Math 5594 – Homework V
(Due Wednesday, November 26)

From the text.
Chapter Problems
8 2
9 1ace, 4, 6, 8, 11, 12, 13, 16

Plus the following additional problem.

1. For each of the following nonlinear ODEs, find all the equilibrium points and use the linearized ODE to classify them as stable or unstable nodes, stable or unstable spirals, saddles, etc.
   (a) \[ x' = -x + y \]
       \[ y' = y - 3x^2 \]
   (b) \[ x'' + x' + x^3 - x = 0 \]. Begin by writing it as a (nonlinear) system.

Additional instructions and hints: For ch.8 problem 2, first find a formula for the flow \( \phi_t(x_0, y_0, z_0) \) then try to guess the conjugacy. For ch.9 problems 1ace, in addition to the instructions in the book, also find all the equilibrium points and use linearization to classify them as stable or unstable nodes, stable or unstable spirals, saddles, etc. For ch.9, problem 4, you will need to guess a Lyapunov function. Is the origin stable when \( \epsilon = 0 \) ?