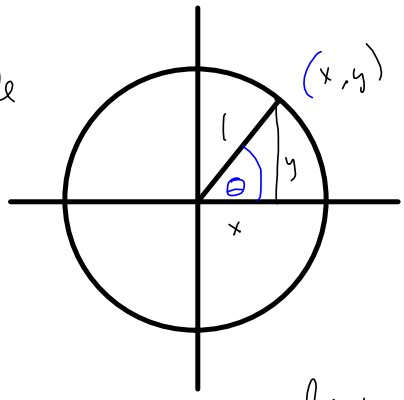
Unit circle



$(x,y) = (\cos\theta, \sin\theta)$

$r = 1$

$x = \cos\theta$

$y = \sin\theta$

general: $x = r\cos\theta$

$y = r\sin\theta$

Eliminate Parameter, θ:

Pythagorus

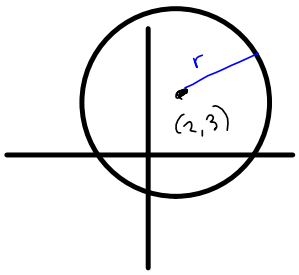
$$x^2 + y^2 = r^2\cos^2\theta + r^2\sin^2\theta$$
$$= r^2(\cos^2\theta + \sin^2\theta)$$
$$= r^2$$

i.e., $x^2 + y^2 = r^2$

$x = 2 + r\cos\theta$

$y = 3 + r\sin\theta$

circle of radius r, centered @ $(2,3)$



$x - 2 = r\cos\theta$

$\frac{x-2}{r} = \cos\theta$

$y - 3 = r\sin\theta$

$\frac{y-3}{r} = \sin\theta$

$$\left(\frac{x-2}{r}\right)^2 + \left(\frac{y-3}{r}\right)^2 = \cos^2 + \sin^2\theta = 1$$

$$\frac{(x-2)^2}{r^2} + \frac{(y-3)^2}{r^2} = 1$$

$$(x-2)^2 + (y-3)^2 = r^2$$

$x = 5\cos\theta$

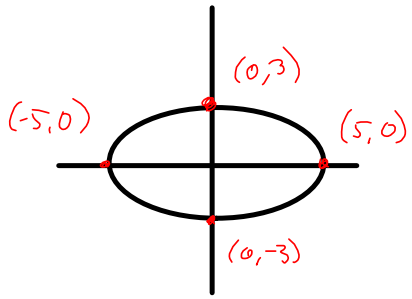
$y = 3\sin\theta$

$\frac{x}{5} = \cos\theta$

$\frac{y}{3} = \sin\theta$

$\left(\frac{x}{5}\right)^2 + \left(\frac{y}{3}\right)^2 = \cos^2\theta + \sin^2\theta = 1$

$\frac{x^2}{5^2} + \frac{y^2}{3^2} = 1$



$x = 7 + 5\cos\theta$

$y = -3 + 3\sin\theta$

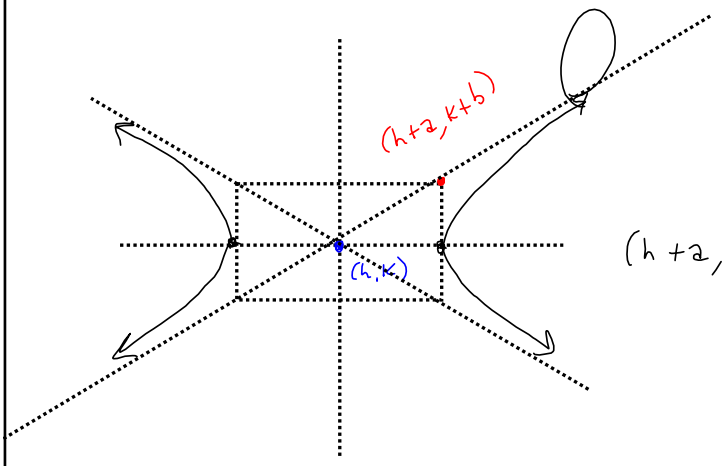
$\vdots$

$\frac{(x-7)^2}{25} + \frac{(y+3)^2}{9} = 1$

Hyperbolas

)(

$$\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1 \Rightarrow \frac{(x-h)^2}{a^2} = 1 + \frac{(y-k)^2}{b^2}$$



$$\frac{(h+a-h)^2}{a^2} - \frac{(k-k)^2}{b^2} \stackrel{?}{=} 1$$

$1 - 0 = 1$? yes

so)(

Try $(h, k+b)$

$$\frac{(h-h)^2}{a^2} - \frac{b^2}{b^2} = 1$$

$-1 = 1$ No way!

