

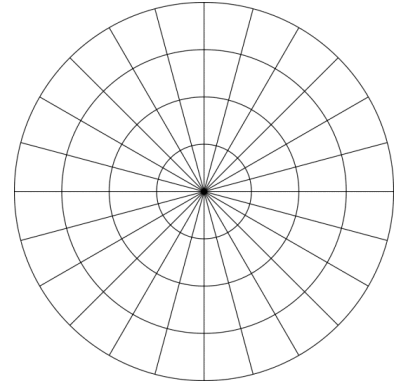
Graphs of Polar Equations

Part 1. Graphs With Constant r or θ .

1. Graph the following polar equations on the same graph:

a) $r = 4$ b) $r = 2$ c) $r = -3$

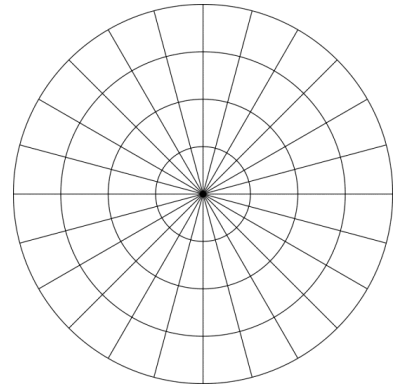
What would the graph of $r = a$ look like where a is a constant?



2. Graph the following polar equations on the same graph:

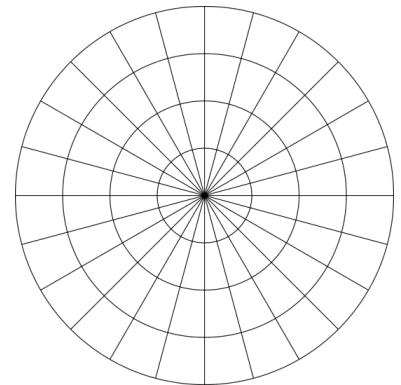
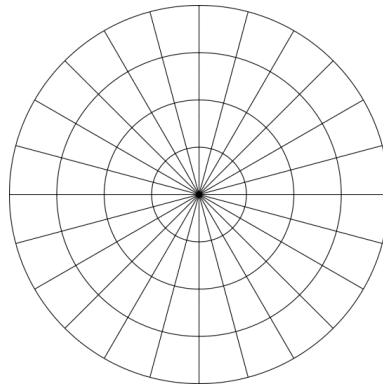
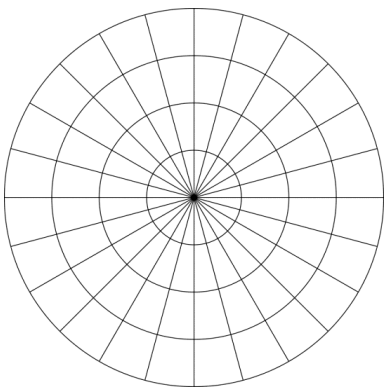
a) $\theta = \frac{\pi}{4}$ b) $\theta = \frac{2\pi}{3}$ c) $\theta = \frac{\pi}{2}$

What would the graph of $\theta = \alpha$ look like where α is a constant?

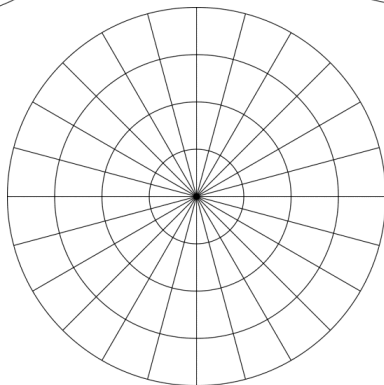
**Part 2. Graphs of Regions in Polar Coordinates**

Graph the following regions determined by the inequalities.

a) $1 \leq r < 3, -\frac{\pi}{4} < \theta \leq \frac{\pi}{3}$ b) $-2 \leq r \leq 4, \frac{\pi}{6} \leq \theta \leq \frac{\pi}{3}$ c) $0 \leq r \leq 3, \frac{3\pi}{4} < \theta < \frac{5\pi}{4}$

