Name: _____

Special Polar Graphs Exploration

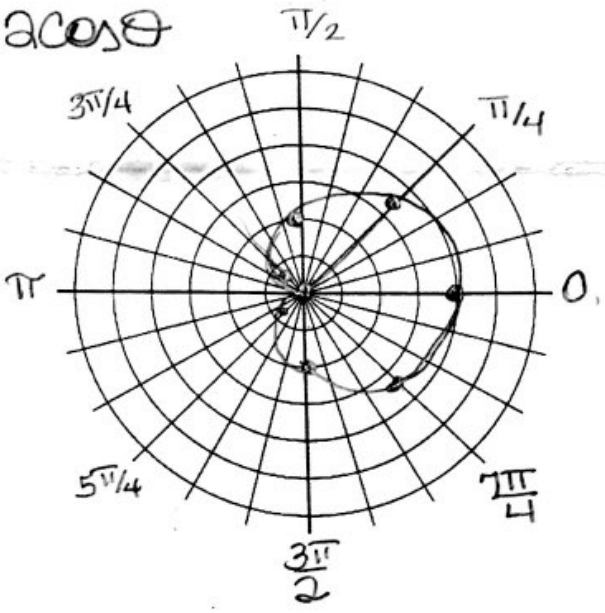
Graph 1: Cardiod

Equations for the groups: $r = 2 + 2\cos\theta$ $r = 3 - 3\cos\theta$ $r = 3 + 3\sin\theta$ $r = 2 - 2\sin\theta$

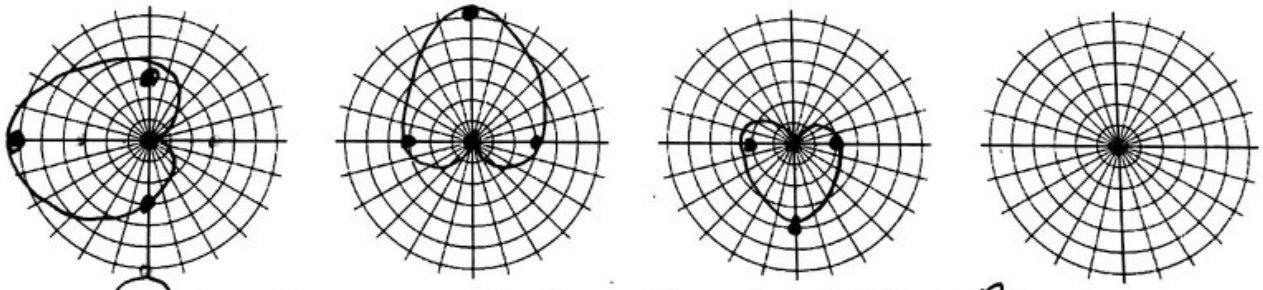
1. Sketch a graph of the equation on a separate sheet of graph paper. Then fill out the table. Use the table to graph on your polar graph.

$r = 2 + 2\cos\theta$

angle (x)	radius (y)
0	4
$\frac{\pi}{4}$	3.4
$\frac{\pi}{2}$	2
$\frac{3\pi}{4}$	0.6
π	0
$\frac{5\pi}{4}$	0.6
$\frac{3\pi}{2}$	2
$\frac{7\pi}{4}$	3.4
2π	4



2. Sketch some of the graphs you see from the other groups.



$r = 3 - 3\cos\theta$ $r = 3 + 3\sin\theta$ $r = 2 - 2\sin\theta$

3. What determines how big the cardioid is?

Amp.

4. What determines which direction the cardioid goes?

Graph 2: limacon w/out a loop

Equations for the groups: $r = 2 + 1\cos\theta$ $r = 3 - 2\cos\theta$ $r = 3 + 2\sin\theta$ $r = 2 - 1\sin\theta$

