1785

The University of Georgia

Mathematics Education
EMAT 4680/6680 Mathematics with Technology
Jim Wilson, Instructor

Exploration 11: Polar Equations

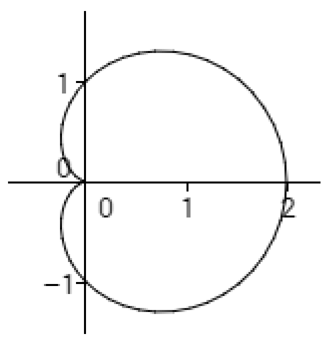
Jaime Maxey

Investigate $r = a + b\cos(k\Theta)$

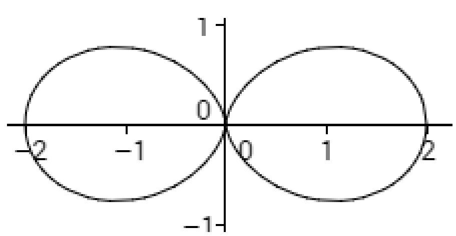
Let us first observe when a=1 and b=1. We will manipulate the value of k.

It appears as though the parameter k determines how many pedals there are. Let's investigate:

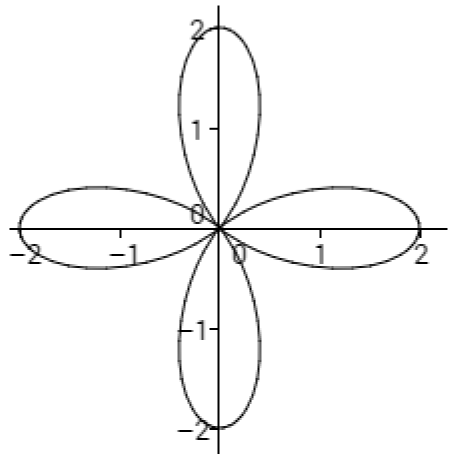
When a=1, b=1, k=1:



When a=1, b=1, k=2:

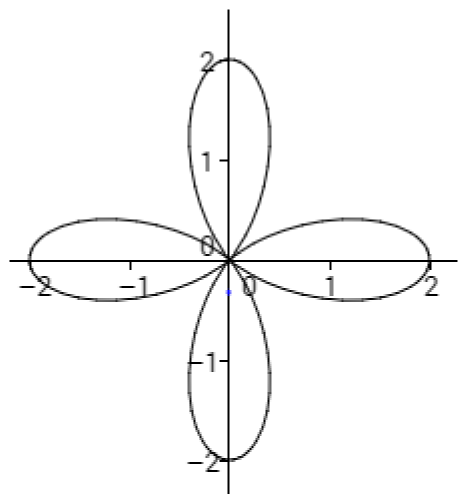


When a=1, b=1, k=4:

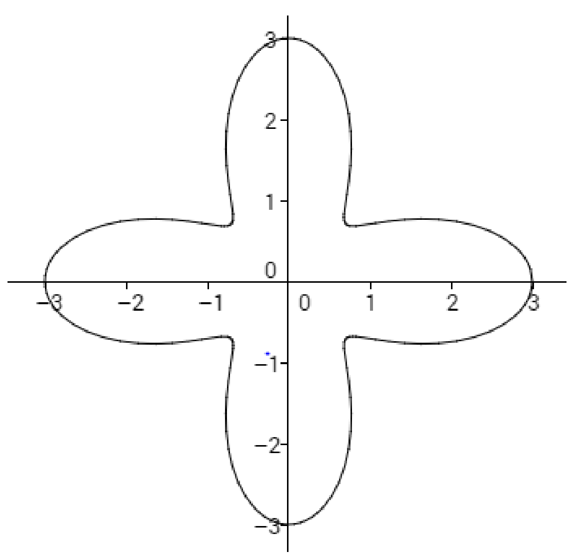


What happens if we keep b and k constant?

