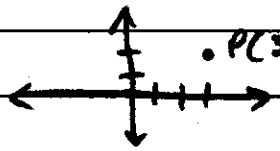
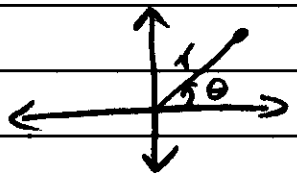
Trig 11.5 Polar Coordinates

x, y coordinates 

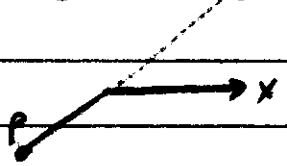
has 2 elements, x & y

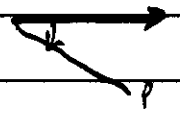
Polar coordinates 

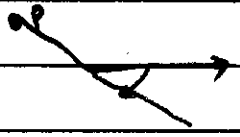
has 2 elements, distance = r and angle = θ

Draw the following points

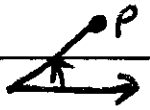
① $P(3, \frac{\pi}{4})$ 

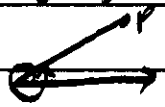
② $P(-3, \frac{\pi}{4})$ 

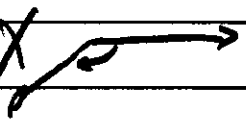
③ $P(3, -\frac{\pi}{4})$ 

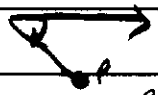
④ $(-3, -\frac{\pi}{4})$ 

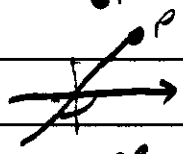
Which Polar coordinates represent the same point as $P(3, \frac{\pi}{3})$?

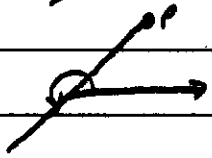


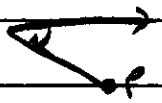
a) $(3, \frac{7\pi}{3})$ ✓ 

b) $(3, -\frac{2\pi}{3})$ ✗ 

c) $(3, -\frac{\pi}{3})$ ✗ 

d) $(-3, \frac{4\pi}{3})$ ✓ 

e) $(-3, \frac{4\pi}{3})$ ✓ 

f) $(-3, -\frac{\pi}{3})$ ✗ 

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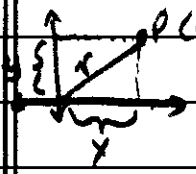

$\cos\theta = \frac{x}{r}$ $\sin\theta = \frac{y}{r}$ $\Rightarrow$ $\boxed{\begin{array}{l} x = r\cdot\cos\theta \\ y = r\cdot\sin\theta \end{array}}$ $\Rightarrow P(r\cdot\cos\theta, r\cdot\sin\theta)$

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

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

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

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

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

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

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

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

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

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

$y = -7\sqrt{3}$ $\quad = \sqrt{7^2+2^2} = 7.2 = 14$

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

$\theta = 360° - 60° = 300°$

$P(14, 300°)$