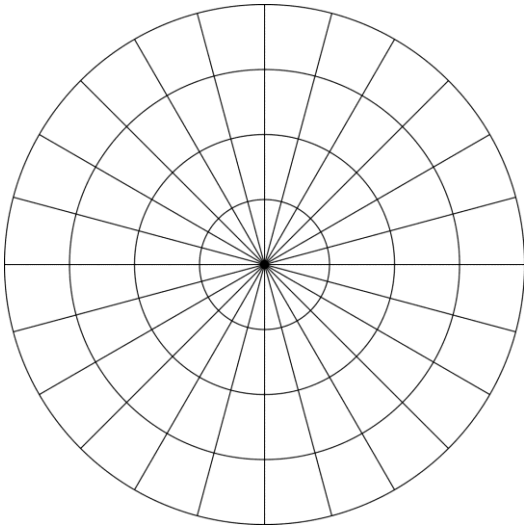


d) Graph $r = \theta$

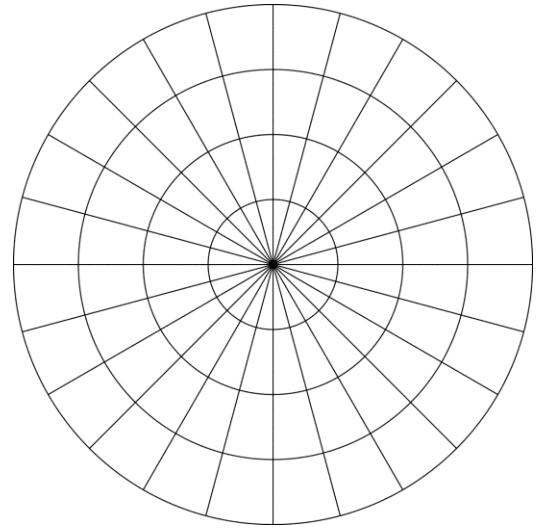


Part 3. Exploring Polar Graphs

a) Graphs of the form $r = a \cos \theta$ or $r = a \sin \theta$. Graph with $a = 1, 2$ and 3



$$r = a \cos \theta$$

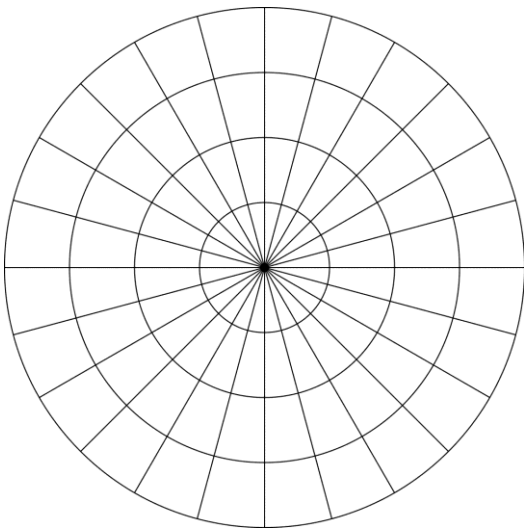


$$r = a \sin \theta$$

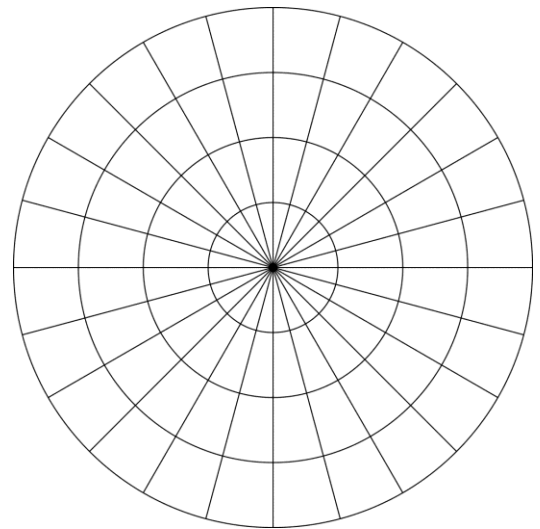
How does the value of the parameter a affect the graph?

