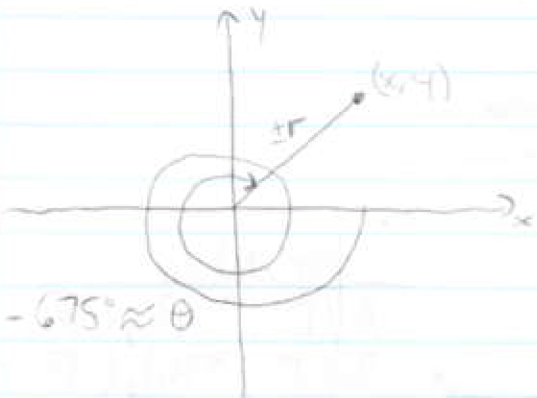
Gerardo Cortez

3/23/10

Today: Polar Coordinates

$\pm r$ = distance from (0,0)

$r^2 = x^2 + y^2$



$|r|$ = distance from (0,0)

θ is an angle from the positive x-axis to the ray from (0,0) to (x, y)

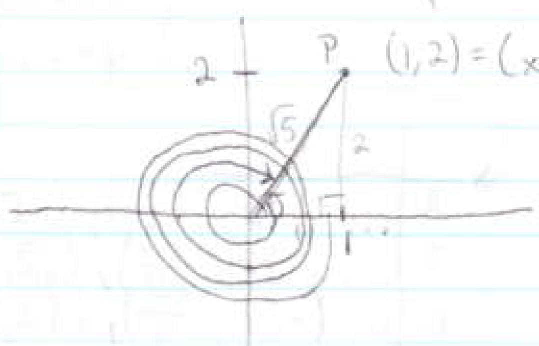
Official definition

$$\begin{cases} x = r\cos\theta \\ y = r\sin\theta \end{cases}$$

{ r, θ can be any real #s that satisfy these equations

Example

$(x, y) = (1, 2)$



"rectangular coordinates"

"cartesian coordinates"

Names for P in polar coordinates:

$(r, \theta) = (\sqrt{5}, \tan^{-1} 2)$

check → $\begin{cases} x = \sqrt{5}\cos(\tan^{-1} 2) = 1 \\ y = \sqrt{5}\sin(\tan^{-1} 2) = 2 \end{cases}$

counter-clockwise: $(r, \theta) = (\sqrt{5}, 2\pi + \tan^{-1} 2)$

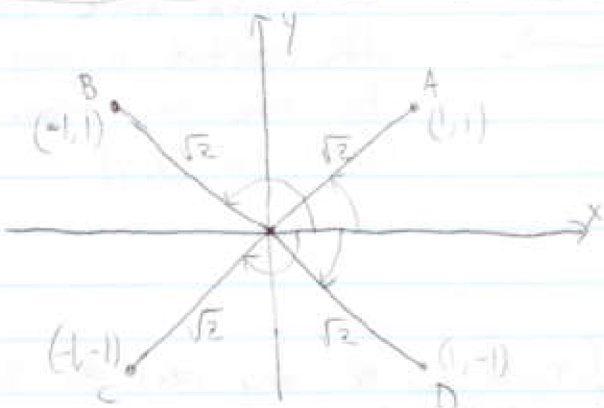
clockwise: $(r, \theta) = (\sqrt{5}, -6\pi + \tan^{-1} 2)$

Circle of radius 7, Write it as:

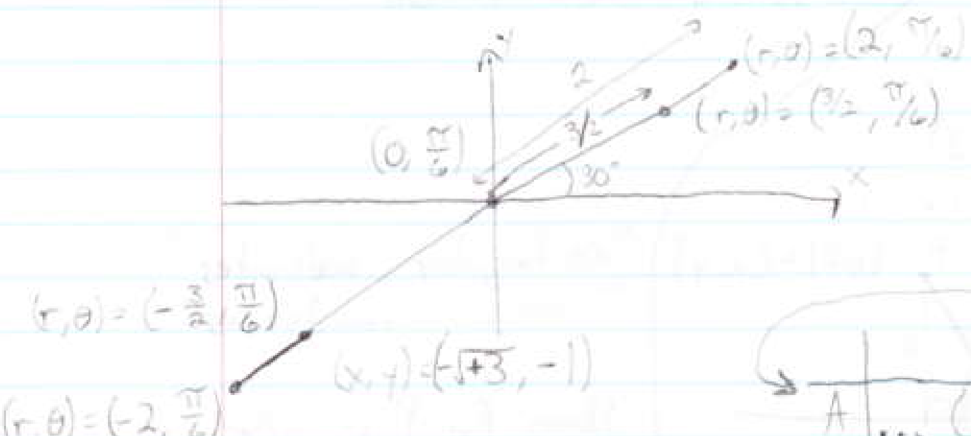
$x^2 + y^2 = 49$ (Cartesian equation)

$\left.\begin{array}{l} x = 7\cos t \\ y = 7\sin t \end{array}\right\}$ (Parametric equations)

$r = 7$ (Polar equation)



	(r, θ)
A	$(\sqrt{2}, \pi/4), (-\sqrt{2}, -\frac{3\pi}{4}),$
B	$(\sqrt{2}, 3\pi/4), (-\sqrt{2}, -\frac{\pi}{4}),$
C	$(\sqrt{2}, -\pi/4), (-\sqrt{2}, \frac{\pi}{4}),$
D	$(\sqrt{2}, -3\pi/4), (-\sqrt{2}, \frac{3\pi}{4}),$



$\theta = \frac{\pi}{6} = 30°$

r can be anything

$\left\{\begin{array}{l} x = r\cos \pi/6 = r\sqrt{3}/2 \\ y = r\sin \pi/6 = r/2 \end{array}\right.$

A	… $(\sqrt{2}, -\frac{7\pi}{4}), (-\sqrt{2}, \frac{5\pi}{4})$
B	… $(\sqrt{2}, -\frac{5\pi}{4}), (\sqrt{2}, -\frac{13\pi}{4})$
C	… $(-\sqrt{2}, \frac{7\pi}{4}), (\sqrt{2}, -\frac{11\pi}{4})$
D	…

Rotated the x-axis 30° counterclockwise.

x-values became r values