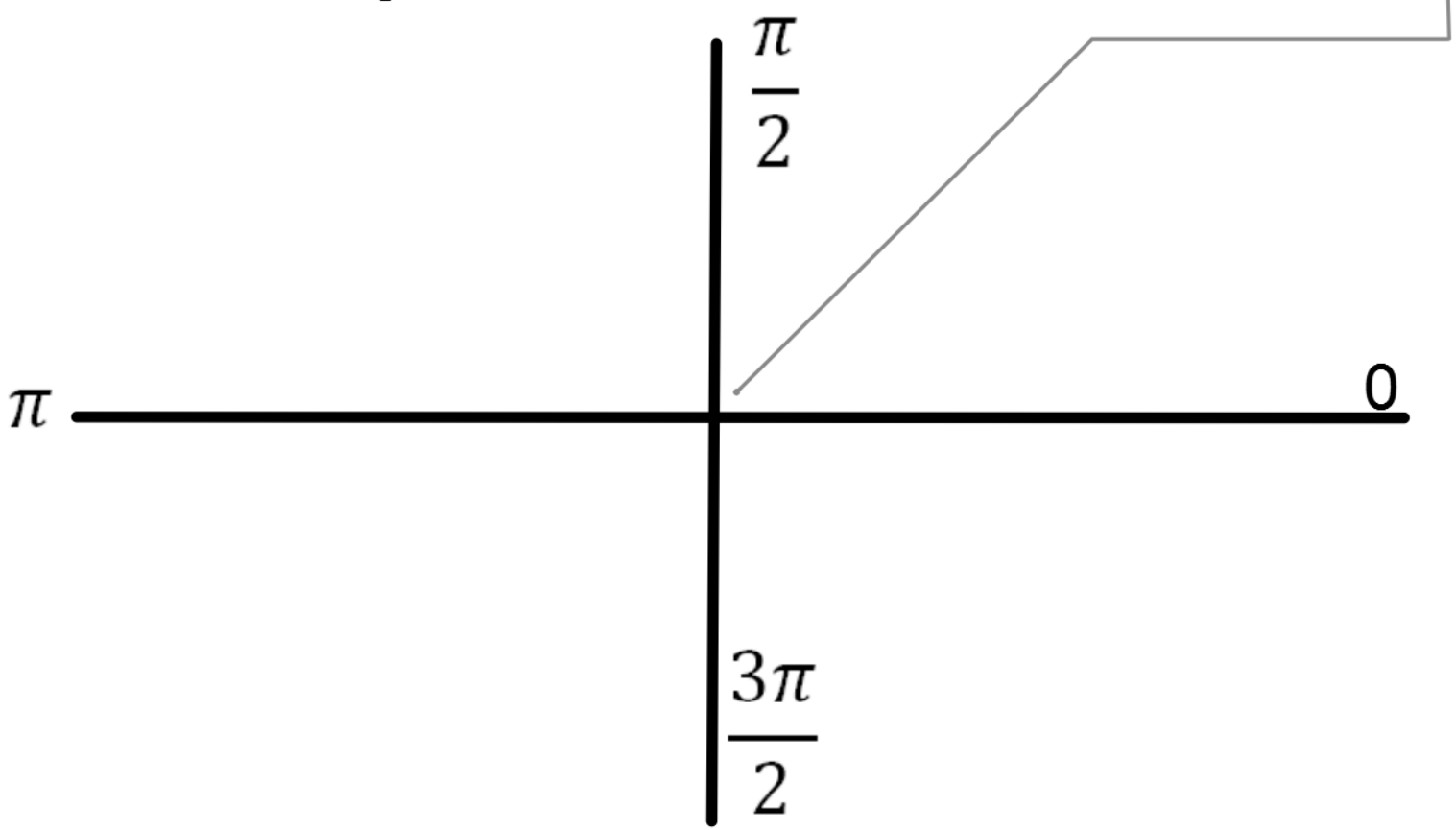
10.3: Polar Coordinates, (Those things that you should have learned about, but maybe didn't, but don't worry, they aren't that hard.)



