Rectangular, Parametric, and Polar Coordinates

Name:_____

Per:_____

Date:_____

In this activity, we will mainly be working with circles. Of course, you can use the different coordinate systems with many different kinds of graphs.

GETTING READY

1) Open the Graph and Table Application (g).
2) Select **Edit** and then **Clear All**.
3) Select **OK** when prompted with the **Clear All** menu.

INVESTIGATION: Rectangular

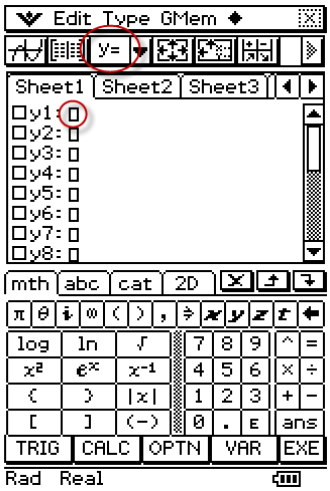
We know that the standard form for the equation of a circle is: $(x-h)^2+(y-k)^2=r^2$

We need to graph that in terms of y. Solving for y gives: $y=\pm\sqrt{r^2-(x-h)^2}+k$

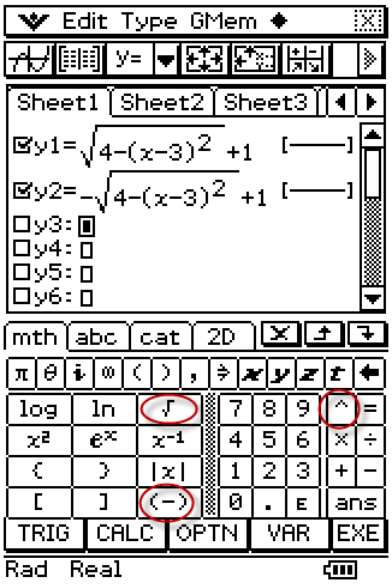
Note that when graphing this on a calculator, you must graph two graphs: the positive square root, and the negative square root.

1) Use the Graph and Table application to graph the equation of the circle $(x-3)^2+(y-1)^2=4$.
   a) First, solve for y:

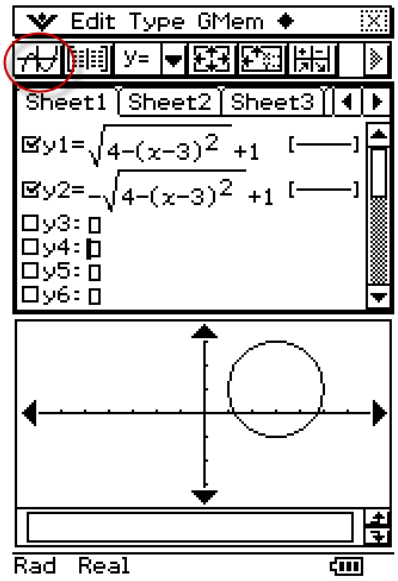
   b) In the window with the sheets, make sure you are in "y=" mode. Tap on the rectangle to the right of y1. Open your k.



c) Enter in the one of the equations (positive or negative) in y1, and the other in y2. Press **EXE** after each entry. (Make sure the boxes next to y1 and y2 are checked like below.)



d) Close your k and then tap the graph ($) toolbar button in the upper left.



e) Where is the center of your circle? What is the radius? How does this relate to the equation of the circle?

f) Now, using your knowledge from above, graph the circle centered at the origin with a radius of 3 on your ClassPad.

g) Now graph a circle centered at (-1, 2) with a radius of 4 on your ClassPad.

h) How easy is it to graph circles centered at the origin on a graphing calculator using **rectangular** coordinates? What about a circle not centered at the origin?

In the rectangular coordinate system, points are plotted using their distances along the x and y axes from the origin (0,0).

INVESTIGATION: Parametric

We will investigate how to graph a circle using parametric equations.

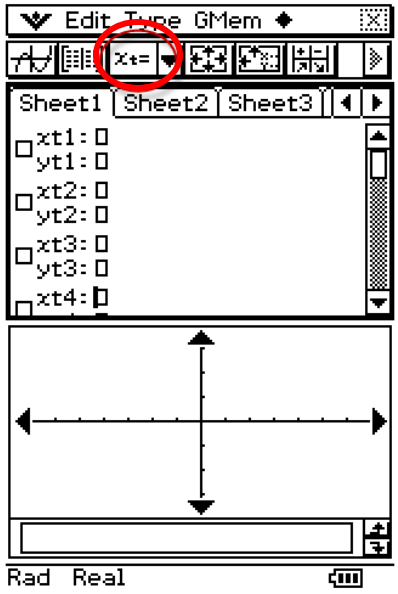
The form we are using is:

$$x_t = (\ ) + (\ )\cos(t)$$

$$y_t = (\ ) + (\ )\sin(t)$$

1) In the Graph Editor Window, make sure you are in "x_t=" mode. Tap on the rectangle to the right of x_t1.

