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Unit 10 (Chapter 6): Parametric & Polar **Pre-Calculus 2018-2019**

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 $P(4, \frac{\pi}{6})$

$x = r\cos\theta$ $y = r\sin\theta$

$x = 4\cos\frac{\pi}{6}$ $y = 4\sin\pi/6$

$x = 4(\sqrt{3}/2)$ $y = 4(1/2)$

$x = 2\sqrt{3}$ $y = 2$

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

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

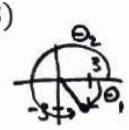
$x^2 + y^2 = r^2$ $\tan\theta = \frac{y}{x}$

$3^2 + (-3)^2 = r^2$ $\tan\theta = \frac{-3}{3}$

$9 + 9 = r^2$ $\tan\theta = -1$

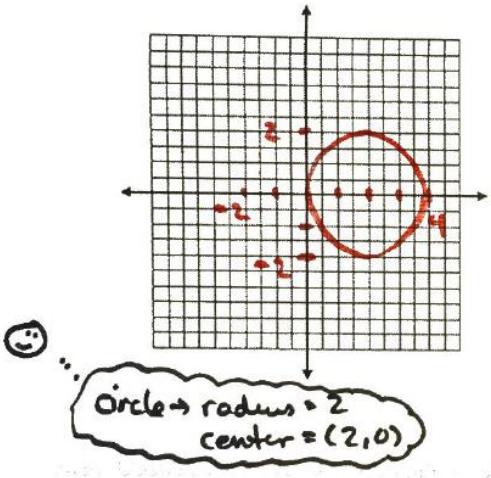
$18 = r^2 \rightarrow r = 3\sqrt{2}$ $\theta = 7\pi/4$ or $-\pi/4$

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

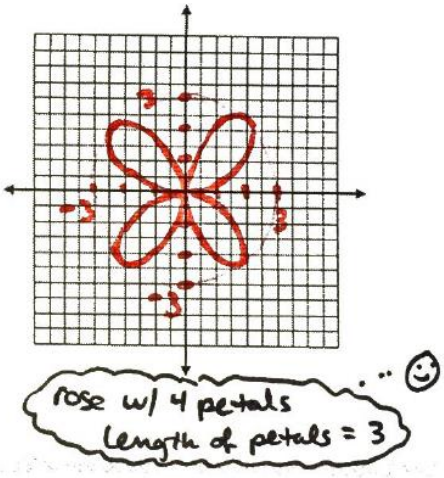


Use a TI-Nspace to sketch a graph of the polar equations:

1. $r = 4\cos\theta$



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



Recall: Polar/Rectangular Coordinate Conversion Equations

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

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

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

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

$r = -6\left(\frac{1}{\sin\theta}\right)$

$r = \frac{-6}{\sin\theta}$

$r\sin\theta = -6$ → then, since $y = r\sin\theta$, $y = -6$ 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 → radius = 2, center = (2, 0)

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

$x = r\cos\theta$

complete the square

$\frac{-4x}{2} \rightarrow \left(\frac{-4}{2}\right)^2 = 4$

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

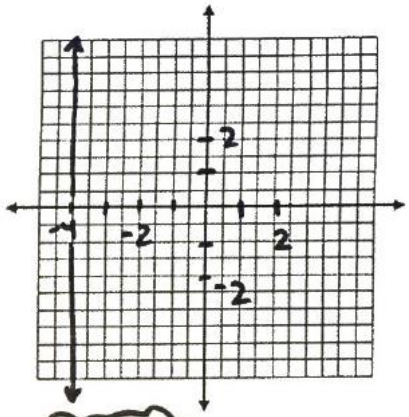
5. $x = -4$

$x = r\cos\theta$

$-4 = r\cos\theta$

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

$r = -4\sec\theta$



vertical line

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

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

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

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

$r\cos\theta = x$

$r\sin\theta = y$

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

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

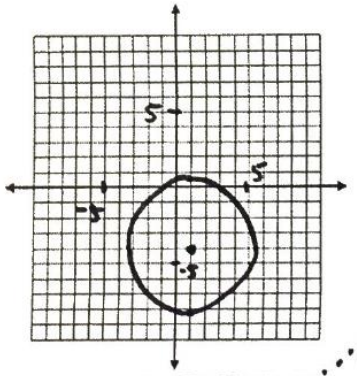
$r(r - 2\cos\theta + 8\sin\theta) = 0$

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

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

circle w/ radius zero

what's the point?



circle → 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-NAd3lA
https://youtu.be/IKbRiU7kL2w
https://youtu.be/9saYZmiQJpk

Homework Assignment

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