Graph 3: lima

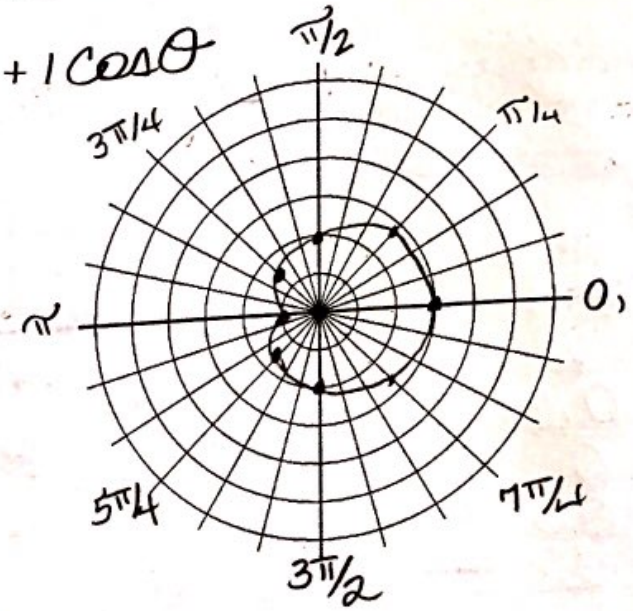
Equations for the g

9. Sketc table t

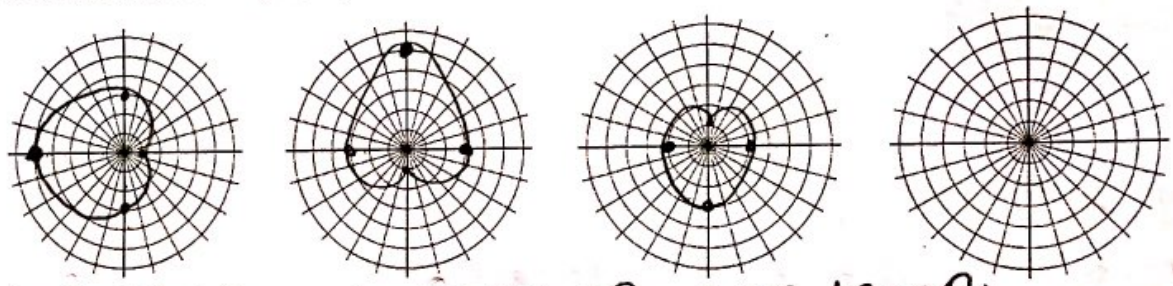
5. Sketch a graph of the equation on a separate sheet of graph paper. Then fill out the table. Use the table to graph on your polar graph.

$r = 2 + 1\cos\theta$

angle (x)	radius (y)
0	3
$\frac{\pi}{4}$	2.7
$\frac{\pi}{2}$	2
$\frac{3\pi}{4}$	1.3
π	1
$\frac{5\pi}{4}$	1.3
$\frac{3\pi}{2}$	2
$\frac{7\pi}{4}$	2.7
2π	3



6. Sketch some of the graphs you see from the other groups.



$r = 3 - 2\cos\theta$ $r = 3 + 2\sin\theta$ $r = 2 - 1\sin\theta$

7. How does determining the size and direction of the limacon compare to the cardioid?

* direction same as cardiod
* add |Vertical Shift| + |amp| to get how far out from the pole it goes

8. How is the graph different from the cardioid graph?

* does not touch the pole
* Smooth Curve

Graph 3: limacon with inner loop

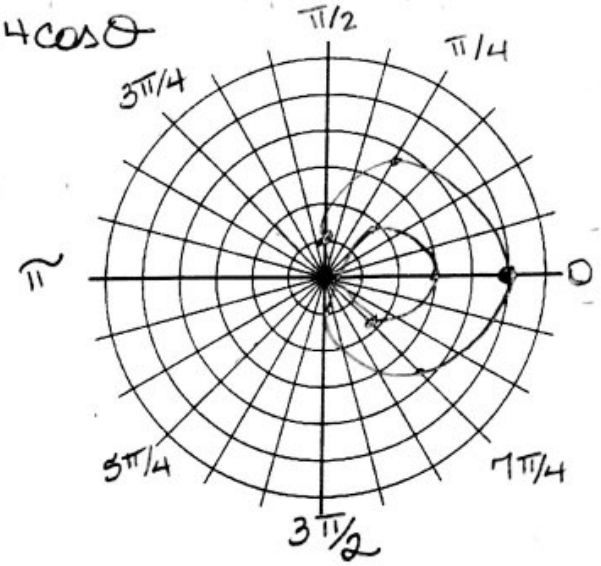
Equations for the groups: $r = 1 + 4\cos\theta$ $r = 2 - 4\cos\theta$

$r = 2 + 5\sin\theta$ $r = 2 - 3\sin\theta$

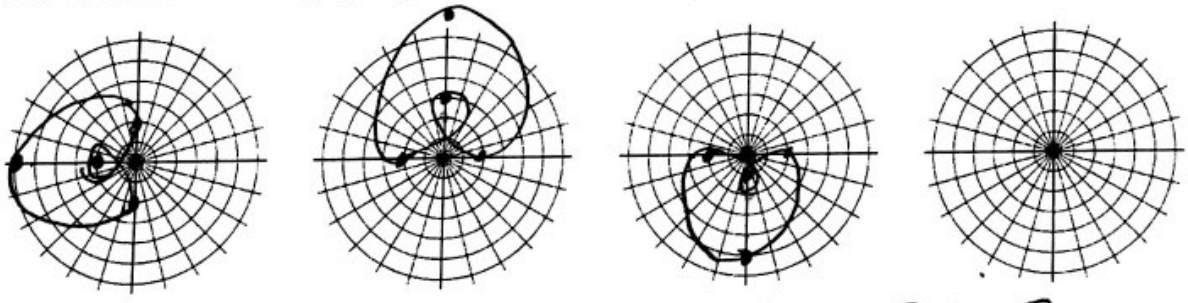
9. Sketch a graph of the equation on a separate sheet of graph paper. Then fill out the table. Use the table to graph on your polar graph.