What is the difference in the graph if you use cosine vs. sine?

b) Graphs of the form $r = 3 \cos b\theta$ or $r = 3 \sin b\theta$ Graph with $b = 2$, and 4 .



$$r = 3 \cos b\theta$$

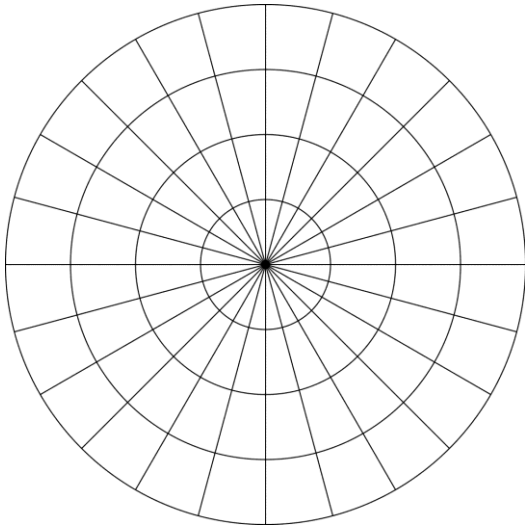


$$r = 3 \sin b\theta$$

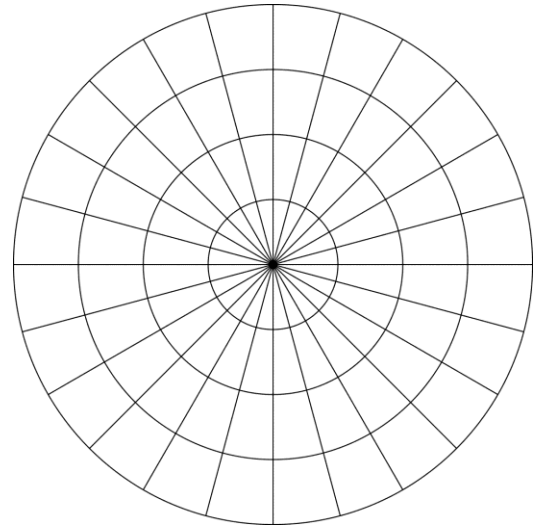
How does the value of the parameter b affect the graph?

What is the difference in the graph if you use cosine vs. sine?

c) Explore graphs of the form $r = 3\cos b\theta$ or $r = 3\sin b\theta$. Graph with $b = 3$, and 5.



$$r = 3\cos b\theta$$

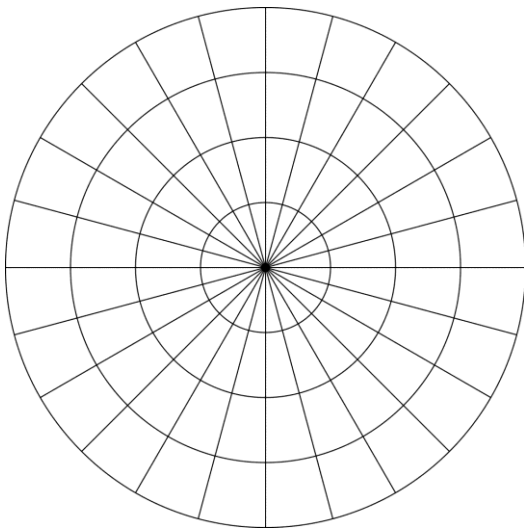


$$r = 3\sin b\theta$$

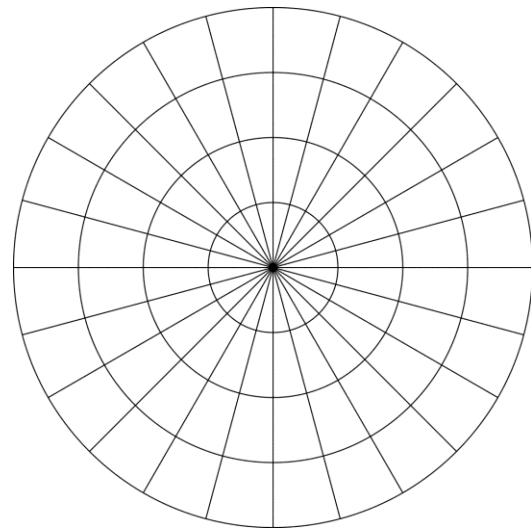
How does the value of the parameter b affect the graph?