So Not ⌣

$$\frac{(y-k)^2}{b^2} - \frac{(x-h)^2}{a^2} = 1$$

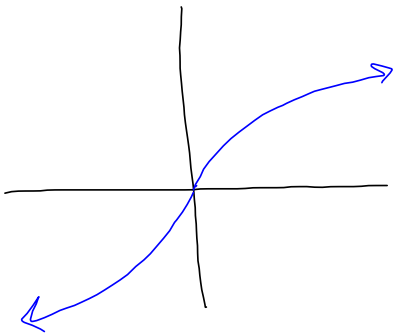
⌢

⌢

$f(x) = x^{\frac{\text{odd}}{\text{odd}}}$

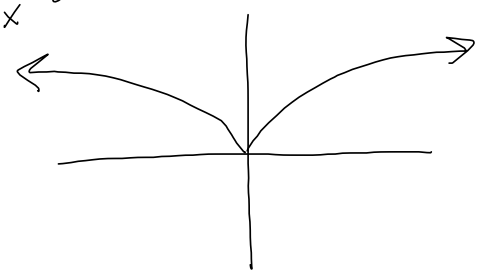
$x^{\frac{3}{5}}$

$x^{\frac{5}{7}}$, $x^{\frac{151}{203}}$

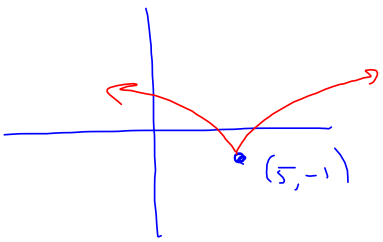


$y = x^{\frac{2}{3}}$

$f(x) = x^{\frac{\text{even}}{\text{odd}}}$

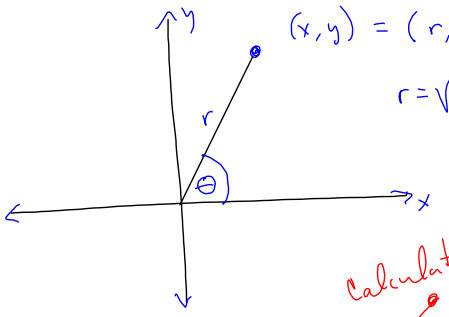


$y = (x-5)^{\frac{2}{3}} - 1$



Polar Coords

Polar



$(x,y) = (r,\theta)$

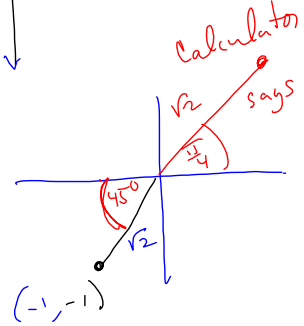
$r = \sqrt{x^2+y^2}$

θ = ? Be careful!

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

$\theta = \arctan\left(\frac{y}{x}\right)$?

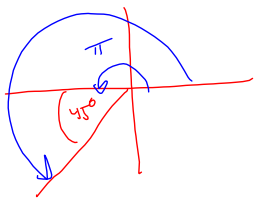
NOT QUITE!



$\theta = \arctan\left(\frac{-1}{-1}\right)$, right?

So, $(r,\theta) = (\sqrt{2}, 45^\circ)$ or $(\sqrt{2}, \frac{\pi}{4})$

You KNOW you're in QIII & calculator gives REFERENCE ANGLE of $\frac{\pi}{4} = 45^\circ$



$\pi + \frac{\pi}{4} = \frac{5\pi}{4}$

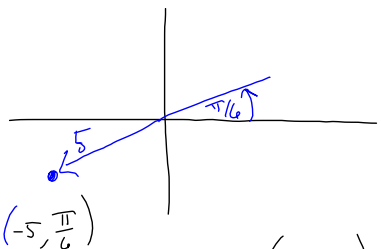
$180^\circ + 45^\circ = 225^\circ$

So, NO!

It's $(\sqrt{2}, 225^\circ)$ or $(\sqrt{2}, \frac{5\pi}{4})$

There's No unique way to represent this points in polar coords.

ALSO, r can be negative!



$(r,\theta) = (-5, \frac{\pi}{6})$

$r < 0$!? go in opposite direction?!

$\left(-5, \frac{\pi}{6}\right) = \left(5, \frac{7\pi}{6}\right) = \left(5, \frac{19\pi}{6}\right)$