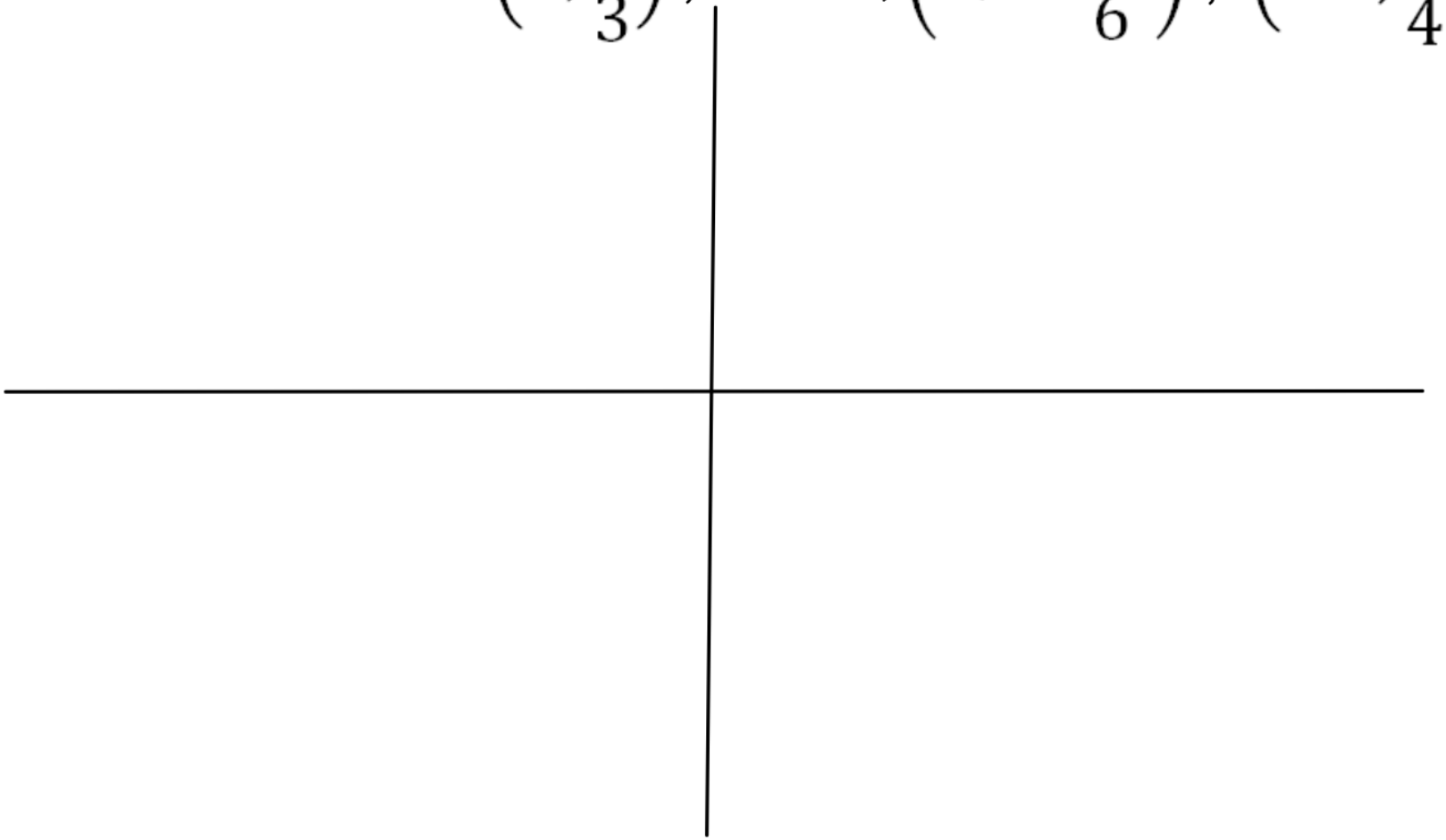
Polar Coordinates are of the form: (r, θ)

where r is the **radius**, or distance from the origin, or **pole**, and θ is the angle, counterclockwise, of the rotation.

