

Warm up

Get ready for Quiz

Objective: Convert polar coordinates and equations to rectangular form, and convert rectangular equations to polar form.

Polar \rightarrow Rectangular

Point P with polar coordinates (r, θ) has rectangular coordinates (x, y) , where

$$\underline{x = r \cos \theta} \quad \text{and} \quad \underline{y = r \sin \theta}$$

Rectangular \rightarrow Polar

Point P with rectangular coordinates (x, y) has polar coordinates (r, θ) , where

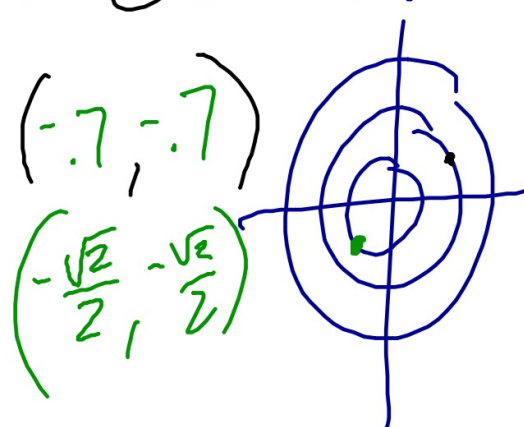
$$\underline{r^2 = x^2 + y^2} \quad \text{and} \quad \underline{\tan \theta = \frac{y}{x}}$$

Convert each point from polar to rectangular:

a. $(2, \pi/6)$
 $r \quad \theta$

$$\begin{aligned} & x, y \\ & (2 \cos \frac{\pi}{6}, 2 \sin \frac{\pi}{6}) \\ & (1.7, 1) \end{aligned}$$

b. $(3, 5\pi/3)$ c. $(-1, 45^\circ)$



Convert each point from rectangular coordinates to polar coordinates.

a. (2, -2)

$$(2\sqrt{2}, 315^\circ)$$

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

$$r^2 = (2)^2 + (-2)^2$$

$$r^2 = 8$$

$$\tan \theta = \frac{-2}{2}$$

b. (-3, -5)

$$(\sqrt{34}, 239^\circ)$$

$$\tan \theta = \frac{-5}{-3}$$

$$\theta = 59^\circ$$

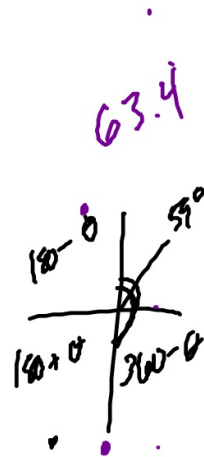
$$\theta = 239^\circ$$

c. (0, -5)

$$(5, 270^\circ)$$

d. (-2, 4)

$$(2\sqrt{5}, 116.6^\circ)$$



Change Rectangular to Polar:



Option #5: **R** \rightarrow **P** **r** (is the rectangular to polar conversion that returns only the **r** value.
Format: **R** \rightarrow **P** **r** (x,y)

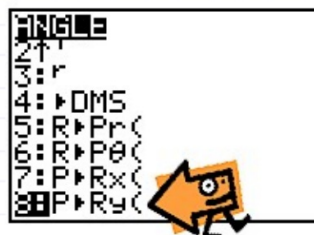


Option #6: **R** \rightarrow **P** θ (is the rectangular to polar conversion that returns only the θ value.
Format: **R** \rightarrow **P** θ (x,y)

Change Polar to Rectangular:



Option #7: **P** \rightarrow **R** **x** (is the polar to rectangular conversion that returns the **x** value.
Format: **P** \rightarrow **R** **x** (x,y)



Option #8: **P** \rightarrow **R** **y** (is the polar to rectangular conversion that returns the **y** value.
Format: **P** \rightarrow **R** **y** (x,y)

(2, 4)
63.4


Writing a polar equation in rectangular form

1. If you have $a r \cos \theta$ replace with x and if you have a $b r \sin \theta$ replace with y .
2. If you still have r multiply both sides by r and replace with $x^2 + y^2 = r^2$

Example 1

$r = 4 \cos \theta$
 $r^2 = 4 r \cos \theta$
 $x^2 + y^2 = 4x$

$x^2 - 4x + y^2 = 0$
 $(x-2)^2 + y^2 = 4$
 $(2,0) \quad r=2$

x, y


Example 2 $r = 5 \csc \theta$

$r = 5 \frac{1}{\sin \theta}$

$r \sin \theta = 5$

$y = 5$

Convert rectangular to polar

1. replace all $x^2 + y^2$ with r^2

2. replace x with $r\cos\theta$ and y with $r\sin\theta$

3. set to $r =$

Example 1

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

$$r^2 = 4$$

$$r = 2$$



If just written as $r = \theta$ remember that is a circle

Example $r = 5$

Example 2

$$x = 5$$

$$r \cos \theta = 5$$

$$r = 5 \sec \theta$$

Example 3

$$2x + 3y = 5$$

$$2r \cos \theta + 3r \sin \theta = 5$$

$$r(2 \cos \theta + 3 \sin \theta) = 5$$

$$r = \frac{5}{2 \cos \theta + 3 \sin \theta}$$

$$\cos(\theta)$$

$$\frac{1}{\cos \theta} = \sec \theta$$