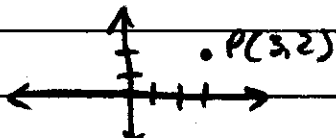
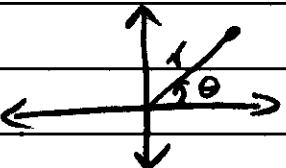
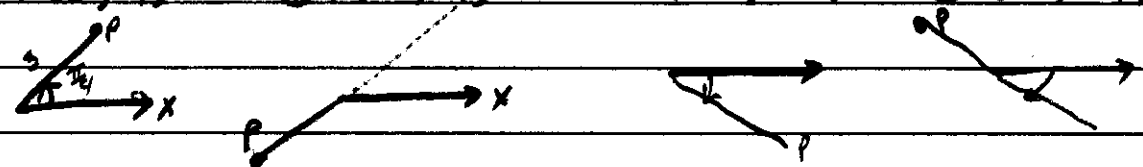


# Trig 11.5 Polar Coordinates


x, y coordinates  has 2 elements,  $x$  &  $y$

Polar coordinates  has 2 elements, distance =  $r$  and angle =  $\theta$

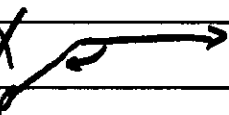
Draw the following points


- ①  $P(3, \frac{\pi}{4})$     ②  $P(-3, \frac{\pi}{4})$     ③  $P(3, -\frac{\pi}{4})$     ④  $P(-3, -\frac{\pi}{4})$
- 

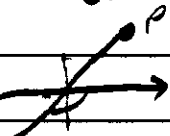
Which Polar coordinates represent the same point as  $P(3, \frac{\pi}{3})$ ?

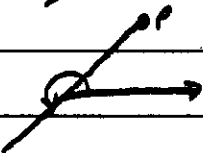
a)  $(3, \frac{2\pi}{3})$  ✓ 




b)  $(3, -\frac{2\pi}{3})$  ✗ 

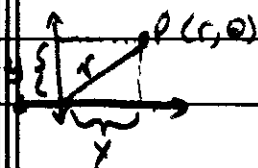
c)  $(3, -\frac{\pi}{3})$  ✗ 

d)  $(-3, \frac{4\pi}{3})$  ✓ 

e)  $(-3, \frac{2\pi}{3})$  ✓ 

f)  $(-3, -\frac{\pi}{3})$  ✗ 

# Trig 11.5



$$\cos \theta = \frac{x}{r}$$

$$\sin \theta = \frac{y}{r}$$

$$\Rightarrow \begin{cases} x = r \cdot \cos \theta \\ y = r \cdot \sin \theta \end{cases} \Rightarrow P(r \cdot \cos \theta, r \cdot \sin \theta)$$

Convert polar coordinates to x, y coordinates

$P(3, \frac{\pi}{4})$  - Find it's (plane) x, y coordinates

$$r = 3 \quad x = r \cdot \cos \theta = 3 \cdot \cos \frac{\pi}{4} = 3 \cdot \frac{\sqrt{2}}{2} = \frac{3\sqrt{2}}{2}$$

$$\theta = \frac{\pi}{4} \quad y = r \cdot \sin \theta = 3 \cdot \sin \frac{\pi}{4} = 3 \cdot \frac{\sqrt{2}}{2} = \frac{3\sqrt{2}}{2} \quad P\left(\frac{3\sqrt{2}}{2}, \frac{3\sqrt{2}}{2}\right)$$

Find x, y coordinates given  $P(-1, \frac{2\pi}{3})$

$$r = -1 \quad x = r \cdot \cos \theta = (-1) \cdot \cos \frac{2\pi}{3} = (-1) \cdot \left(-\cos \frac{\pi}{3}\right) = (-1) \cdot \left(-\frac{1}{2}\right) = \frac{1}{2}$$

$$\theta = \frac{2\pi}{3} \quad y = r \cdot \sin \theta = (-1) \cdot \sin \frac{2\pi}{3} = (-1) \cdot \left(\sin \frac{\pi}{3}\right) = (-1) \cdot \left(\frac{\sqrt{3}}{2}\right) = -\frac{\sqrt{3}}{2}$$

$$\text{so } P(x, y) = \left(\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$$

Given  $P(-1, 1)$  Find it's  $P(r, \theta)$

$$x = -1 \quad r = \sqrt{x^2 + y^2} = \sqrt{(-1)^2 + (1)^2} = \sqrt{2}$$

$$y = 1 \quad \tan \theta_r = \left|\frac{y}{x}\right| = \left|\frac{1}{-1}\right| = 1$$

$$\theta_r = 45^\circ \quad \theta = 180^\circ - 45^\circ = 135^\circ \quad P(\sqrt{2}, 135^\circ)$$

Given  $P(7, -7\sqrt{3})$  Find it's  $P(r, \theta)$

$$x = 7 \quad r = \sqrt{x^2 + y^2} = \sqrt{7^2 + (-7\sqrt{3})^2} = \sqrt{7^2 + 7^2 \cdot 3} = \sqrt{7^2(1+3)}$$

$$y = -7\sqrt{3} \quad = \sqrt{7^2 + 2^2} = 7 \cdot 2 = 14$$

$$\tan \theta_r = \left|\frac{y}{x}\right| = \left|\frac{-7\sqrt{3}}{7}\right| = \sqrt{3} = 60^\circ$$

$$\theta = 360^\circ - 60^\circ = 300^\circ$$

$$P(14, 300^\circ)$$