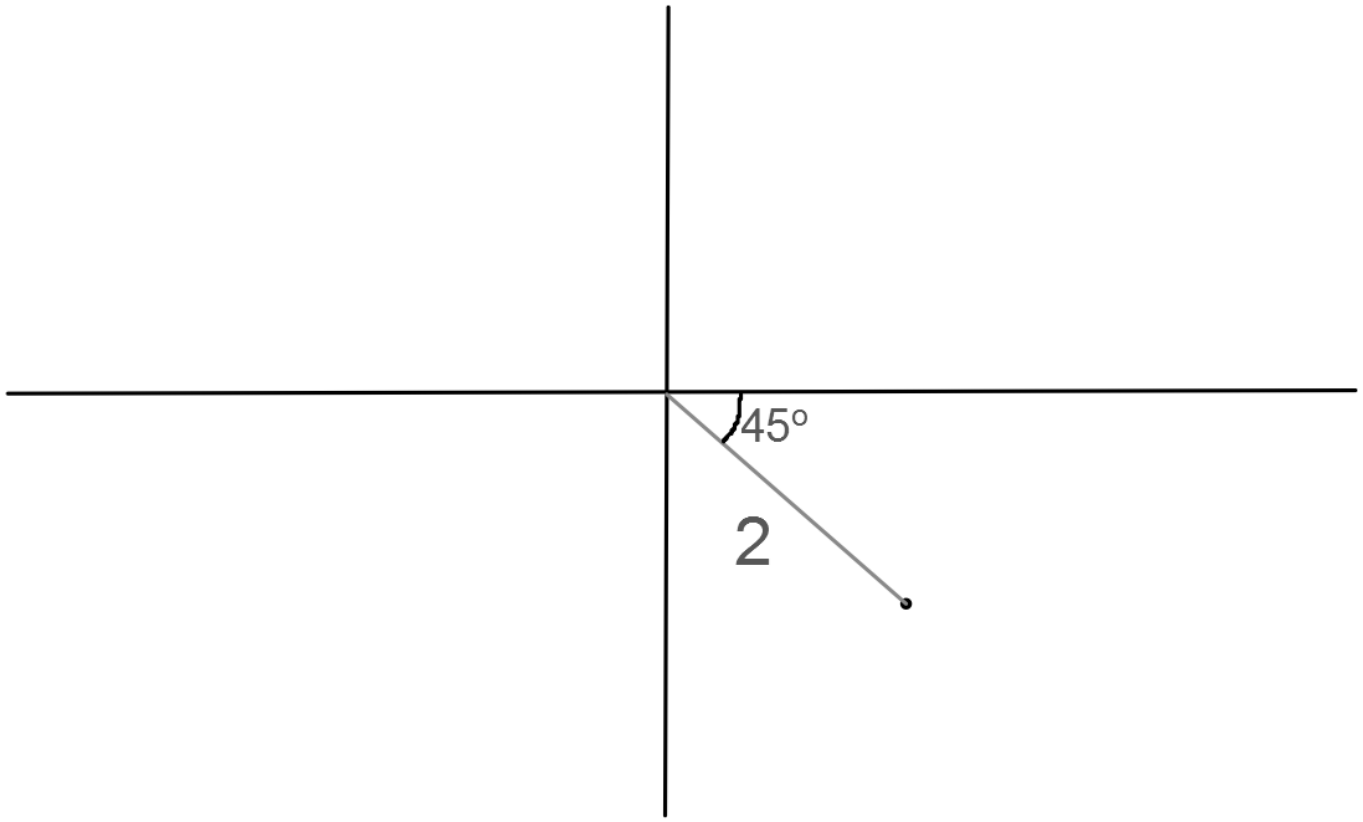


Graph these polar coordinates:

