

Polar Coordinates



Preliminaries and Objectives

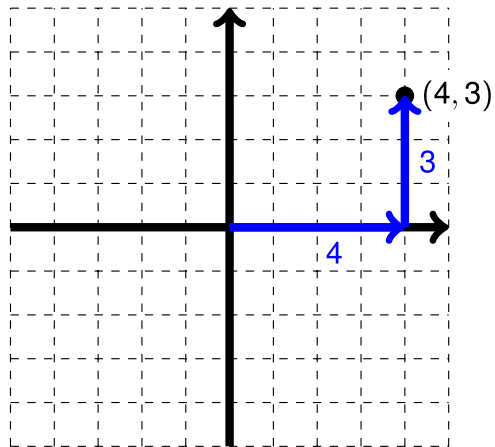
Preliminaries

- Rectangular (Cartesian) Coordinate System
- Definition of sin and cos

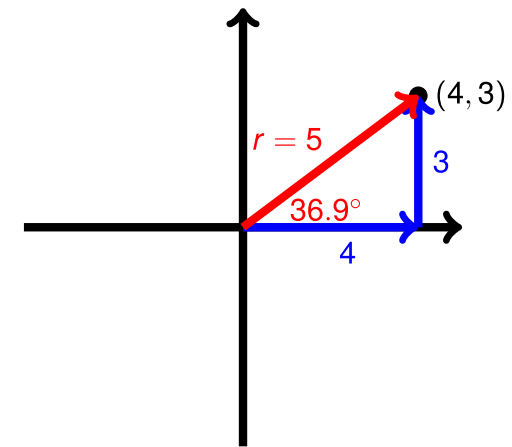
Objectives

- Convert from rectangular coordinates to polar coordinates
- Convert from polar coordinates to rectangular coordinates

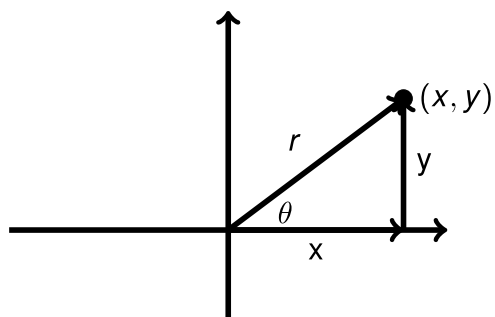
Cartesian and Polar Coordinate Systems



Cartesian and Polar Coordinate Systems



Polar Coordinates

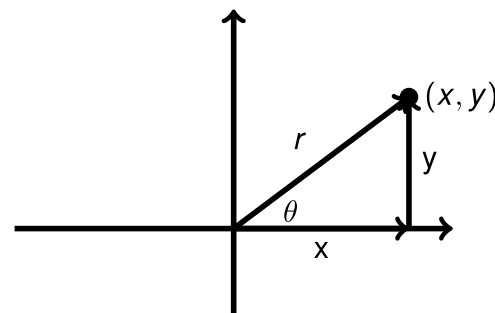


If we know x and y

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

$$\tan \theta = \frac{y}{x}$$

Polar Coordinates



If we know r and θ

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

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

$$x = r \cos \theta$$

$$y = r \sin \theta$$

Examples

Convert $(-6, 2)$ to polar coordinates

Solution: $r = \sqrt{(-6)^2 + 2^2} = \sqrt{40} \approx 6.325$ $\tan \theta = -\frac{1}{3}$, so we find $\tan^{-1} -\frac{1}{3} \approx -18.4^\circ$, but θ is in the second quadrant, so $\theta \approx 161.6^\circ$

Convert $r = 10$, $\theta = 276^\circ$ to Cartesian coordinates

Solution:

$$x = r \cos \theta = 10 \cos 276^\circ \approx 1.045$$

$$y = r \sin \theta = 10 \sin 276^\circ \approx -9.945$$

Recap

If we know x and y

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

$$\tan \theta = \frac{y}{x}$$

If we know r and θ

$$x = r \cos \theta$$

$$y = r \sin \theta$$