Polar Coordinates (Appendix H1)

Thanks to Faan Tone Liu

Key Points:

- Every location in the plane can be described by (r, θ), where

$$\begin{aligned} r &= \text{distance from the origin} \\ \theta &= \text{angle from the positive } x\text{-axis.} \end{aligned}$$

- Consider the following picture:

- Converting from polar to rectangular coordinates:

$$\begin{aligned} x &= \\ y &= \end{aligned}$$

- Converting from rectangular to polar coordinates:

$$\begin{aligned} r^2 &= \\ \tan\theta &= \end{aligned}$$

Examples:

1. Plot the following points:

   A. $(r, \theta) = (2, \frac{2\pi}{3})$
   B. $(r, \theta) = (4, \frac{3\pi}{2})$
   C. $(r, \theta) = (-3, \frac{3\pi}{4})$
   D. $(r, \theta) = (0, \frac{11\pi}{6})$

2. Convert $(2, \frac{2\pi}{3})$ into rectangular coordinates.

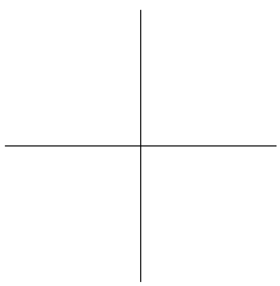
3. Convert $(-5, -5\sqrt{3})$ into polar coords.

4. Convert $r = 2$ to rectangular coords.

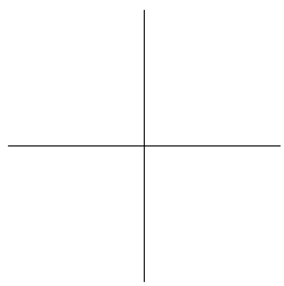
5. Convert $3\cos\theta$ to rectangular coords.

6. Graph the following polar curves:

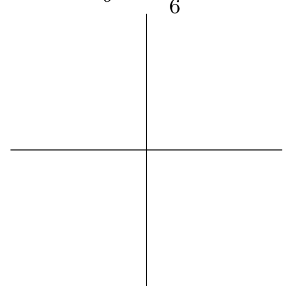
$r = 1$



$r = \theta$

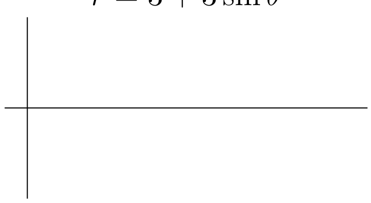


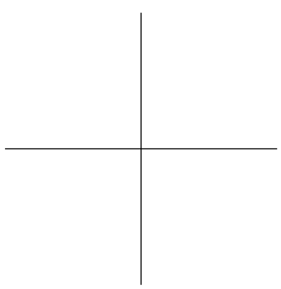
$\theta = \frac{5\pi}{6}$



7. Graph the following polar curves (Hint: first graph in rect. coords):

$r = 3 + 3\sin\theta$





$r = 3\cos\theta$