

Assignment
Polar Graphs

Name _____

Objective: You will graph several types of polar graphs, and explore to see how parameter changes alter the graphs.

Use your calculator:

Change the mode to radians and polar (from function)

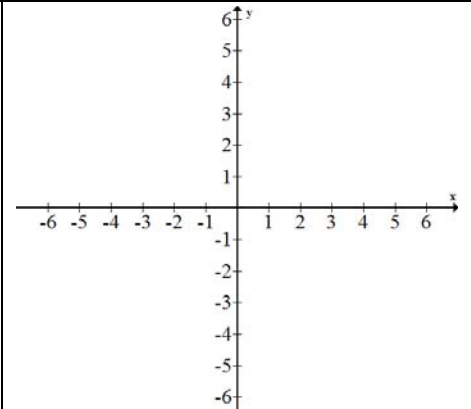
Assignment Details:

- For each type of graph, graph all equations on the same grid.
- Use θ (same button as x)
- You may need to zoom out to be able to see complete graphs.
- Answer the questions about how changes in a , b , or n affect the graph.

Circle Exploration

Graph the following equations on the same grid.

1. $r_1(\theta) = 2 \cos(\theta)$
2. $r_2(\theta) = 3 \cos(\theta)$
3. $r_3(\theta) = -4 \cos(\theta)$
4. $r_4(\theta) = -5 \cos(\theta)$



Circle Analysis

1. In the equation $y = a + b \cos(n\theta)$, what is the value of a for each of the equations in *Circle Exploration* questions? What is the value of n ?

$a =$ _____ $n =$ _____

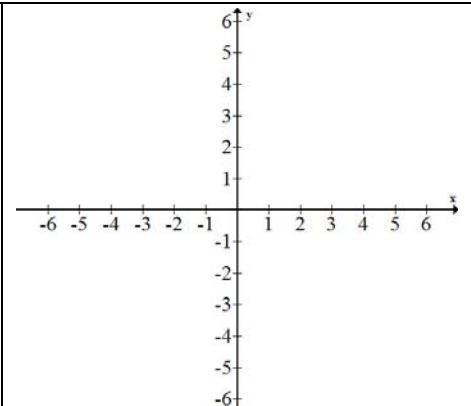
2. What effect does the absolute value of b have on the graph of the circle?

3. What effect does the positive or negative value of b have on the graph?

Rose Curves Exploration

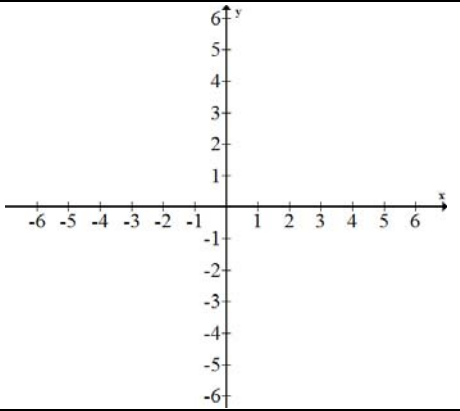
Graph the following equations on the same grid.

1. $r_1(\theta) = 4 \cos(\theta)$
2. $r_2(\theta) = 4 \cos(2\theta)$
3. $r_3(\theta) = 4 \cos(3\theta)$
4. $r_4(\theta) = 4 \cos(4\theta)$



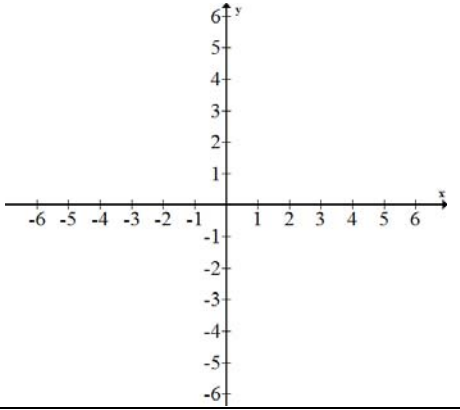
Graph the following equations on the same grid.

- $r_1(\theta) = 4 \cos(3\theta)$
- $r_2(\theta) = 5 \cos(3\theta)$
- $r_3(\theta) = 6 \cos(3\theta)$



Rose Curves Exploration (continued)
Graph the following equations on the same grid.

- $r_1(\theta) = 5 \cos(3\theta)$
- $r_2(\theta) = -5 \cos(3\theta)$



Rose Curve Analysis

4. In the equation $y = a + b \cos(n\theta)$, what is the value of a for each of the equations in the *Rose Exploration*? What is the value of b in the first section of graphs?

