

## Polar Graphing Activity

You will explore graphs of polar equations. A polar equation is a function rule in the form  $r = f(\theta)$ , where  $\theta$  can be measured in radians or degrees.

**Use your calculator to explore the following:**

1. Consider equations of the form:  $r = a \sin \theta$   
 $r = a \cos \theta$ . Experiment with different values for  $a$ .

- a. What type of figure is created by these equations?
- b. How do the figures differ when different trig functions are used (sin vs. cos)?
- c. What is significant about the  $a$ -value?

2. Consider equations of the form:  $r = a \pm b \sin \theta$   
 $r = a \pm b \cos \theta$ . *Limaçons*

Graph together:  $r = 2 + 5 \sin \theta$       Graph together:  $r = 4 + 3 \sin \theta$       Graph together:  $r = 4 + 4 \sin \theta$   
 $r = 1 + 3 \cos \theta$        $r = 3 + 2 \cos \theta$        $r = 2 - 2 \cos \theta$

- a. How do the figures differ when different trig functions are used (sin vs. cos)?
- b. What is it about the “ $a$ ” & “ $b$ ” values that determines the shape of the graph?
- c. What is the significance of “ $a + b$ ”?

3. Consider equations of the form:  $r = a \sin(n\theta)$   
 $r = a \cos(n\theta)$ . *Rose Curves*

Graph these functions one at a time:  $r = 2 \sin(3\theta)$      $r = 4 \sin(2\theta)$      $r = 2 \cos(3\theta)$      $r = 4 \cos(2\theta)$

- a. How do the figures differ when different trig functions are used (sin vs. cos)?
- b. What determines the length of a petal?
- c. What determines the number of petals?

4. Consider equations of the form:

$$r = a\theta + b$$

$$r = ab^\theta$$

To see these graphs better, do the following: ZOOM 6; change  $\theta$  max to  $6\pi$ ; then ZOOM 5.

a. Graph these two:  $r = \theta + 2$       Then graph these two:  $r = 3^\theta$

$$r = 2\theta$$

$$r = 2 \cdot 3^\theta$$

*Spirals of Archimedes*

*Logarithmic Spirals*

b. What is the difference between the Spirals of Archimedes and Logarithmic Spirals?

5. Graph each of the following, one at a time.

$$r = \frac{5}{6 + 8 \cos \theta} \quad r = \frac{6}{4 + 3 \cos \theta} \quad r = \frac{2}{3 + 3 \cos \theta}$$

a. What is the name of the shape for each figure produced?

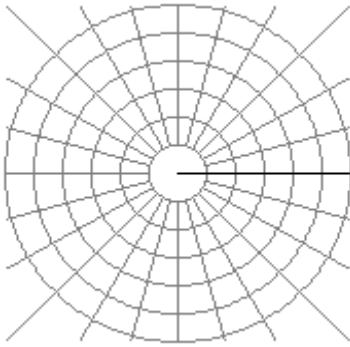
b. How are these equations related to those of the limaçons?

## Polar Graphing Practice

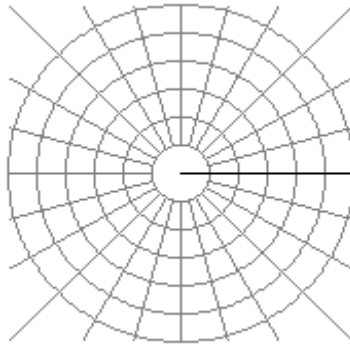
1. What shape is the following graph:  $r = 8 \sin \theta$ ? Identify the center and radius. Then convert the equation into rectangular form.

2. Sketch accurate graphs of the following:

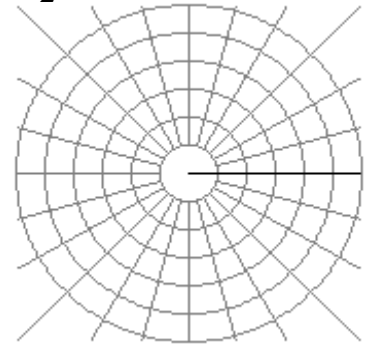
a.  $r = 4 \sin(3\theta)$



b.  $r = 5 \cos(2\theta)$



c.  $r = \frac{\theta}{2} + 3$  (Graph 2 revolutions.)



**Write polar equations for the following:**

3. A circle with radius 4.8, oriented to the polar axis \_\_\_\_\_

4. An example of a logarithmic spiral \_\_\_\_\_

5. A rose curve with 20 petals of length 13 units, oriented to the  $\pi/2$  axis \_\_\_\_\_

6. An example of a hyperbola oriented to the  $\pi/2$  axis \_\_\_\_\_

7. An example of an ellipse oriented to the polar axis \_\_\_\_\_