Polar Coordinates

UNIVERSITY OF MINNESOTA

Preliminaries and Objectives

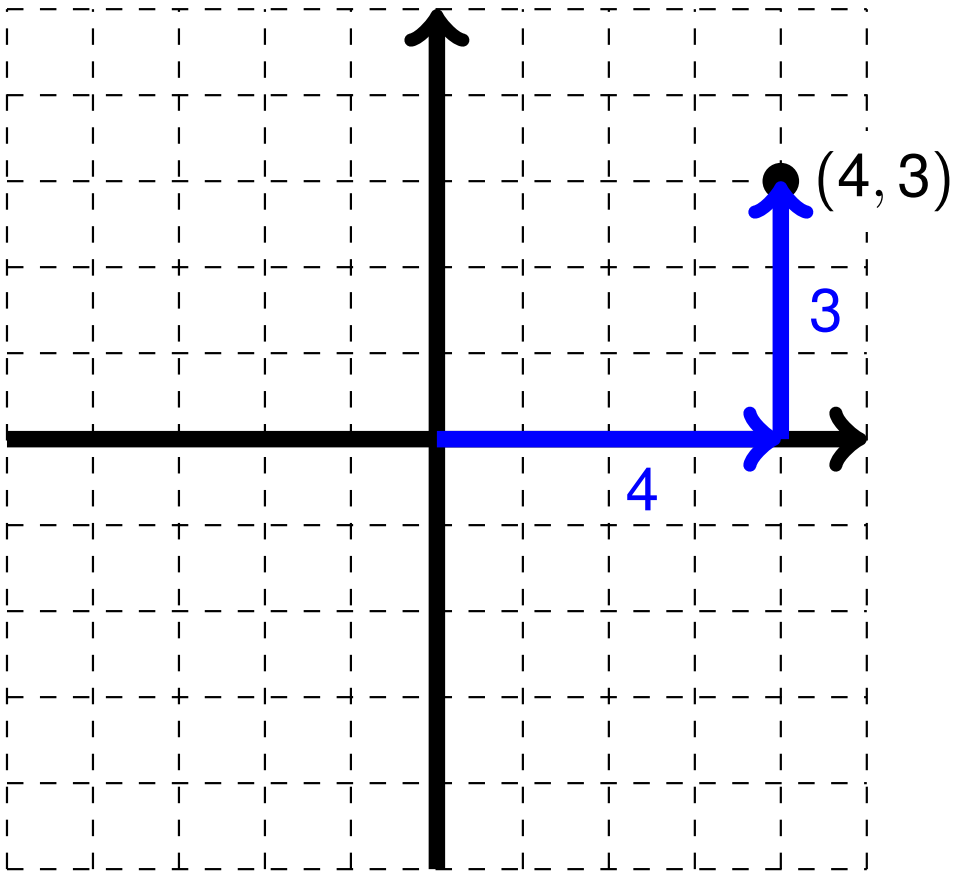
Preliminaries

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

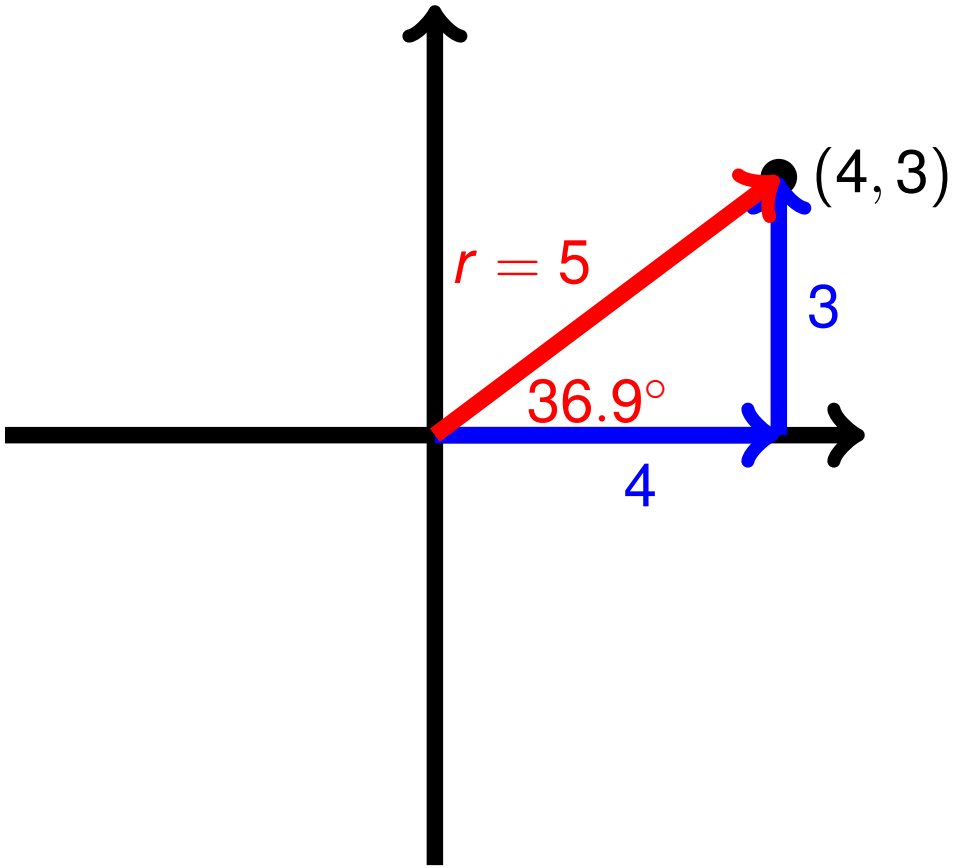
Objectives

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

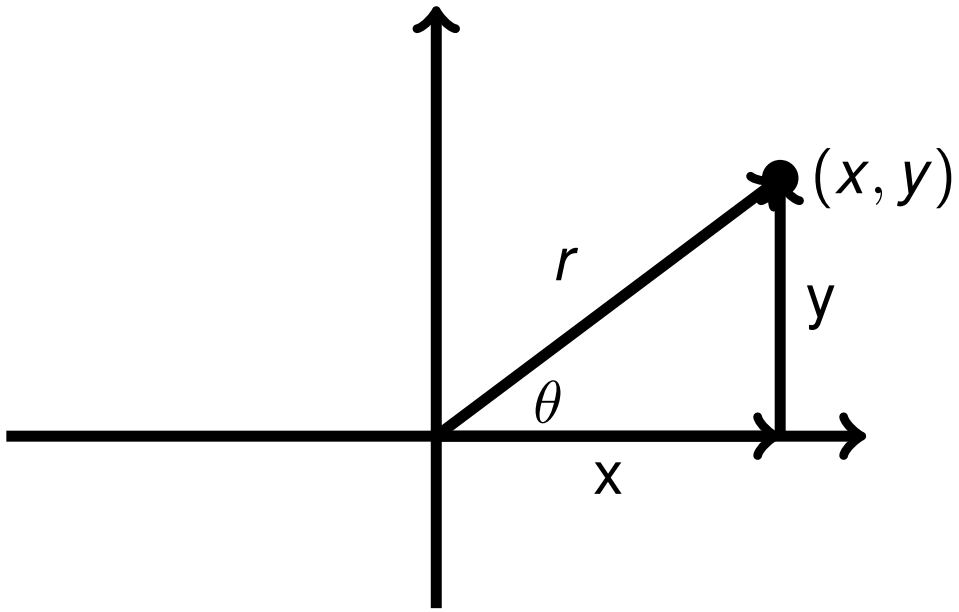
Cartesian and Polar Coordinate Systems



Cartesian and Polar Coordinate Systems



Polar Coordinates



If we know x and y

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

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

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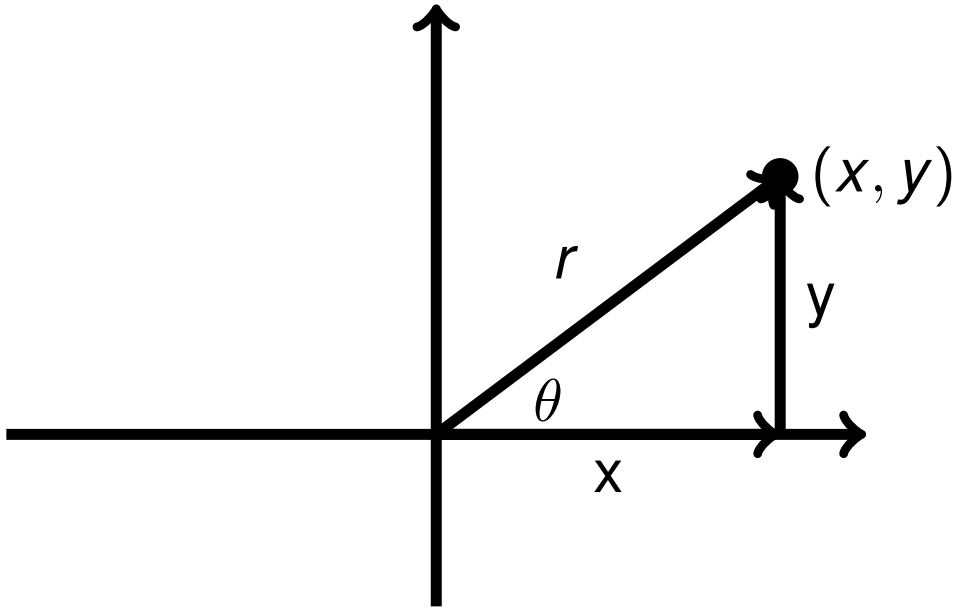

If we know r and θ

$$\cos\theta = \frac{x}{r} \qquad \sin\theta = \frac{y}{r}$$

$$x = r\cos\theta \qquad y = r\sin\theta$$

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 $\tan^{-1} -\frac{1}{3} \approx -18.4°$, but θ is in the second quadrant, so $\theta \approx 161.6°$

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

Solution:
$x = r\cos\theta = 10\cos 276° \approx 1.045$
$y = r\sin\theta = 10\sin 276° \approx -9.945$

Recap

If we know x and y

$$r = \sqrt{x^2 + y^2} \qquad \tan\theta = \frac{y}{x}$$

If we know r and θ

$$x = r\cos\theta \qquad y = r\sin\theta$$