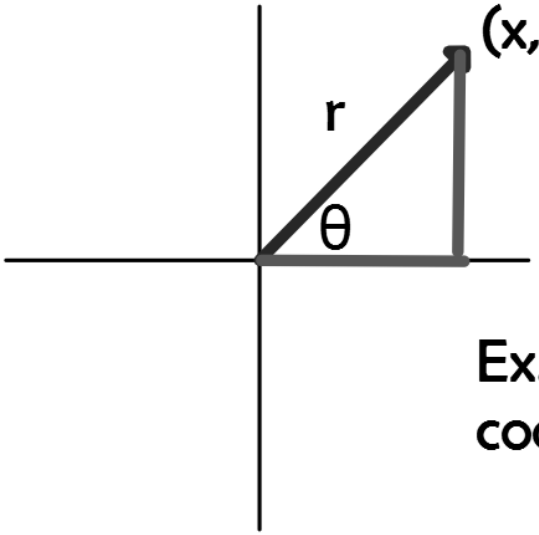
$$\left(1, \frac{\pi}{3}\right), (2, \pi), \left(1, -\frac{5\pi}{6}\right), \left(-1, \frac{\pi}{4}\right)$$



Name this point in 4 different ways...that's right, you heard me correctly...4 ways.



Converting Polar coordinates to Cartesian coordinates.



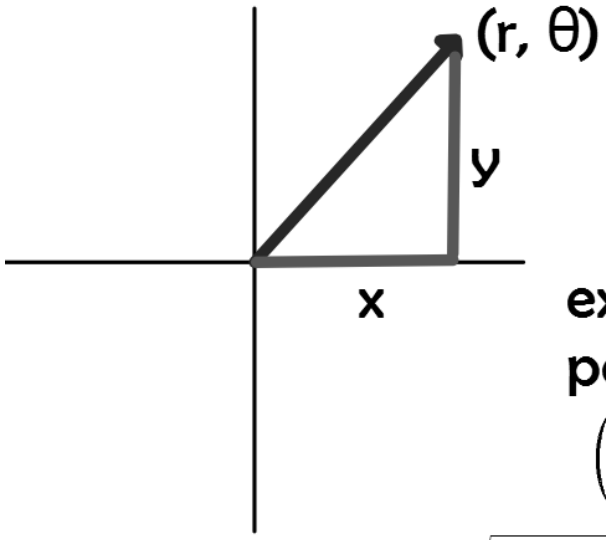
$$x = r\cos(\theta)$$
$$y = r\sin(\theta)$$

Ex. Convert $\left(\sqrt{2}, \frac{5\pi}{4}\right)$ **to Cartesian coordinates.**

$$x = \sqrt{2}\cos\left(\frac{5\pi}{4}\right) = \sqrt{2}\left(-\frac{\sqrt{2}}{2}\right) = -1$$

$$y = \sqrt{2}\sin\left(\frac{5\pi}{4}\right) = \sqrt{2}\left(-\frac{\sqrt{2}}{2}\right) = -1$$

Converting Cartesian coordinates to polar coordinates



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

$$\frac{y}{x} = \frac{r\sin(\theta)}{r\cos(\theta)} = \tan(\theta)$$

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

ex. Change into polar coordinates:

$$\left(-3\sqrt{3}, 3\right)$$

$$r = \sqrt{\left(-3\sqrt{3}\right)^2 + (3)^2} = \sqrt{27 + 9} = 6$$

$$\theta = \tan^{-1}\left(\frac{3}{-3\sqrt{3}}\right) = \tan^{-1}\left(\frac{-1}{\sqrt{3}}\right) = \frac{-\pi}{6}$$

Since the coordinate is in quadrant II, add/subtract π to θ.

$$\left(6, \frac{5\pi}{6}\right)$$