# Converting Rectangular Equations to Polar Equations & Polar Eqns to Rect. Eqns

Remember our conversions:

$r^2 = x^2 + y^2$ $\quad x = r\cos\theta$

$\theta = \tan^{-1}\left(\frac{y}{x}\right)$ $\quad y = r\sin\theta$

## Polar → Rect

① $(r)^2 = (5)^2$

$r^2 = 25$

substitute

$\boxed{x^2 + y^2 = 25}$

② $(r) = (3\sin\theta)\cdot r$

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

$\boxed{x^2 + y^2 = 3y}$

☆ Sometimes we multiply by r to get $r^2$, other times we square both sides.

③ $\theta = \frac{\pi}{3}$ tan

$\tan\left(\tan^{-1}\left(\frac{y}{x}\right)\right) = \tan\left(\frac{\pi}{3}\right)$

$\frac{y}{x} = \tan\left(\frac{\pi}{3}\right)$

$\frac{y}{x} = \sqrt{3}$

$\boxed{y = x\sqrt{3}}$

④ $r = -6\sec\theta$

$\cos\theta(r) = \left(\frac{-6}{\cos\theta}\right)\cos\theta$

$r\cos\theta = -6$

$\boxed{x = -6}$

⑤ $r = \frac{13}{10\cos\theta - 7\sin\theta}$

mult. by denom.

$r(10\cos\theta - 7\sin\theta) = 13$

$10r\cos\theta - 7r\sin\theta = 13$

$\boxed{10x - 7y = 13}$

## Rect → Polar

① $x + y = 2$

$r\cos\theta + r\sin\theta = 2$

Put into $r =$ form...

$\frac{r(\cos\theta + \sin\theta)}{\cos\theta + \sin\theta} = \frac{2}{\cos\theta + \sin\theta}$

$\boxed{r = \frac{2}{\cos\theta + \sin\theta}}$

② $\left(\frac{x^2}{9} + \frac{y^2}{4} = 1\right)\cdot 36$

$4x^2 + 9y^2 = 36$

$4r^2\cos^2\theta + 9r^2\sin^2\theta = 36$

$\frac{r^2(4\cos^2\theta + 9\sin^2\theta)}{4\cos^2\theta + 9\sin^2\theta} = \frac{36}{4\cos^2\theta + 9\sin^2\theta}$

$\sqrt{r^2} = \sqrt{\frac{36}{4\cos^2\theta + 9\sin^2\theta}}$

$\boxed{r = \sqrt{\frac{36}{4\cos^2\theta + 9\sin^2\theta}}}$