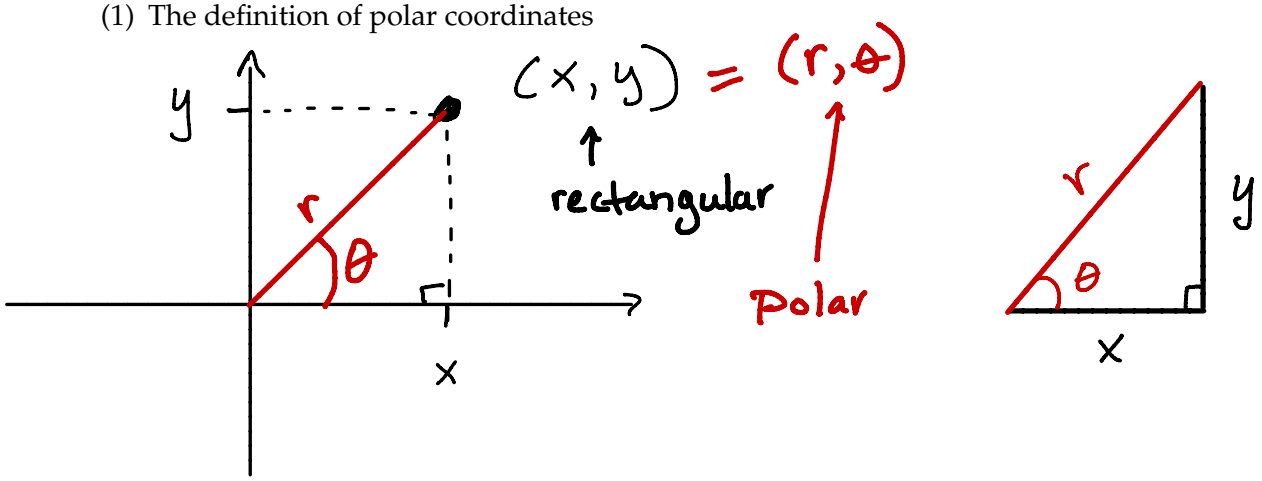
SECTION 7.3: POLAR COORDINATES (DAY 1)

(1) The definition of polar coordinates



Conversion formulas

$\sin\theta = \frac{y}{r}$, $\cos(\theta) = \frac{x}{r}$

or

$y = r\sin\theta$

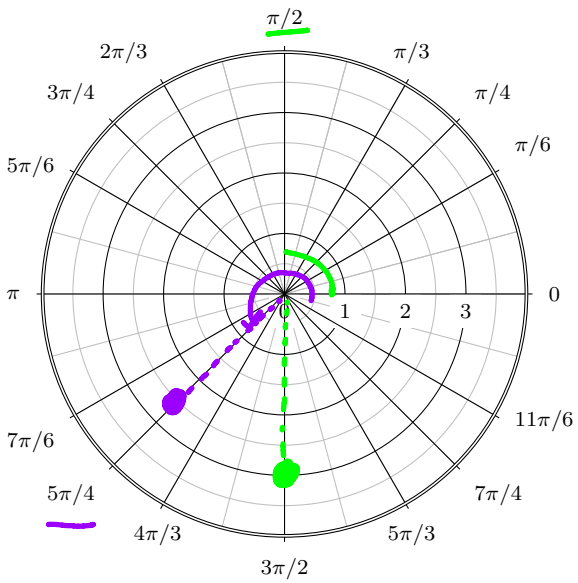
$x = r\cos\theta$

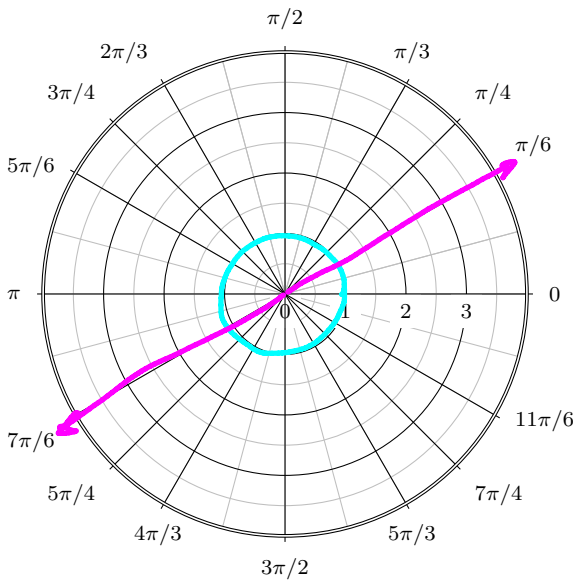
$x^2 + y^2 = r^2$

$\tan(\theta) = \frac{y}{x}$

Find other coordinates for P and Q: $P(2.5, 3\pi/4)$ $Q(3, \frac{3\pi}{2})$

(2) In the polar grids below, graph the points $P = (2.5, 5\pi/4)$, $Q = (-3, \pi/2)$, $r = 1$, and $\theta = \pi/6$.





