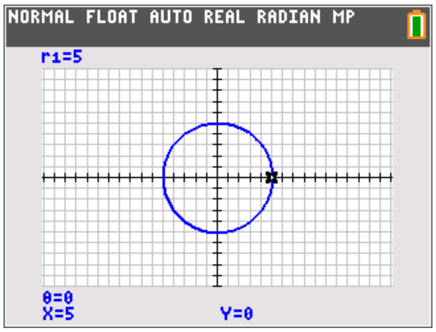
Problem 1 – Converting Rectangular to Polar

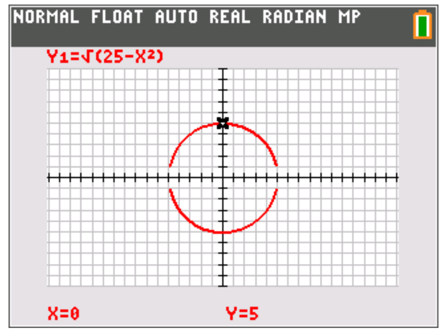
How can a polar equation be converted to a rectangular equation?

In this activity, this type of conversion will be explored using some basic concepts.

In the lower left, observe a circle of radius 5 in polar coordinates. In the lower right, observe a circle of radius 5 in rectangular coordinates.



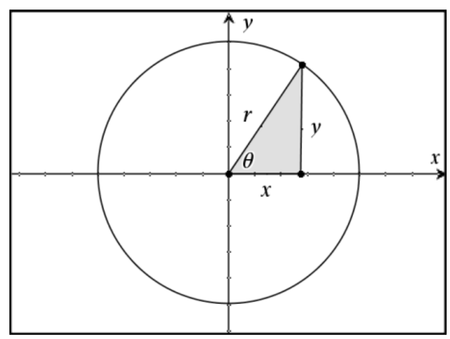
$r(q)=5$



$x^2+y^2=25$

1. What do the polar and rectangular circle equations have in common?

It's helpful to remember that $x^2+y^2=r^2$. This is a link between the two equation forms. What other links exist? Look over the diagram to the right.

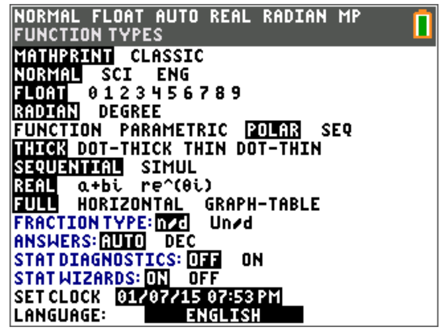


2. Using this diagram, identify three basic equations useful in converting rectangular equations to polar form.

3. Convert $x^2+(y-4)^2=16$ to polar form using the equations identified above. Show your work in the space provided.

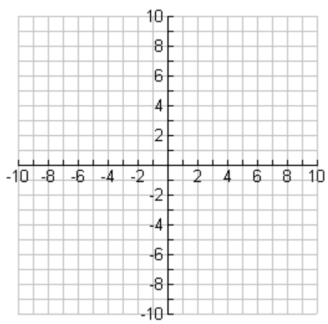
To set your calculator to Polar mode, press [mode] and select **POLAR** as shown to the right. At this time, also set your graphing calculator to Radian mode by selecting **RADIAN** on this screen as well.

To graph a polar equation on your graphing calculator, press [y=] and enter your equation.

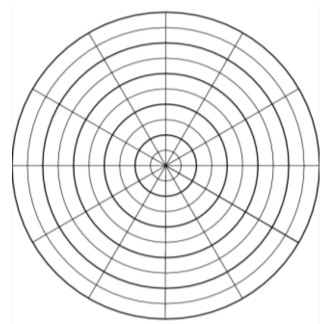


4. Test your results by graphing both the rectangular and polar forms. If the results are equivalent, as long as the graphing window is set at the same values, the graphs will appear the same. Make sketches of the initial rectangular equation and the polar equation obtained in the previous exercise on the pair of axes below.

Rectangular Graph



Polar Graph



Problem 2 – Converting Polar to Rectangular

Polar equations may also be converted to rectangular form using substitution. Trigonometric identities, such as the angle sum and difference formulas can be useful tools in this process.

Recall these formulas:

$\cos(A + B) = \cos A \cdot \cos B - \sin A \cdot \sin B$

$\cos(A - B) = \cos A \cdot \cos B + \sin A \cdot \sin B$

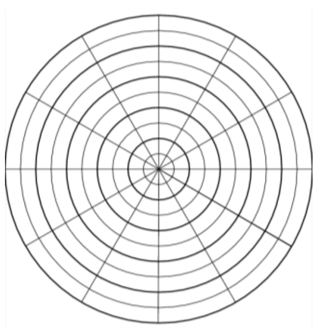
$\sin(A + B) = \sin A \cdot \cos B + \cos A \cdot \sin B$

$\sin(A - B) = \sin A \cdot \cos B - \cos A \cdot \sin B$

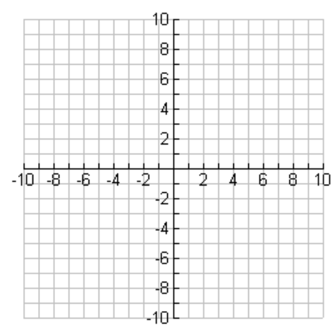
5. Convert the polar equation $2 = r \cdot \cos(\theta + \pi)$ to rectangular form. Show your work in the space provided.

6. Make sketches of the initial rectangular equation and the polar equation obtained in the previous exercise on the pair of axes below.

Polar Graph



Rectangular Graph



Name ____________________
Class ____________________

Additional Practice

7. Write the polar form of each of the following equations:

a. $x^2 + y^2 = 64$

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

c. $x = -5$

d. $x^2 - y^2 = 1$

8. Write the rectangular form of each of the following polar equations:

a. $r = 3$

b. $r = 3\sin\theta$ (Hint: Multiply each side by r first.)

c. $6 = r \cdot \cos\left(\theta - \frac{\pi}{4}\right)$

d. $r = 3\sec(\theta + 60°)$