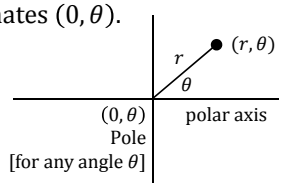
Section 10.1

Polar Coordinates

POLAR COORDINATES

The **polar coordinate system** is another way to specify points in a plane. Points are specified by the ***directed*** distance, r, form the pole and the ***directed*** angle, θ, measured counter-clockwise from the polar axis. The **pole** has coordinates $(0, \theta)$.



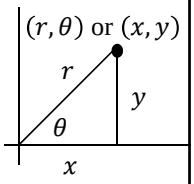
UNIQUESNESS OF POLAR COORDINATES

In polar coordinates, ordered pairs of points are ***NOT*** unique; that is, there are many "names" to describe the same physical location.

The point (r, θ) can also be represented by $(r, \theta + 2\pi k)$ and $(-r, \theta + \pi + 2\pi k)$.

CONVERTING BETWEEN RECTANGULAR AND POLAR COORDINATES

- Polar coordinates to rectangular coordinates
  $x = r\cos\theta \quad y = r\sin\theta$
- Rectangular coordinates to polar coordinates
  $r^2 = x^2 + y^2$
  $\tan\theta = \frac{y}{x}$

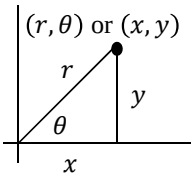


FUNCTIONS IN POLAR COORDINATES

A function in polar coordinates has the form $r = f(\theta)$.

Some examples:
1. $r = 4\cos\theta$
2. $r = 3$
3. $r = -3\sec\theta$

POLAR EQUATIONS TO RECTANGULAR EQUATIONS

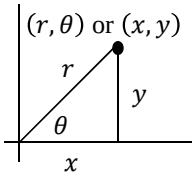


NOTE: $r = \sqrt{x^2 + y^2}$

To convert polar equations into rectangular equations use:

$$\cos\theta = \frac{x}{\sqrt{x^2 + y^2}}; \quad \sin\theta = \frac{y}{\sqrt{x^2 + y^2}};$$
$$r^2 = x^2 + y^2$$

RECTANGULAR EQUATIONS TO POLAR EQUATIONS



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

To convert rectangular equations to polar equations use:

$x = r\cos\theta \quad r^2 = x^2 + y^2$

$y = r\sin\theta \quad \tan\theta = \frac{y}{x}$