

3450:438/538:001 **Homework 10** Fall 2007

Course: Advanced Engineering Math I

Instructor: Dr. Laura Gross

Recommended due date: Friday, November 2, 2007

THIS HOMEWORK IS NOT FOR COURSE CREDIT. However, you need to do problems to learn the material. Also, about 1/3 of your exam will consist of recommended homework problems.

1. Consider the system from Homework 9: $x'_1 = -2x_1 + x_2$, $x'_2 = x_1 - 2x_2$.
 - (a) Draw a sketch of a representative set of trajectories in the phase plane, based on the eigenvalues and eigenvectors you found in Homework 9.
 - (b) Simply using your answer to (1a), draw an approximate sketch of the solution to the differential equation subject to the initial condition $x_1(0) = 2$, $x_2(0) = 3$.
 - (c) If you wish, you may plot your solution to this IVP (found in Homework 9) parametrically in the x_1 - x_2 plane. Remember to include an arrow to indicate the direction of increasing t . Compare the graph to (1b).
 - (d) Classify the critical point $(0, 0)$ as to type and stability.

2. Consider the system $x' = 8x + 12y$, $y' = -9x + 47y$.
 - (a) Find the general real-valued solution. (**Recommended:** Verify the solution by substituting it back into the system.)
 - (b) Draw a sketch of a representative set of trajectories in the phase plane.
 - (c) Classify the critical point $(0, 0)$ as to type and stability.

3. Consider the system $x' = -2y$, $y' = -x + y$.
 - (a) Find the general real-valued solution. (**Recommended:** Verify the solution by substituting it back into the system.)
 - (b) Draw a sketch of a representative set of trajectories in the phase plane.
 - (c) Classify the critical point $(0, 0)$ as to type and stability.