**PreCalculus 10.7 Polar Coordinates**

$$P=\left(r,θ\right)$$

$$r$$

$$θ$$

pole

polar axis

 Rectangular (Cartesian) Coordinate System Polar Coordinate System

 $(x, y)$ $(r, θ)$

**Plotting Points on the Polar Coordinated System**

Example: $\left(3, -\frac{π}{3}\right)$

 Other names for the same point:

$$-\frac{π}{3}$$

Example: $\left(5, \frac{4π}{3}\right)$

 Other names for the same point:

Example: $\left(-1, 210°\right)$

 Other names for the same point:

**Coordinate Conversion**

 Polar-to-Rectangular Rectangular-to-Polar

 $x=r\cos(θ)$ $\tan(θ=\frac{y}{x})$

 $y=r\sin(θ)$ $r^{2}=x^{2}+y^{2}$

Example: Convert each point to rectangular coordinates.

 $\left(4, \frac{π}{2}\right)$

 $\left(2, \frac{2π}{5}\right)$

 $\left(7, 30°\right)$

Example: Convert each point to polar coordiantes.

 $\left(2, 2\right)$

 $\left(-1, 0\right)$

 $\left(-6, -2\right)$

**Converting Rectangular Equations to Polar Form**

1. Use substitutions
2. Solve for *r*

Examples: $x^{2}+y^{2}=9$

 $x=4$

 $2x+3y=6$

**Converting Polar Equations to Rectangular Form**

Examples: $r=1$

 $θ=\frac{π}{4}$

 $r=\csc(θ)$

 $r=2\cos(θ)$

 $r=\frac{1}{1-\cos(θ)}$