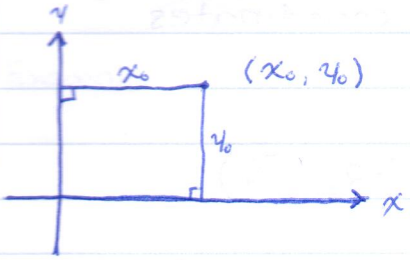
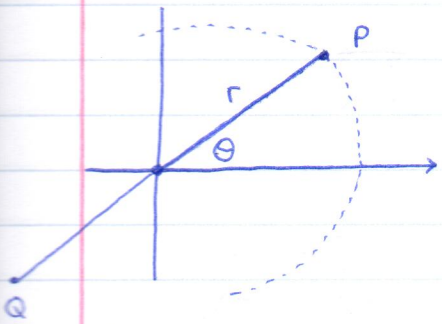
Polar Coordinates



Cartesian Coordinates



Polar Coordinates

r is the "signed" distance from the origin

θ is the angle measured from the positive x-axis

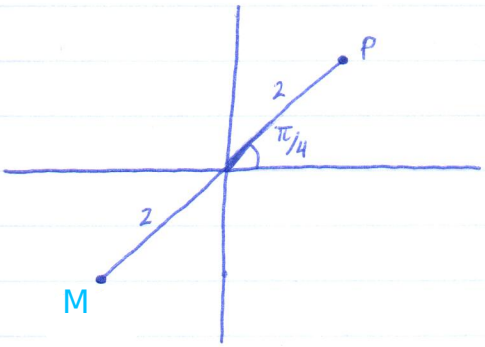
Point (r, θ)

Example:

consider the following point

$P = (2, \frac{\pi}{4})$ in polar coordinates.

$Q = (-2, \pi + \frac{\pi}{4})$, $M = (2, \pi + \frac{\pi}{4})$

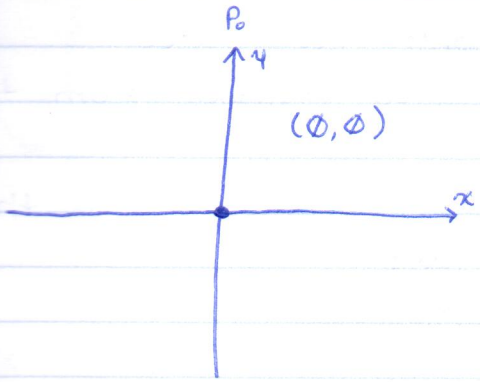


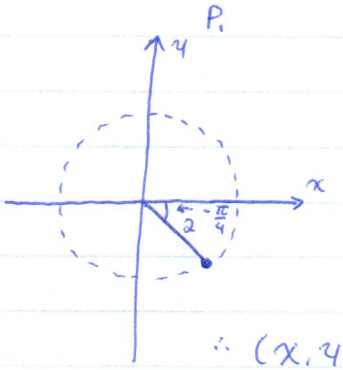
Note: Q=P

Notice: $(-r, \theta) = (r, \theta + \pi)$

g's: Given the following points in polar coordinates plot them.

$P_0\ (\emptyset, \pi)$, $P_1\ (2, -\pi/4)$ $P_2\ (-2, -\pi/4)$



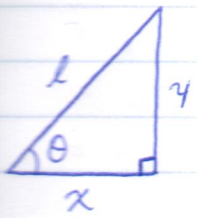


$\cos\frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$\sin\frac{\pi}{4} = \sqrt{2}/2$

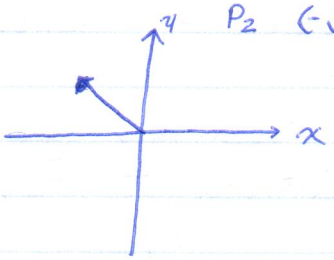
$\therefore (x, y) = (\sqrt{2}, -\sqrt{2})$

Triangle:



$x = l\cos\theta$

$y = l\sin\theta$



$P_2\ (-\sqrt{2}, \sqrt{2})$

opposite direction to P_1

Polar Coordinates

Example

given cartesian

(a) $(\sqrt{3}, 1)$ (b) $(1, -\sqrt{3})$ (c) $(-1, \emptyset)$

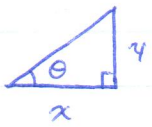
Find Polar coordinates.

Soln: Recall: $x = r\cos\theta$, $y = r\sin\theta$

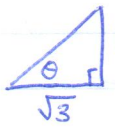
Given x, y

(i) Find $r \Rightarrow r^2 = x^2 + y^2$

(ii) Find θ



(a) $x = \sqrt{3}$, $y = 1$

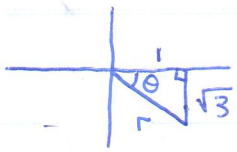


$r^2 = 1^2 + (\sqrt{3})^2$ $\quad \tan\theta = 1/\sqrt{3}$

$r = 2$ $\quad \theta = \pi/6$

$(2, \pi/6)$

(b) $x = 1$, $y = -\sqrt{3}$



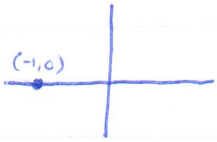
$r = 2$

$\theta = \pi/3$

point is $(2, -\frac{\pi}{3})$

OR $(2, 5\pi/3)$

(c) $x = -1$ $\quad y = \emptyset$



$r = 1$ $\quad \theta = \pi$

$(1, \pi)$