

Unit 10 (Chapter 6): Parametric & Polar

6.4 Polar Coordinates: Equation Conversion

Target 10D: Understand the Polar Coordinate System by performing Polar/Rectangular Coordinate Conversions

Review of Prior Concepts

1. Find the rectangular coordinates of the point with the polar coordinates $P(4, \frac{\pi}{6})$


$$\begin{aligned} x &= r \cos \theta & y &= r \sin \theta \\ x &= 4 \cos \frac{\pi}{6} & y &= 4 \sin \frac{\pi}{6} \\ x &= 4(\frac{\sqrt{3}}{2}) & y &= 4(\frac{1}{2}) \\ x &= 2\sqrt{3} & y &= 2 \end{aligned}$$

$(2\sqrt{3}, 2)$

2. Find two polar coordinate pairs for the point with rectangular coordinates $Q(3, -3)$

$$\begin{aligned} x^2 + y^2 &= r^2 & \tan \theta &= \frac{y}{x} \\ 3^2 + (-3)^2 &= r^2 & \tan \theta &= \frac{-3}{3} \\ 9 + 9 &= r^2 & \tan \theta &= -1 \\ 18 &= r^2 \rightarrow r = 3\sqrt{2} & \theta &= \frac{7\pi}{4} \text{ or } -\frac{\pi}{4} \end{aligned}$$

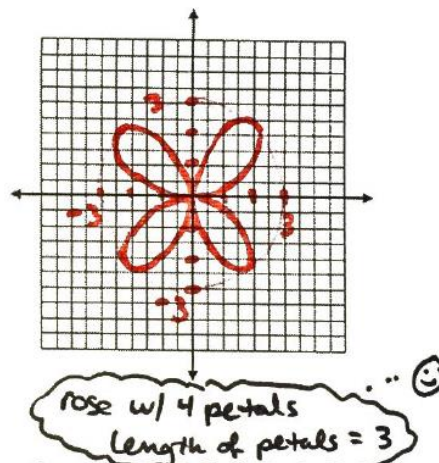
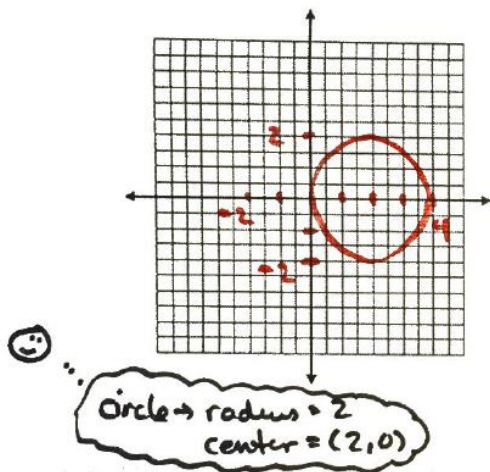
$(3\sqrt{2}, \frac{7\pi}{4})$
 $(3\sqrt{2}, -\frac{\pi}{4})$



☒ Use a TI-Nspire to sketch a graph of the polar equations:

1. $r = 4 \cos \theta$

2. $r = 3 \sin 2\theta$



Recall: Polar/Rectangular Coordinate Conversion Equations

$$\begin{aligned} x &= r \cos \theta \\ y &= r \sin \theta \end{aligned}$$

$$\begin{aligned} x^2 + y^2 &= r^2 \\ \tan \theta &= \frac{y}{x} \end{aligned}$$

- Convert the polar equation to rectangular form and identify the graph. Support your answer by graphing the polar equation on a TI-Nspire.

3. $r = -6 \csc \theta$

$$\begin{aligned} r &= -6(\frac{1}{\sin \theta}) \\ r &= \frac{-6}{\sin \theta} \\ r \sin \theta &= -6 \end{aligned}$$

Since, $y = r \sin \theta$
then $y = -6$
horizontal line

4. $r = 4 \cos \theta$

$r(r) = r(4 \cos \theta)$

$r^2 = 4r \cos \theta$

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

$x^2 - 4x + y^2 = 0$

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

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

circle \rightarrow radius = 2
center = (2, 0)

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

Complete the square
 $-\frac{4x}{2} \rightarrow (-\frac{4}{2})^2 = 4$

- Convert the rectangular equation to polar form. Sketch a graph of the polar equation.

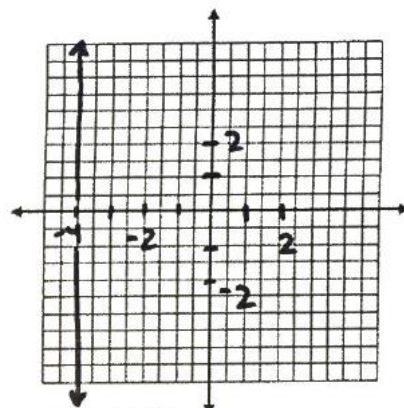
5. $x = -4$

$x = r \cos \theta$

$-4 = r \cos \theta$

$\frac{-4}{\cos \theta} = r$

$r = -4 \sec \theta$



vertical line

6. $(x-1)^2 + (y+4)^2 = 17$

$x^2 - 2x + 1 + y^2 + 8y + 16 = 17$

$x^2 - 2x + y^2 + 8y = 0$

$r^2 - 2x + 8y = 0$

$r^2 - 2r \cos \theta + 8r \sin \theta = 0$

$r(r - 2 \cos \theta + 8 \sin \theta) = 0$

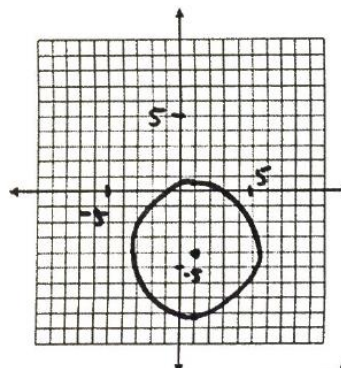
$r = 0$ $r - 2 \cos \theta + 8 \sin \theta = 0$

$r = 2 \cos \theta - 8 \sin \theta$

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

circle w/ radius zero

what's the point?



Circle \rightarrow radius = $\sqrt{17}$
center = (1, -4)

More Practice

Polar Equations

http://www.analyzemath.com/polarcoordinates/polar_to_rectangular_eq.html

<http://www.ck12.org/book/CK-12-Trigonometry-Concepts/section/6.6/?noindex=None>

<https://www.math.uh.edu/~mmsosa/Math1330/Calendar/1330Day28.pdf>

http://www.softschools.com/math/pre_calculus/polar_equation_conversion_between_rectangular_form/

<https://youtu.be/29VW-NAd31A>

<https://youtu.be/IKbRiU7kL2w>

<https://youtu.be/9saYZmiQJpk>

Homework Assignment

p.539 #1-7 odd,13,15,21,27,29