Math 1432 DAY 36

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Bubble in PS ID and Popper Number very carefully. If you make a bubbling mistake, your scantron can’t be saved in the system. In that case, you will not get credit for the popper even if you turned it in.

Check your CASA account for Quiz due dates. Don’t miss any online quizzes!

Be considerate of others in class. Respect your friends and do not distract anyone during the lecture.

Don’t forget to take practice test 4!!!
Chapter 10 - Polar Coordinates and Parametric Equations

10.1 – Polar Coordinates and Polar Curves

Cool polar graphs made with “Winplot”
Chapter 10 - Polar Coordinates and Parametric Equations

10.1 – Polar Coordinates and Polar Curves

How do you describe the position of a point in a plane using distance and angle rather than x- and y-coordinates?

\[ r = \text{directed distance from } O \text{ to } P \]
\[ \theta = \text{directed angle} \]
Example: Plot the points.

A. \[2, \frac{\pi}{3}\]

B. \[3, -\frac{\pi}{6}\]

C. \[3, \frac{11\pi}{6}\]

D. \[2, \frac{5\pi}{3}\]

E. \[-2, \frac{\pi}{4}\]
Example: Plot the points and find two additional polar representations of each point using $-2\pi < \theta < 2\pi$

A \[3, \frac{-3\pi}{4}\] 

B \[4, \frac{3\pi}{4}\]

Note: \[r, \theta = [r, \theta \pm 2n\pi] = [-r, \theta \pm (2n + 1)\pi]\] and \([r, \theta + \pi] = [-r, \theta]\]
Changing from polar form to rectangular form:

Formulas: $x = r \cos \theta$, $y = r \sin \theta$

Example: Change the following to rectangular form

A. $\left[ 2, \frac{\pi}{3} \right]$

B. $\left[ \sqrt{3}, \pi \right]$
Changing from rectangular to polar form:

Formulas: \( x^2 + y^2 = r^2 \)

For \( \theta \), can use formulas above or \( \theta = \arctan \frac{y}{x}, \ x \neq 0 \)

Example: Change the following to polar form:

A. \((1, \sqrt{3})\)

B. \((2, -2)\)
Changing from polar form to rectangular form:

Formulas: \( x = r \cos \theta \) \( y = r \sin \theta \)

Changing from rectangular to polar form:

Formulas: \( x^2 + y^2 = r^2 \)

For \( \theta \), can use formulas above or \( \theta = \arctan \frac{y}{x}, x \neq 0 \)

1. Write the following in polar form.
   
   A. \( y = 4 \)
   
   B. \( y = x \)
   
   C. \( x^2 - y^2 = 4 \)
D. \[ x^2 + y^2 = 4 \]

E. \[ x^2 + y^2 - 2x = 0 \]

F. \[ x^2 + (y - 2)^2 = 4 \]
2. Write in rectangular form and describe the graph.

A. \( r \sin \theta = 4 \)

B. \( r \cos \theta = 2 \)

C. \( \theta = \frac{\pi}{4} \)

D. \( r = 4 \cos \theta \)

E. \( r = 2 \sin \theta \)

F. \( r = 2 \csc \theta \)
Example: Write \( r = \frac{4}{2 + \cos \theta} \) in rectangular form.

Exercise: Write \( r = \frac{2}{1 + 2 \sin \theta} \) in rectangular form.

Exercise: Write \( r = 2 \sec \theta \tan \theta \) in rectangular form.
Graphing in Polar Coordinates

Lines

Horizontal Lines:

Vertical Lines:

Lines through the origin:

Arbitrary lines
Circles

Circle centered at (0, 0) with radius a.

Cartesian:

Polar:
Circle centered at \((a, 0)\) with radius \(a\).

Cartesian:

Polar:

Circle centered at \((0, a)\) with radius \(a\).

Cartesian:

Polar:
Example: Graph $r = 6\sin(\theta)$
Example: Graph $r = 4\cos(\theta)$
EXTRA - Testing for Symmetry (READ! Homework!)

If \([r, -\theta] \Rightarrow [r, \theta]\) then the graph is symmetric about the x–axis.

If \([r, \pi - \theta] \Rightarrow [r, \theta]\) then the graph is symmetric about the y–axis.

If \([r, \pi + \theta] \Rightarrow [r, \theta]\) then the graph is symmetric about the origin.
Exercise: Find points of symmetry of \( \left[ 2, \frac{1}{3}, \pi \right] \) about:

a) x-axis

b) y-axis

c) origin

Exercise: Test \( r = \cos(2\theta) \) for symmetry.
POPPER # 27

Q# Identify the shape of the polar curve $r = 4$.
   a. line
   b. circle
   c. parabola
   d. hyperbola
   e. none of the above

Q# Identify the shape of the polar curve $r = 2 \sin \theta$.
   a. line
   b. circle
   c. parabola
   d. hyperbola
   e. none of the above

Q# Find the center of the circle $r = 4 \cos \theta$.
   a. (0,4)
   b. (4,0)
   c. (2,0)
   d. (0,2)
   e. none of the above