When a=1, b=1, k=4:



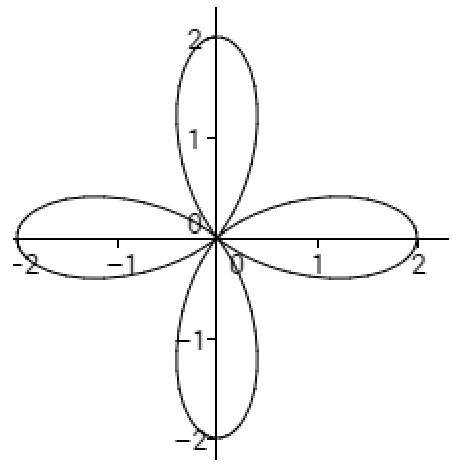
When a=2, b=1, k=4:



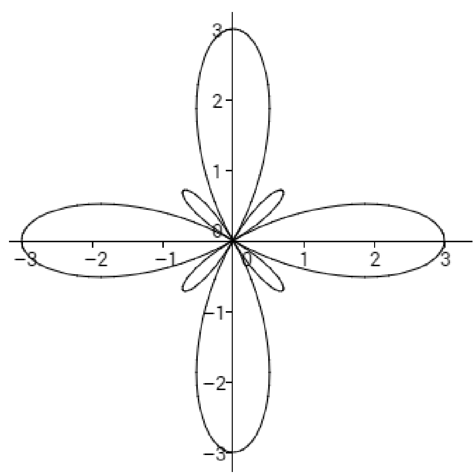
As a increases, the shape of the figure spread outwards further from the origin. The petals begin to open up or spread out more from the origin where they were originally pinched in.

What happens if we keep a and k constant?

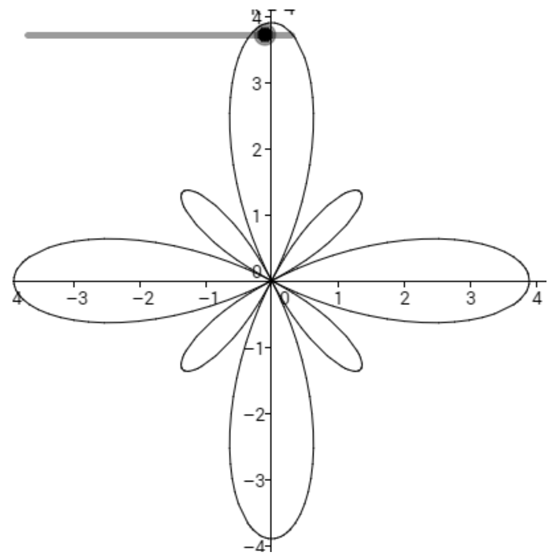
When a=, b=1 and k=4:



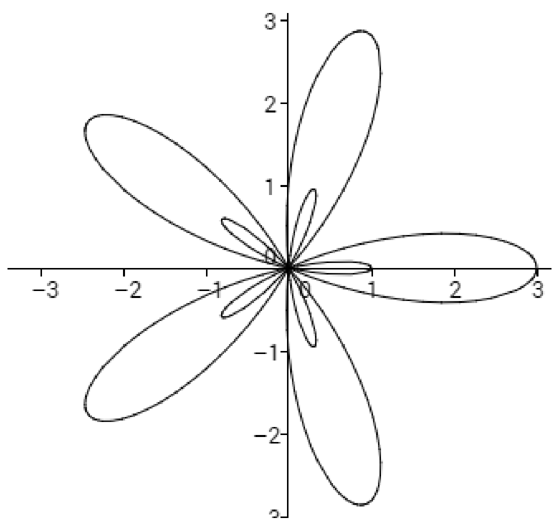
When a=1, b=2 and k=4



When a=1, b=3 and k=4



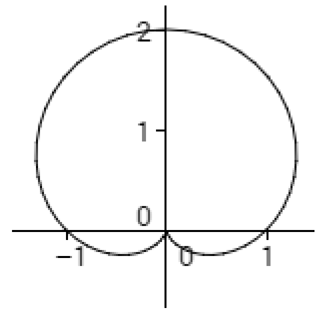
As b increases, the graph appears to stretch further out. In addition, if by is greater than 1, there are 2k petals formed (the additional petals formed are smaller than the original ones). If k is even then the additional smaller petals are outside of the larger petals. If k is odd the additional smaller petals are inside of the larger petals. Below is the case for a=1, b=2, k=5.