The graphs in b and c look like daisies to me, but are called rose curves with each “petal” being called a leaf.

d) Explore graphs of the form $r = a + a\cos\theta$ or $r = a + a\sin\theta$. Graph with $a = 2$.



$$r = 2 + 2\cos\theta$$



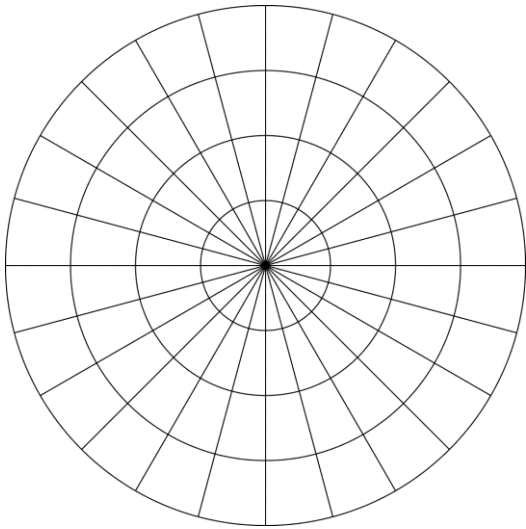
$$r = 2 + 2\sin\theta$$

How does the value of the parameter a affect the graph?

What is the difference in the graph if you use cosine vs. sine?

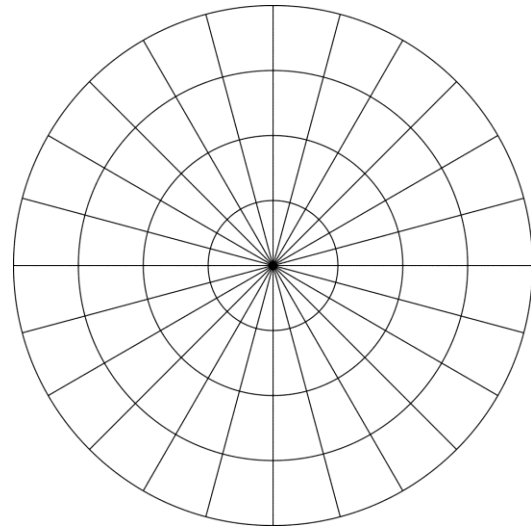
These graphs are called cardioids since they are sort of “heart” shaped.

e) Explore graphs of the form $r = a + b\cos\theta$ or $r = a + b\sin\theta$. Graph with $a = 1$ and $b = 2$.



$$r = 1 + 2\cos\theta$$

How does the value of the parameter a affect the graph?



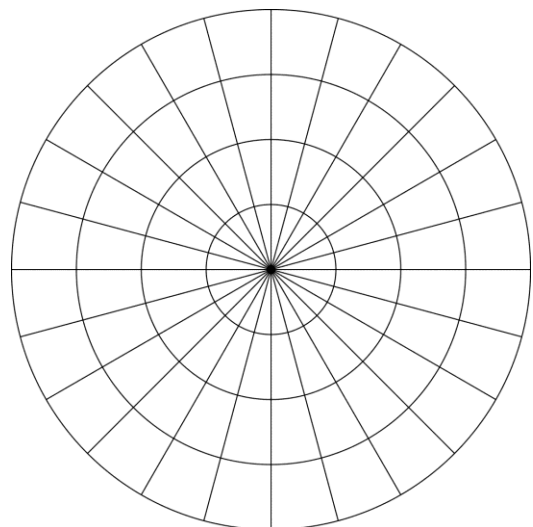
$$r = 1 + 2\sin\theta$$

How does the value of the parameter b affect the graph?

What is the difference in the graph if you use cosine vs. sine?

These graphs are called limacons.

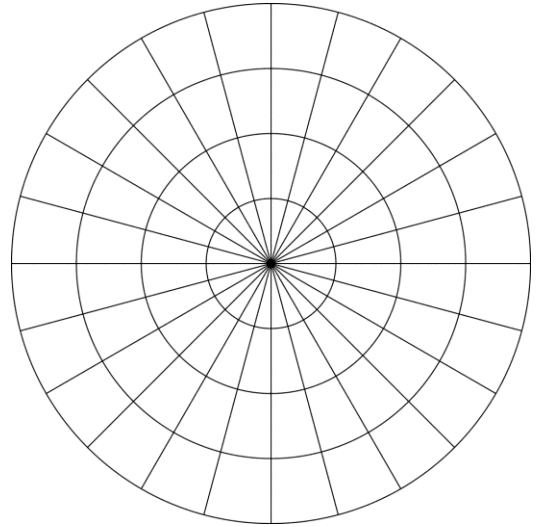
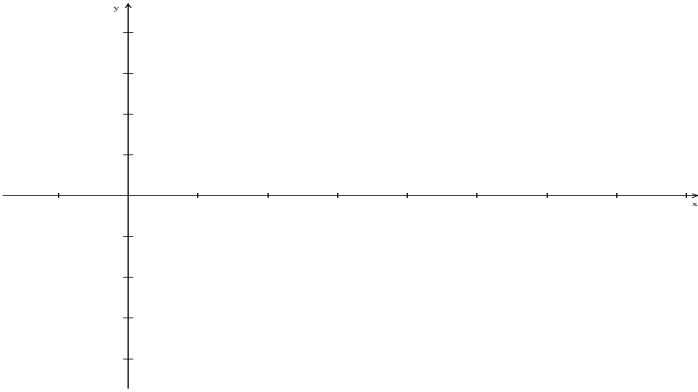
f) Fun graph. Graph $r = 2 - 2\sin(\theta) + \frac{\sin(\theta)\sqrt{|\cos(\theta)|}}{\sin(\theta) + 1.4}$



