

Polar Graphing Activity

You will explore graphs of polar equations. A polar equation is a function rule in the form $r = f(\theta)$, where θ 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 θ_{\max} to 6π ; 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?

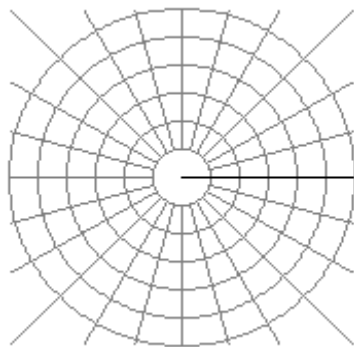
- b. How are these equations related to those of the limaçons?

Polar Graphing Practice

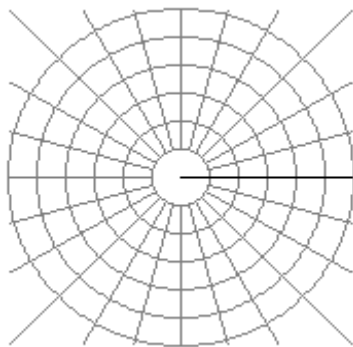
1. What shape is the following graph? $r = 8\sin\theta$ Identify the center and radius. Then convert the equation into rectangular form.

2. Sketch accurate graphs of the following:

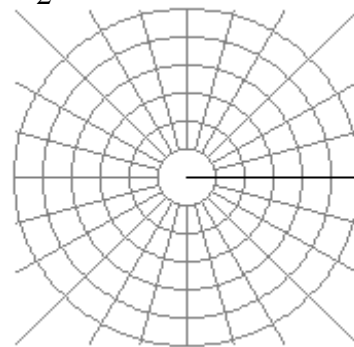
a. $r = 4\sin(3\theta)$



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 and oriented to the polar axis _____
4. An example of a hyperbola oriented to the $\pi/2$ axis _____
5. An example of an ellipse oriented to the polar axis _____