Algorithm for finding Polar coords.

$x = r\cos\theta$
$y = r\sin\theta$ $\Longrightarrow$ ✓ $r = \sqrt{x^2+y^2}$

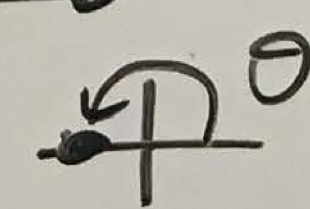
$\tan\theta = \frac{y}{x}$ BUT $\theta \neq \arctan\left(\frac{y}{x}\right)$ in general

Find $\theta \in [0, 2\pi)$

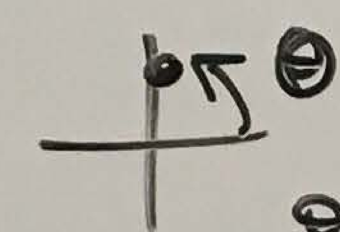
- if $x = y = 0$, θ is undefined

else if $x>0, y=0$, $\theta = 0$

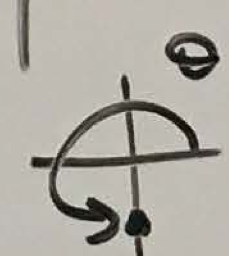
else if $x<0, y=0$, $\theta = \pi$



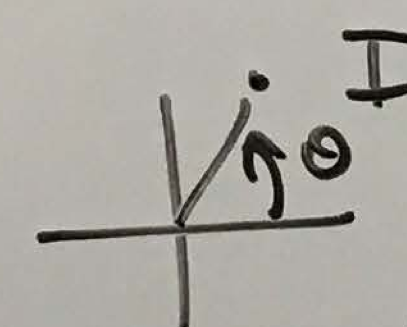
else if $x=0, y>0$, $\theta = \frac{\pi}{2}$



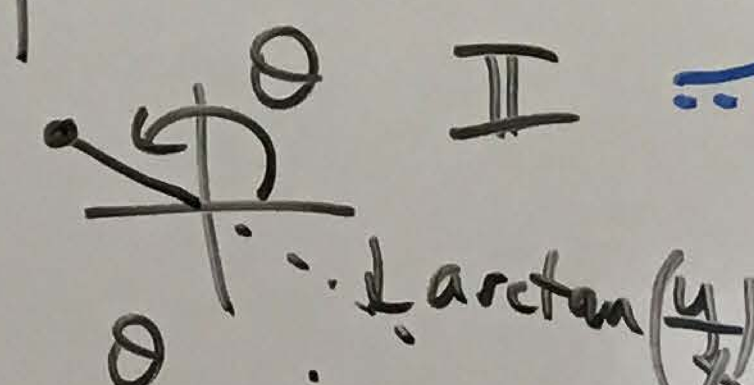
else if $x=0, y<0$, $\theta = \frac{3\pi}{2}$



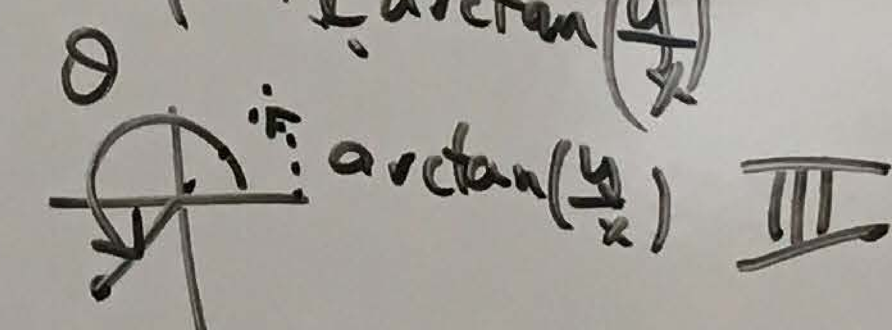
else if $x>0, y>0$, $\theta = \arctan\left(\frac{y}{x}\right)$



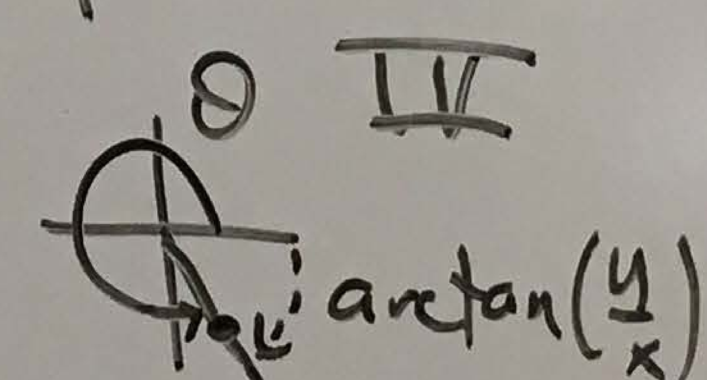
else if $x<0, y>0$, $\theta = \arctan\left(\frac{y}{x}\right) + \pi$



else if $x<0, y<0$, $\theta = \arctan\left(\frac{y}{x}\right) + \pi$

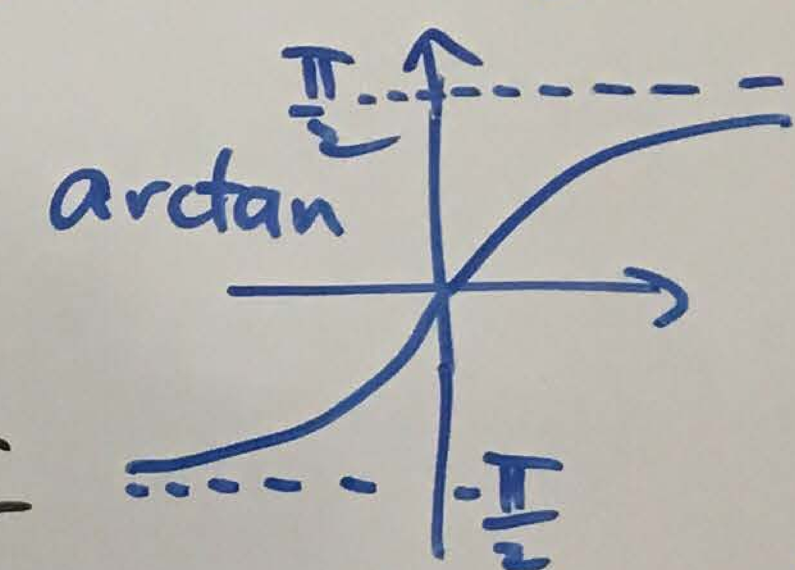


else if $x>0, y<0$, $\theta = \arctan\left(\frac{y}{x}\right) + 2\pi$



else print "bug in program".

Definition: $\arctan(t)$ is the angle, between $-\frac{\pi}{2}$ and $\frac{\pi}{2}$, whose tangent is t.



$\tan\theta = t$ has infinitely many solutions:

$\theta = \arctan(t) + n\pi$

for any integer n.