LAB 2: THE SPIROGRAPH

In this lab, we use the Spirograph (a child's toy from Hasbro) to investigate parametric curves.

Suppose you begin with a circle of radius R centered at the origin, C. Take another circle of radius r, label it $\hat{C}$, as shown in Figure 1. A felt pen is connected to $\hat{C}$, and it rotates about C. The pen leaves a trace- a sample trace is given in Figure .

Here are the lab questions. Your write up should be a discussion that incorporates the answers- Don't just list them! See the sample write up for an example.

(1) Come up with parametric equations, $x(t)$ and $y(t)$, for the path of the pen in the Spirograph.
(2) Come up with some nice patterns! You should try different end values of t.
(3) Do all the curves end up being periodic (in the sense that the curve is closed)? Can you describe when you will get closed curves? (Experiment with different values of R and r).
(4) Give the general formula for the arc length of the pen in the spirograph. Give a numerical value for the arc length of a closed curve (from your previous example).
(5) In the "Conclusions" section, you can bring in some of the mathematical names of these curves. You might do a little internet research to see if there is anything interesting about them.

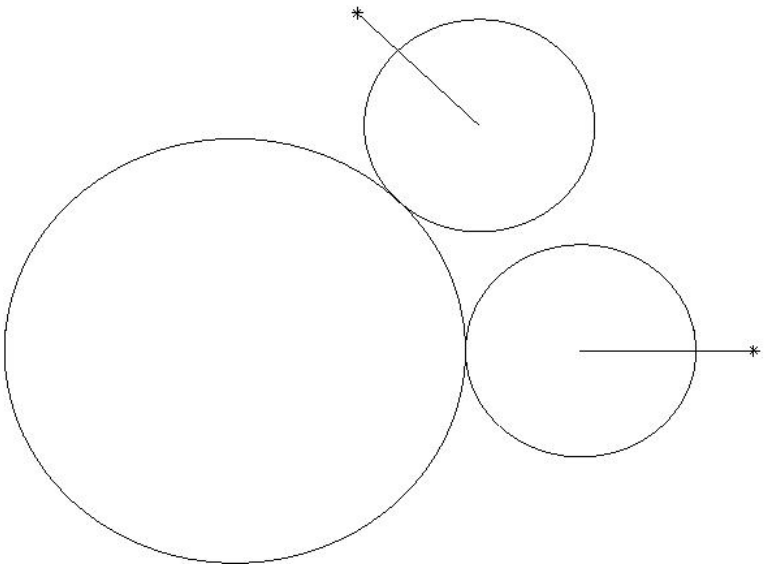

FIGURE 1. The set up for the spirograph.

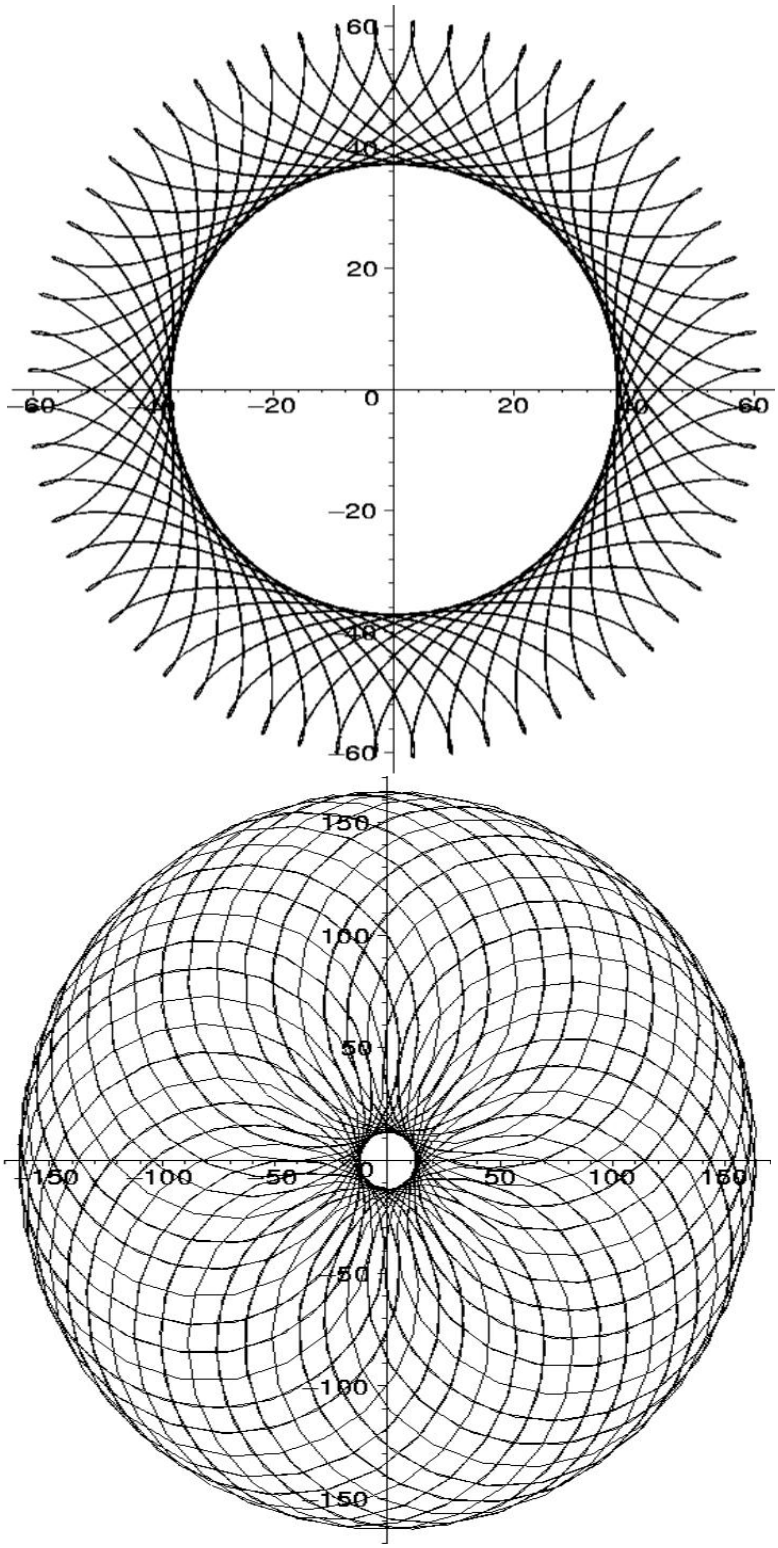

FIGURE 2. Two examples.