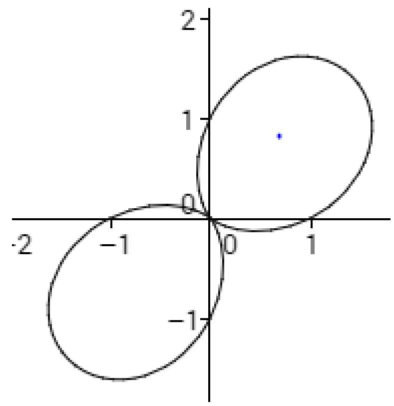
Investigate $r = a + bsin(k\Theta)$

Let us first observe when a=1 and b=1. We will manipulate the value of k.

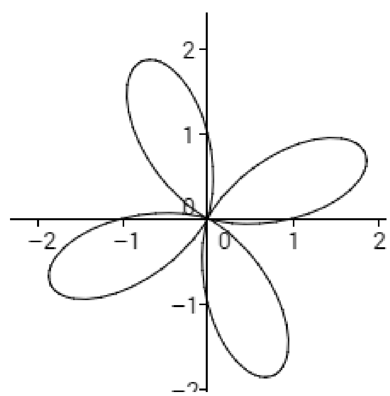
When a=1, b=1, k=1:



When a=1, b=1, k=2:



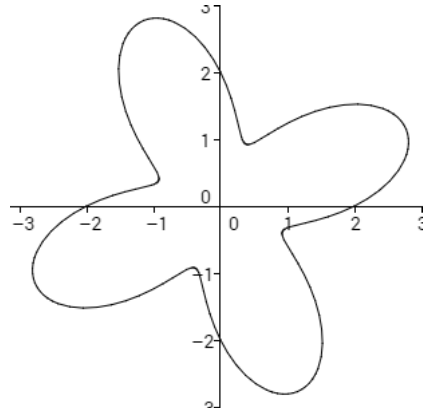
When a=1, b=1, k=4:



It again appears as though k determines the number of petals or loops formed, but this time all of the graphs cross the x-axist at (-1,0) and (1,0).

What happens when we keep b and k constant?

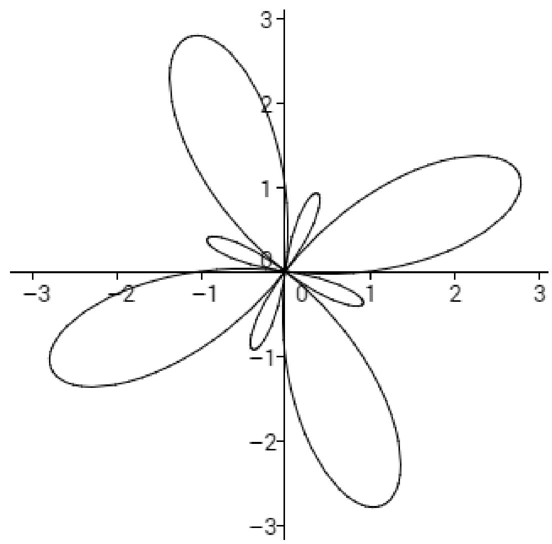
When a=2, b=1, k=4



Again it appears as though our figure spreads out more as a increases.

What about when a and k are constant?

When a=1, b=2, k=4.



It appears as though as b increases, the graph stretches out further, just as with our previous function.

In both explorations, altering a, b, and k resulted in the same graphical changes. The only difference in the graphs are the orientation of the petals because our relationship between theta and r are different as defined by the sine and cosine functions.