$r = 1 + 4\cos\theta$

angle (x)	radius (y)
0	5
$\frac{\pi}{4}$	3.8
$\frac{\pi}{2}$	1
$\frac{3\pi}{4}$	-1.8
π	-3
$\frac{5\pi}{4}$	-1.8
$\frac{3\pi}{2}$	1
$\frac{7\pi}{4}$	3.8
2π	5



10. Sketch some of the graphs you see from the other groups.



$r = 2 - 4\cos\theta$ $r = 2 + 5\sin\theta$ $r = 2 - 3\sin\theta$

11. What determines the size of the inner loop?

The difference in the Amp + Vertical shift

12. Compare the equations of the cardioid, limacon without inner loop, and limacon with inner loop. Explain how the numbers in the equation effect the part of the graph near the origin. Why do they effect it this way?

$r = a \pm b\cos\theta$ Cardiod $a = b$ dwot touches pole

$r = a \pm b\sin\theta$ No loop $a > b$ dwot does not touch the origin

with loop $a < b$ dwot forms the inner loop!

Graph 4: $r = 4\cos(2\theta)$

13. Sketch a graph of the equation on a separate sheet of graph paper. Then fill out the table. Use the table to graph on your polar graph.

angle (x)	radius (y)
0	4
$\frac{\pi}{4}$	0
$\frac{\pi}{2}$	-4
$\frac{3\pi}{4}$	0
π	4
$\frac{5\pi}{4}$	0
$\frac{3\pi}{2}$	-4
$\frac{7\pi}{4}$	0
2π	4

$\pi/8 = 2.8$

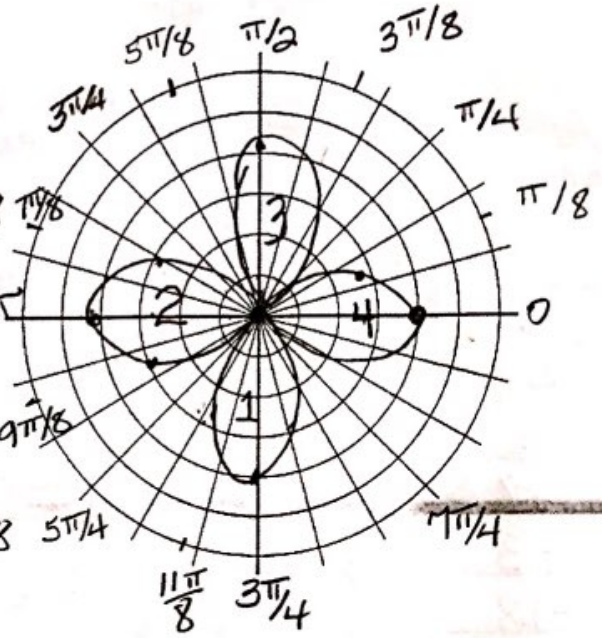
$3\pi/8 = -2.8$

$5\pi/8 = -2.8$

$7\pi/8 = 2.8$

$9\pi/8$ 2.8

$11\pi/8 = -2.8$

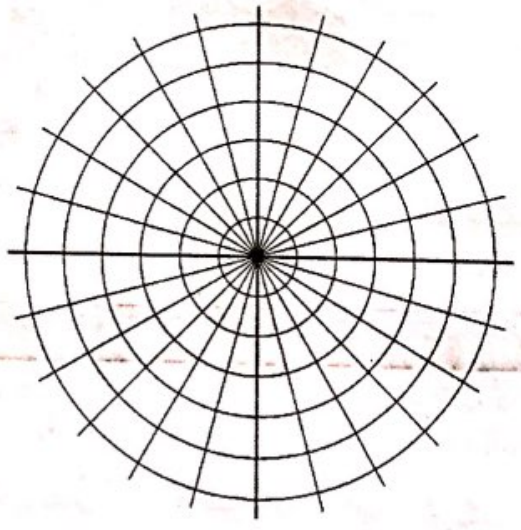


Graph 5: $r = 3\sin(3\theta)$

14. Predict the number of petals the graph will have: 3.

15. Sketch a graph of the equation on a separate sheet of graph paper. Then fill out the table. Use the table to graph on your polar graph.

angle (x)	radius (y)
0	
$\frac{\pi}{4}$	
$\frac{\pi}{2}$	
$\frac{3\pi}{4}$	
π	
$\frac{5\pi}{4}$	
$\frac{3\pi}{2}$	
$\frac{7\pi}{4}$	
2π	



16. Did the graph have as many petals as you thought it would? Why or why not?

The petals graph on top of themselves for an odd function

8 petals

3 petals

17. How many petals would $r = 3\cos(4\theta)$ have? How many petals would $r = 6\sin(3\theta)$ have? How about $r = 5\sin(6\theta)$?

12 petals

$r = \cos(4\theta)$ – 8p

$r = 6\sin(3\theta)$ – 3p

$r = 5\sin(6\theta)$ – 12p

18. How does the amplitude change the petals?

The length of the curve

19. What difference does the cosine/sine make?

whether you start the graph at a pole (sin) or halfway through the petal (cos)