Graph Editor Window



TIP: When entering parametric equations, use your k to find the **sin** and **cos**. They are under the **9** tab. Tap on the **TRIG** tab at the bottom to get to the proper window.

2) Play around with different equations. Try entering different numbers and see what happens. Zoom in and out as needed using the addition/subtraction keys, or the **Zoom** menu Also, make sure you are in **Zoom, Square**. This way, you can visually see if the result is a circle or not.

a) What do you notice about the center of the circle? What about the radius?

We are working with the form:

$$x_t = (\ ) + (\ )\cos(t)$$

$$y_t = (\ ) + (\ )\sin(t)$$

b) What does changing the number in the first parenthesis in the x_t equation do to the graph?

c) What does changing the number in the second parenthesis in the x_t equation do to the graph?

d) What does changing the number in the first parenthesis in the y_t equation do to the graph?

e) What does changing the number in the second parenthesis in the y_t equation do to the graph?

f) What numbers represent the center of the circle? What numbers represent the radius? Did you get a graph that wasn't a circle when you were experimenting? If so, what graph did you get?

g) Now, using your knowledge from above, graph the circle centered at the origin with a radius of 3 using parametric equations and on the ClassPad.

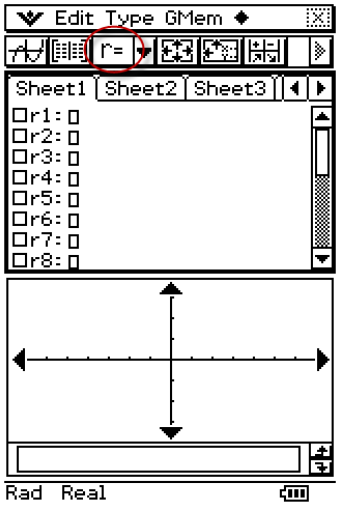
h) Now graph a circle centered at (-1, 2) with a radius of 4 using parametric equations and on the ClassPad.

i) How easy is it to graph circles centered at the origin on a graphing calculator using **parametric** coordinates? What about a circle not centered at the origin?

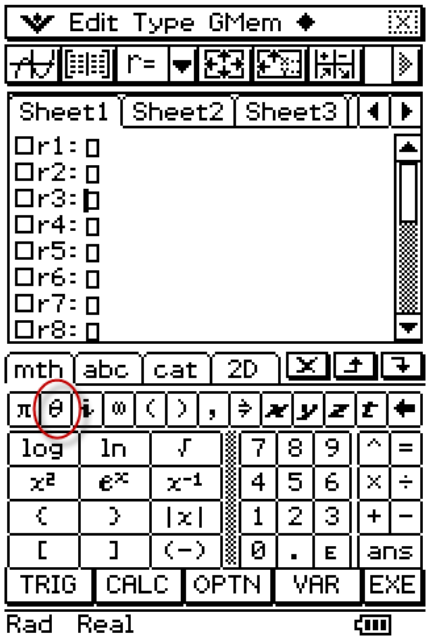
INVESTIGATION: Polar

These equations are of the form "r=".

1) In the Graph Editor window, make sure you are in "r=" mode. Tap on the rectangle to the right of r1.



2) Experiment with different entries and see what kind of graphs you get using θ as the independent variable. You can find this in the k under the 9 tab. **Note: In some of your equations, you may want to try not using theta.**



Use the space below to record your findings. Include the equation and a brief description of the graph. Make sure you record information for at least 5 different graphs.

TIP: You can enter in all your equations at the same time if you choose. Only check the boxes to the left of the equations you wish to see on the axes.

Equation	Description

3) Now, using your knowledge from above, graph the circle centered at the origin with a radius of 3.

4) Now try to graph a circle centered at (-1, 2) with a radius of 4. Can you easily do this?

5) How easy is it to graph circles centered at the origin on a graphing calculator using **polar** coordinates? What about a circle not centered at the origin?

PUTTING IT ALL TOGETHER

Using what you've learned from this activity, write a letter to a friend advising them on how to best graph circles. Think about the differences between graphing with a calculator and graphing by hand and address this in your letter. Also be sure to talk about all three coordinate systems (rectangular, parametric, polar). You can use the space below to construct your letter.