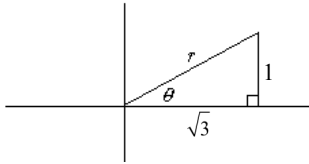


Aim: What is the polar coordinate system?

I. Do Now:

1. Find the value of r and $m\angle\theta$.



2. Convert $\frac{3\pi}{4}$ to degrees.

3. Evaluate:

$$\sin \frac{3\pi}{4}$$

$$\cos \frac{3\pi}{4}$$

$$\tan \frac{3\pi}{4}$$

II. Thus far, we have been using the *rectangular coordinate system* (also known as the *Cartesian coordinate system*, after the mathematician René Descartes). Now, we will learn the *polar coordinate system*, which has various applications, including circular and orbital motion, navigation, and radio antennas.

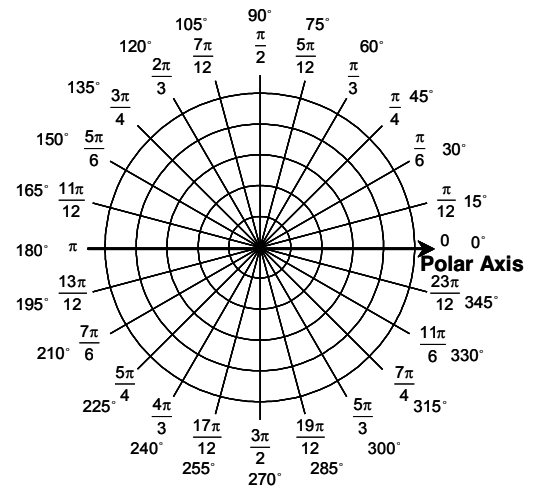
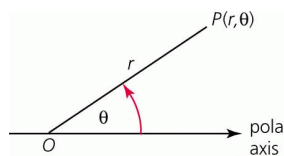
Polar Coordinate System:

A fixed point O is called the *pole* or origin.

The *polar axis* is usually a horizontal ray pointing to the right of the pole.

A point P can be identified by the polar coordinates (r, θ) , where:

- r is the directed distance from O to P .
- θ is the directed angle whose initial side is on the polar axis and whose terminal side is on the line OP .



III. Plotting Points in the Polar Coordinate System

4. Plot the following points on the graph below:

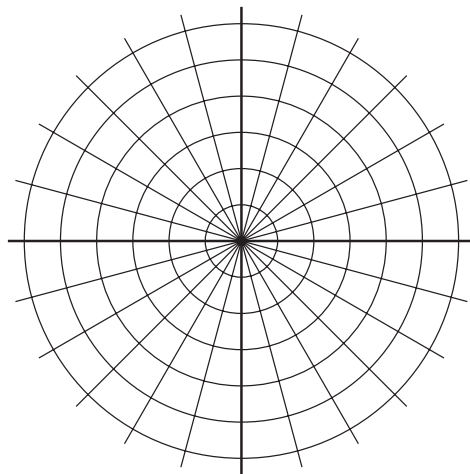
$$A\left(3, \frac{\pi}{4}\right)$$

$$B\left(2, \frac{\pi}{3}\right)$$

$$C\left(3, -\frac{\pi}{6}\right)$$

$$D\left(3, \frac{11\pi}{6}\right)$$

$$E\left(-2, \frac{4\pi}{3}\right)$$



5. Plot the following points on the graph below:

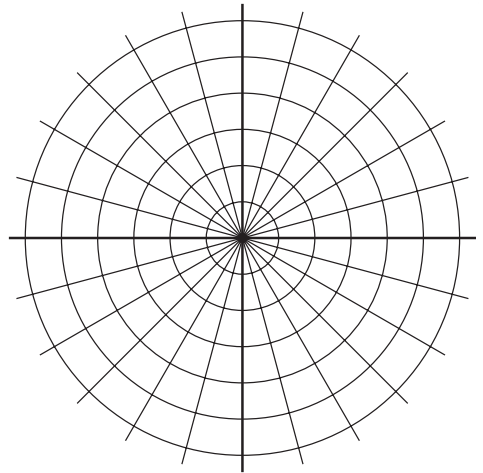
$$F(4, 60^\circ)$$

$$G(-4, 240^\circ)$$

$$H\left(3, \frac{2\pi}{3}\right)$$

$$I\left(-3, \frac{5\pi}{3}\right)$$

$$J\left(-2, \frac{4\pi}{3}\right)$$



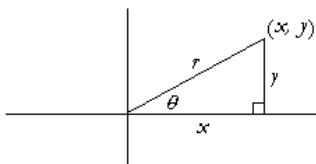
Observations:

IV. Converting from Polar Coordinates to Rectangular Coordinates

Given the triangle below, find:

(a) $\cos \theta$

(b) $\sin \theta$



V. Examples: Find the exact rectangular coordinates of each point:

6. $(3, 270^\circ)$

7. $\left(-2, -\frac{5\pi}{6}\right)$

8. $(-6, 120^\circ)$

9. $\left(-4, \frac{5\pi}{4}\right)$