$a =$ _____ $b =$ _____

5. How many rose leaves does each equation produce?

A.	$r_1(\theta) = 4 \cos(\theta)$	leaves =
B.	$r_2(\theta) = 4 \cos(2\theta)$	leaves =
C.	$r_3(\theta) = 4 \cos(3\theta)$	leaves =
D.	$r_4(\theta) = 4 \cos(4\theta)$	leaves =

E. Predict the number of leaves for $r(\theta) = 4 \cos(5\theta)$: _____ (check, if necessary)

6. How does the value of n determine the number of leaves?

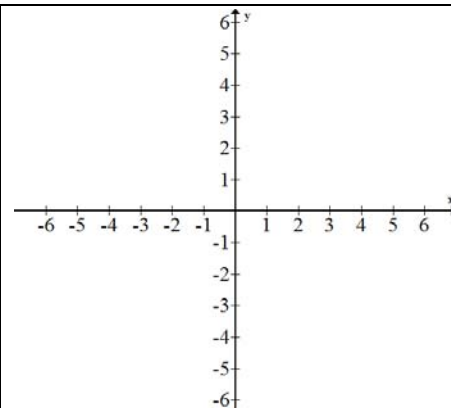
7. What effect does the value of b have on the leaves of the rose?

8. What effect does the positive or negative value of b have on the graph?

Limaçon Curves Exploration

Graph the following equations on the same grid.

1. $r_1(\theta) = 1 + 2 \cos(\theta)$
2. $r_2(\theta) = 2 + 4 \cos(\theta)$
3. $r_3(\theta) = 1 - 3 \cos(\theta)$
4. $r_4(\theta) = 2 - 5 \cos(\theta)$



Limaçon Curve Analysis

9. In the equation $y = a + b \cos(n\theta)$, what is the value of n for each of the equations in *Limaçon Curve Exploration*?

$n =$ _____

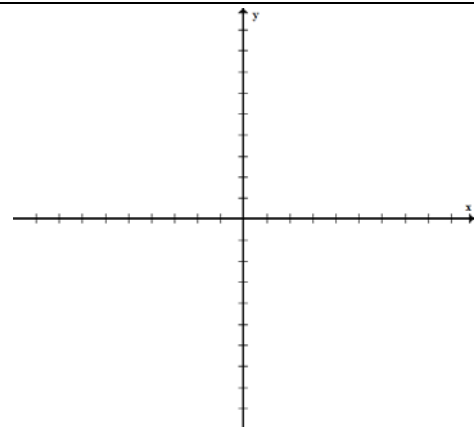
10. How does the absolute value of a compare to the absolute value of b ?
11. How do the absolute values of a and b affect the graph?
12. What effect does the positive or negative value of b have on the graph?

Cardioid Exploration

Graph the following equations on the same grid.

1. $r_1(\theta) = 2 + 2 \cos(\theta)$
2. $r_2(\theta) = 3 + 3 \cos(\theta)$
3. $r_3(\theta) = 4 + 4 \cos(\theta)$
4. $r_4(\theta) = 5 + 5 \cos(\theta)$

- highlight $r(\theta) = 3 + 3 \cos(\theta)$
- Now graph $r_5(\theta) = 3 - 3 \cos(\theta)$



Cardioid Curve Analysis

13. In the equation $y = a + b \cos(n\theta)$, what is the value of n for each of the equations in *Cardioid Curve Exploration*?

$n =$ _____

14. How does the absolute value of a compare to the absolute value of b ?
15. How do the absolute values of a and b affect the graph?
16. What effect does the positive or negative value of b have on the graph?

Summary

Consider the function $r(\theta) = a + b\sin(n\theta)$. Describe the graph produced and indicate whether the graph is a circle, rose, limaçon or cardioid. (Can you determine the shape without graphing? If necessary, use the calculator to help with the graphs.)

17.	$a = 0, b = 2, n = 1$	
18.	$a = 0, b = 4, n = 1$	
19.	$a = 0, b = -6, n = 1$	
20.	$a = 0, b = 2, n = 2$	
21.	$a = 0, b = 2, n = 3$	
22.	$a = 0, b = -3, n = 4$	
23.	$a = 1, b = 2, n = 1$	
24.	$a = 2, b = 2, n = 1$	
25.	$a = 3, b = -4, n = 1$	
26.	$a = 2, b = -5, n = 1$	

27. How do the curves $r(\theta) = a + b \cos(n\theta)$ and $r(\theta) = a + b \sin(n\theta)$ compare?

28. Generalize how the values of a , b , and n produce the different curves.