Pre-Calculus 120 A



Polar Coordinates

In a Cartesian coordinate system we identify each point in the plane according to a unique ordered pair of real numbers (x, y).

We can also locate a point according to its distance from the origin (pole) and rotation from the positive x-axis (polar axis). As illustrated in the diagram to the right, if P(x, y) is a point in the plane **r** units from the pole and a rotation **\theta** from the polar axis, then the ordered pair (x, y) can also be identified by (**r**, **\theta**). These coordinates are called the **polar coordinates** of P.



CONVERTING FROM POLAR COORDINATES (r, θ) TO RECTANGULAR COORDINATES (x, y):

- Find x using x = r cos θ (Since cos $\theta = \frac{x}{r}$)
- Find y using $y = r \sin \theta$ (Since $\sin \theta = \frac{y}{r}$)
- The rectangular coordinates are (x, y)

Example 1: Converting from Polar Coordinates to Rectangular Coordinates

Sketch a diagram and convert the following polar coordinates to *exact* rectangular coordinates.

a. (6, 135°) b. $(-5, \frac{5\pi}{3})$ c. (7, -150°)

Solution:



Pre-Calculus 120 A

CONVERTING FROM RECTANGULAR COORDINATES (x, y) TO POLAR COORDINATES (r, θ):

- Find the radius, r, using the Pythagorean relationship $r = \sqrt{x^2 + y^2}$.
- Find the reference angle, θ_R , using $\tan \theta_R = \left| \frac{y}{x} \right|$.
- Find the angle, θ , by determining the quadrant in which the terminal arm is located and using the reference angle, θ_R .
- The polar coordinates are (r, θ).

Example 2: Converting from Rectangular Coordinates to Polar Coordinates

Sketch a diagram and convert the following rectangular coordinates to polar coordinates.

a. P(8, 15) b. Q(7, -24)

Solution:

