Math 464, Worksheet 20

Use your model from Worksheet 19:

\[ \Delta R = 0.02R \left( 1 - \frac{R}{100} \right) - 0.002RF \]

\[ \Delta F = 0.0004RF - 0.01F \]

1. Use Excel to generate a solution for this model with initial conditions \( R(0) = 2 \) and \( F(0) = 10 \).

2. Graph the solution functions \( R(t) \) and \( F(t) \).

3. Extend your solution until you have at least three local maxima in each function.

4. Graph the solution as a parametric plot in \( R-F \) axes.

5. How long does it take for the solution to make one “cycle”? More specifically:
   
   (a) Compute the time between local maxima on the \( R(t) \) graph. Repeat until you run out of visible maxima.

   (b) Repeat for the local minima on \( R(t) \).

   (c) Repeat for maxima/minima on the \( F(t) \) graph.

6. Repeat Problems 1-4 for each of the following initial conditions. If the solutions oscillate, also repeat Problem 5.

   (a) \( R(0) = 50 \) and \( F(0) = 0 \)

   (b) \( R(0) = 0 \) and \( F(0) = 50 \)

   (c) \( R(0) = 50 \) and \( F(0) = 50 \)

   (d) \( R(0) = 150 \) and \( F(0) = 0 \)

   (e) \( R(0) = 150 \) and \( F(0) = 50 \)

7. Try to find some initial values \( F(0) \) and \( R(0) \), both non-zero, so that the solutions do not oscillate.

8. Try to find some initial values so that the solution oscillates with a “period” distinctly different from earlier problems.