Name: ________________________ Group Members: ________________________

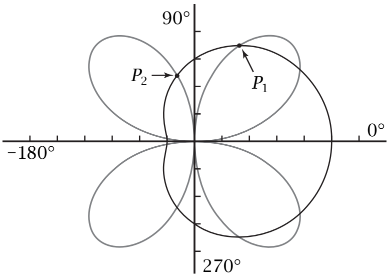
Exploration 13-3a: Intersections of Polar Curves

Date: ____________

Objective: Plot polar curves on your grapher, and determine which intersection points represent solutions to the system of equations.

The figure shows

- The limaçon $r_1 = 3 + 2\cos\theta$
- The rose $r_2 = 5\sin 2\theta$



1. Plot the two graphs on your grapher. Use degrees, simultaneous mode, and a fairly small θ-step so that the graphs plot relatively slowly. Pause the plotting when the graphs reach the intersection point P_1. Approximately what does θ equal at this point?

2. Resume the plotting, and then pause it again at the θ-value corresponding to point P_2 on the limaçon. Where is the point on the rose for this value of θ? Explain why P_2 is not a solution to the system of equations.

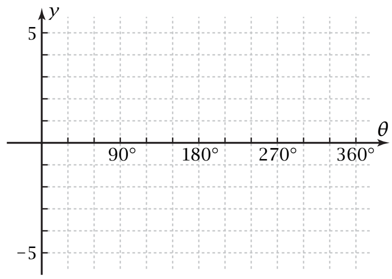
3. Continue the graphing until a complete 360° has been plotted. Which of the intersections in the figure are solutions to the system of equations and which are not? What do you notice about the r-values on the rose for the points that are not solutions?

4. With your grapher in function mode, plot the auxiliary Cartesian graphs

   $y_1 = 3 + 2\cos\theta$

   $y_2 = 5\sin 2\theta$

   Sketch the result.



5. Solve numerically to find the first two positive values of θ where the graphs in Problem 4 intersect. Show that these correspond to two of the points where the polar graphs intersect.

6. Show on the auxiliary graphs in Problem 4 that a second-quadrant angle θ for point P_2 corresponds to a solution to the limaçon equation but not to a solution to the rose equation.

7. What did you learn as a result of doing this Exploration that you did not know before?