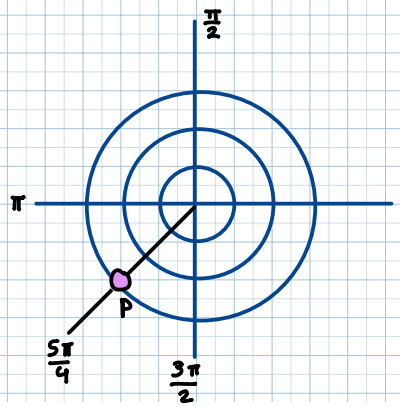
1. Graph the point $p = (3: \frac{5\pi}{4})$ on a polar grid. Convert p to rectangular coordinates.

$r = 3, \quad \theta = \frac{5\pi}{4}$

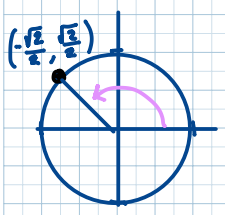


2. Convert $(-5, 5)$ into polar coordinates.

r distance from origin :

$\|(-5,5) - (0,0)\| = \sqrt{(-5)^2 + (5)^2} = \sqrt{50} = 5\sqrt{2}$

θ angle in $[0, 2\pi)$ so that



$x = r\sin(\theta)$ and $y = r\cos(\theta)$

$5 = 5\sqrt{2}\sin(\theta)$ and $-5 = 5\sqrt{2}\cos(\theta)$

$\frac{\sqrt{2}}{2} = \sin(\theta)$ and $-\frac{\sqrt{2}}{2} = \cos(\theta)$

$\theta = \frac{3\pi}{4}$

So $(-5,5)$ in polar coordinates is $(5\sqrt{2} : \frac{3\pi}{4})$.

3. Convert the polar equation $r - 9 = 0$ into rectangular coordinates.

$r = \sqrt{x^2 + y^2}$

$r - 9 = 0$

$r = 9$

$r^2 = 9^2$

$x^2 + y^2 = 81$ circle centered at $(0,0)$ with radius $r = 9$.

4. Convert the polar equation $r\sin(\theta) + 5r\cos(\theta) = 2$ into rectangular coordinates.

$r\sin(\theta) = y$ and $r\cos(\theta) = x$

$r\sin(\theta) + 5r\cos(\theta) = 2$

$y + 5x = 2$

$y = 2 - 5x$ line with slope -5 and y-intercept at 2.

5. Convert the rectangular equation $x^2 + (y-1)^2 = 4$ into a polar equation.

$x = r\cos(\theta)$ and $y = r\sin(\theta)$

$x^2 + (y-1)^2 = 4$

$r^2\cos^2(\theta) + (r\sin(\theta) - 1)^2 = 4$

$r^2\cos^2(\theta) + r^2\sin(\theta) - 2r\sin(\theta) + 1 = 4$

$r^2(\cos^2(\theta) + \sin^2(\theta)) - 2r\sin(\theta) = 3$

$r^2 - 2r\sin(\theta) - 3 = 0$