SECTION 7.3: POLAR COORDINATES (DAY 2)

(1) The points below are in polar coordinates. Convert them to rectangular coordinates.

(a) $(5, 5\pi/3)$

$x = r\cos\theta = 5\cos(5\pi/3) = 5 \cdot \frac{1}{2} = 5/2$

$y = r\sin\theta = 5\sin(\frac{5\pi}{3}) = 5(-\frac{\sqrt{3}}{2}) = -5\sqrt{3}/2$

$(\frac{5}{2}, \frac{-5\sqrt{3}}{2})$

(b) $(-0.5, -5\pi/6)$ $= (\frac{1}{2}, \frac{\pi}{6})$

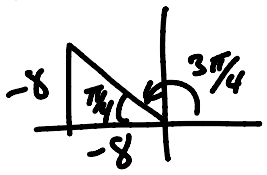
$x = \frac{1}{2}\cos(\frac{\pi}{6}) = \frac{1}{2} \cdot \frac{\sqrt{3}}{2} = \sqrt{3}/4$

$y = \frac{1}{2}\sin(\frac{\pi}{6}) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

$(\sqrt{3}/4, 1/4)$

(2) The points below are in rectangular coordinates. Convert them to polar coordinates.

(a) $(-8, 8)$

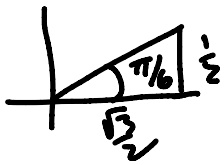


$r = \sqrt{8^2 + 8^2} = 8\sqrt{2}$

$(8\sqrt{2}, 3\pi/4)$

(b) $(2\sqrt{3}, 2)$ $= (4(\frac{\sqrt{3}}{2}), 4(\frac{1}{2}))$

$(2, \pi/6)$

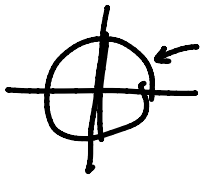


$\theta = \pi/6$

$r = \sqrt{4 \cdot 3 + 4} = 2$

(3) Describe the graph of each polar equation below and convert it to a rectangular equation.

(a) $r = 4$

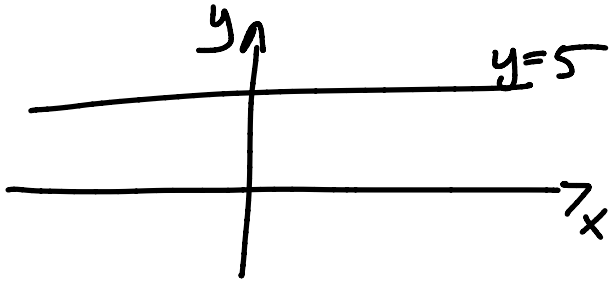


circle center (0, 0)
radius 4

$r^2 = 16$

$x^2 + y^2 = 16$

(b) $r = 5\csc(\theta)$ $= \frac{5}{\sin\theta}$



$r\sin\theta = 5$

$y = 5$

Convert P and Q into rectangular

Point P $(2.5, \frac{5\pi}{4})$ in polar is $\left(\frac{-2.5\sqrt{2}}{2}, \frac{-2.5\sqrt{2}}{2}\right)$ in rectangular.

$x = 2.5\cos\left(\frac{5\pi}{4}\right) = 2.5\left(\frac{-\sqrt{2}}{2}\right)$

$y = 2.5\sin\left(\frac{5\pi}{4}\right) = 2.5\left(\frac{-\sqrt{2}}{2}\right)$

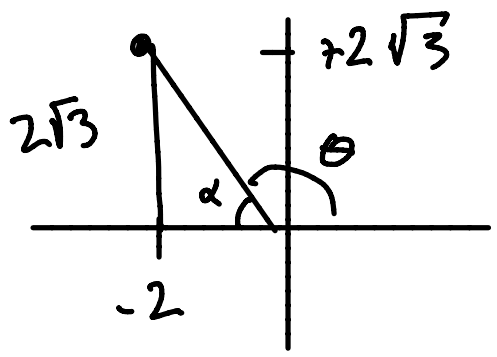
Q $(-3, \frac{\pi}{2})$ in polar is $(0, -3)$ in rectangular.

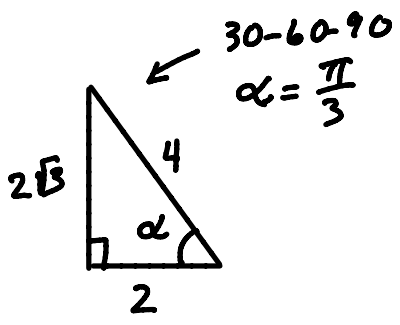
Convert the point $(-2, 2\sqrt{3})$ in rectangular coordinates to polar coordinates.

ANS: $(-2, 2\sqrt{3})$ converted to polar is $\left(4, \frac{2\pi}{3}\right)$

Solution: Find r: $r = \sqrt{(-2)^2 + (2\sqrt{3})^2} = \sqrt{4+12} = \sqrt{16} = 4$

Find θ





So $\theta = \pi - \frac{\pi}{3} = \frac{2\pi}{3}$