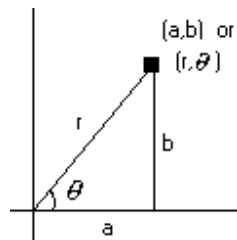**Polar And Rectangular Coordinates:**

A. Rectangular coordinates are what most people use when graphing coordinates.   Given the point (a,b) you move over 'a' spaces on the x -axis, and then up or down 'b' spaces on the y-axis.

B. Polar Coordinates are the same points as rectangular coordinates, only they are expressed in terms of 'r' and ' θ ' as the point (r, θ). Here is a picture of the relationship between polar and rectangular coordinates:

As you can see, r is the hypotenuse and θ is the angle.

C. Change from Rectangular to Polar:

1. To change from rectangular coordinates you sh ould be familiar with the *basic trigonometric properties* and also *Pythagorean Triples*.

2. r = $\sqrt{a^2 + b^2}$

3. $\theta = \tan^{-1}\left(\frac{b}{a}\right)$

Ex [1] If (2,2) = (r, θ), then θ = _____ (degrees)

a. The answer is $\tan^{-1}(^2/_2)$ or $\tan^{-1}(1) = 45$ degrees.

Ex [2] If (6,-8) = (r, θ), then r = _____

a. You should know the Pythagorean Triple (6,8,10). The answer is 10.

b. If you don't know this, then you can see that
$$\sqrt{6^2 + (-8)^2} = \sqrt{100} = 10$$

D. Changing from Polar to Rectangular

    1. Like above, you need to know *basic trigonometric properties*.

    2. $x = r \cos \theta$

    3. $y = r \sin \theta$

        Ex [1] If $(4, \dfrac{\pi}{3}) = (x,y)$ then $y = $ _____.

          a. The answer is $4\sin \dfrac{\pi}{3}$ which is $4(\sqrt{3}/2)$ which is $2\sqrt{3}$.

        Ex [2] If $(6, 60^\circ) = (x,y)$ then $x = $ _____.

          a. The answer is $6 \cos 60^\circ = 6 \times {}^{1}/_{2} = 3$.