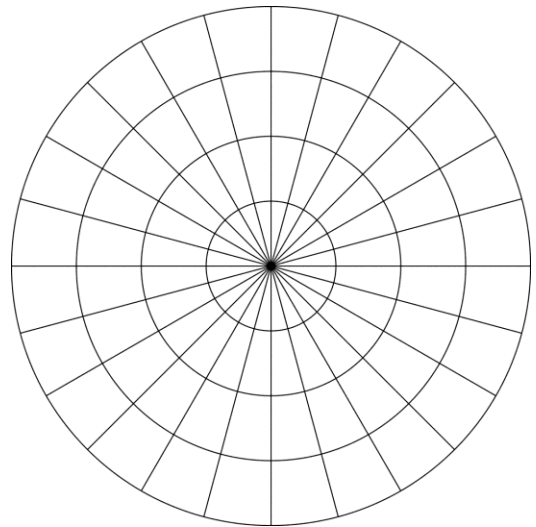
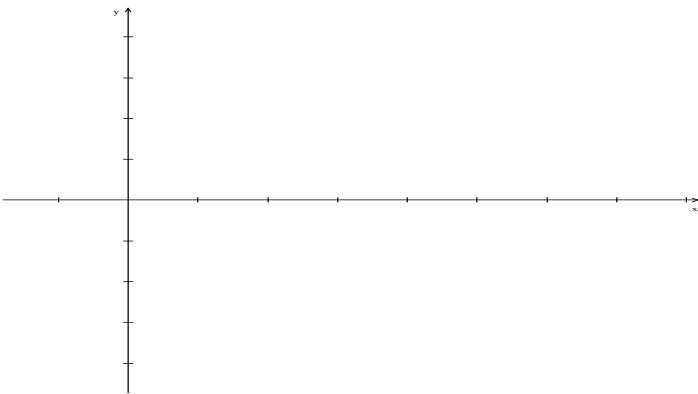
Part 4. Graphing Polar Equations by Hand

To graph polar equations involving sines and cosines by hand, we first graph them in rectangular coordinates and then use the key points to graph in polar coordinates.

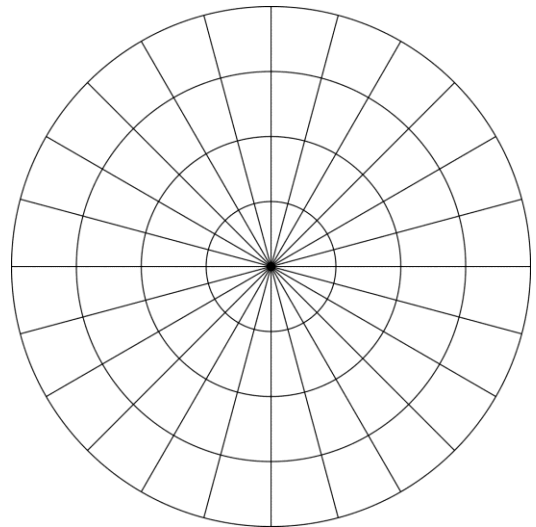
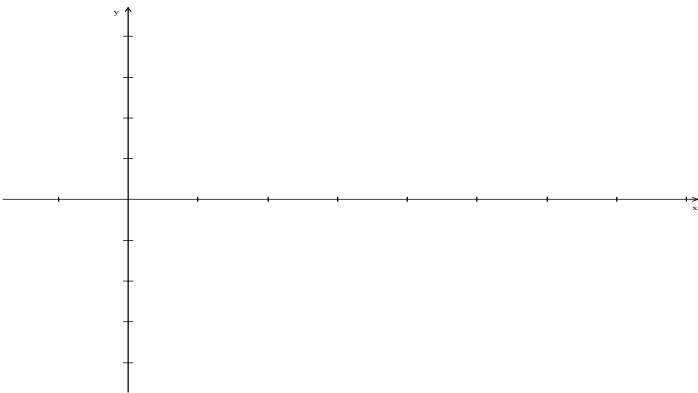
a) Graphing $r = 3\cos(2\theta)$



