Weeks 9-10 **Math 0290** *Differential Equations* - RUBIN - Winter/Spring '09

IMPORTANT DATES:

- HOMEWORK FROM WEEK 8 is due on **Wednesday, March 4th**. There will also a QUIZ on that material in class that day.
- There are no classes due to SPRING BREAK on Monday, March 9th, Wednesday, March 11th, and Friday, March 13th.
- HOMEWORK FROM THIS HANDOUT **FROM CHAPTER 10 ONLY** is due on **Wednesday, March 18th**.
- MIDTERM EXAM 2 will be held in class on **Friday, March 20th**. It will cover material up to an including Section 10.3.

TOPICS:

Section 10.1: The Linearization of a Nonlinear System - We already know how to find critical points. You know how to take partial derivatives of functions. In this section, we will find a critical point and form a corresponding matrix, the ***Jacobian***, by taking partial derivatives of terms from an ODE and evaluating them at the critical point. The eigenvalues of the Jacobian matrix J tell us about the phase portrait of the ODE near the critical point, just as they did for a linear system $y' = Ay$; that is, we can think of J just like A. The only exception is if J has purely imaginary or zero eigenvalues.

homework: pg. 468-9, # 1, 7, 22, 23, 25 (for 22, 23, 25, just find signs of whichever coefficients $a_1, b_1, c_1, a_2, b_2, c_2$ are nonzero and state which of these are zero).

Section 10.2: Long-Term Behavior of Solutions - key concepts: *stable, unstable*, and *asymptotically stable* critical points

homework: pg. 474, # 1, 4.

Section 10.3: Invariant Sets and the Use of Nullclines - For us, since we have already discussed the use of nullclines in phase portraits, this will pretty much be a review section. The new definition will be an *invariant* set.

homework: pg. 480-1, # 1, 9, 13, 15.

Section 5.1: The Definition of the Laplace Transform - key concepts:

1. the Laplace transform
2. piecewise continuous functions
3. computing the Laplace transform for a piecewise continuous function
4. a function of exponential order

homework (THESE ARE NOT DUE ON MARCH 18th!): pg. 196-7, # 2, 3, 8 (note that you can check your answers using the Table on pg. 204), 25, 28 (also plot $f(t)$ by hand for each of these; this should be simple, but you should do this to make sure you know what it looks like).