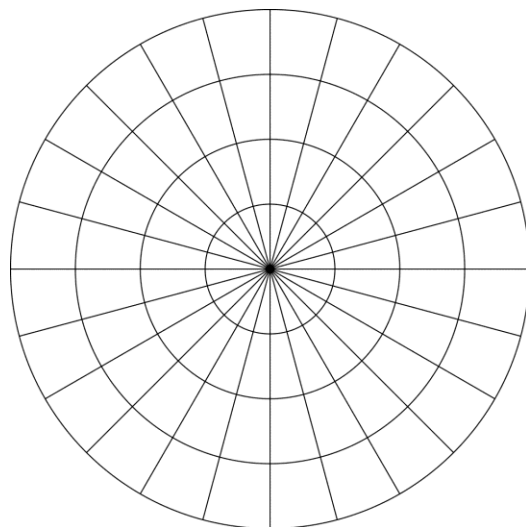
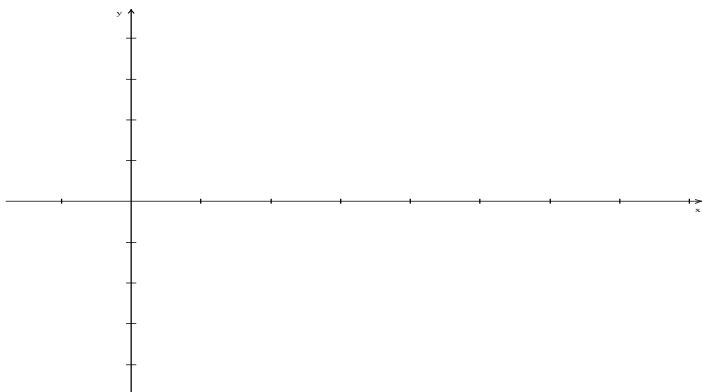
a) Graphing $r = 4\sin(3\theta)$



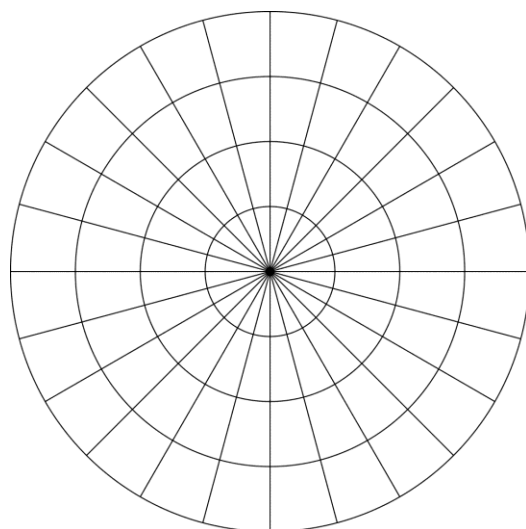
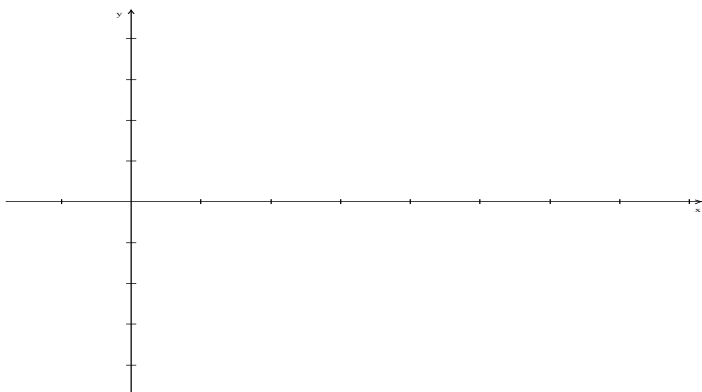
a) Graphing $r = 1 + 2\cos(\theta)$



a) Graphing $r = 1 + \sin(\theta)$



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



a) Graphing $r = 3 + \cos(5\theta)$

