Week 7 **Math 0290** *Differential Equations* - RUBIN - Winter/Spring '09

DUE DATE: There will be a **Proficiency Exam** on **Monday, February 23rd**, in class. The homework problems from this handout are due at the end of the Proficiency Exam.

TOPICS:

Section 4.7: Forced Harmonic Motion - If a periodic forcing is applied to a mass-spring system, then undetermined coefficients and/or variation of parameters can be used to solve for the displacement of the mass as a function of time. The solution will have different properties in the undamped case depending on how the *driving frequency* compares to the *intrinsic frequency*. With damping, the solution can be considered as a transient part plus a steady state part.

homework: pg. 185-6, # 9, 10, 17. BONUS: Prove that $A(\cos\omega t - \cos\omega_0 t) = 2A(\sin(\omega_0 - \omega)t/2)(\sin(\omega_0 + \omega)t/2)$.

Section 8.1: Systems - Definitions and Examples - key concepts:

- nonlinear, autonomous/nonautonomous equations
- vector notation for a system of ODEs
- initial value problem
- transforming a higher order ODE into a system of first order ODEs

homework: pg. 336-7, # 10, 11, 16.

Section 8.2: Geometric Interpretation of Solutions - key concepts:

- parametric plot
- phase plane/space, solutions curves
- direction field

homework: pg.345-6, # 2, 15, 18(i)(ii). You can use MATLAB for your plots and should use PPLANE for #15 in particular.

Section 8.3: Qualitative Analysis - key concepts:

- existence and uniqueness of solutions
- implications of uniqueness for the phase plane
- equilibrium points
- nullclines

homework: pg. 352, # 2, 6, 7. You can use MATLAB (e.g. PPLANE will do it) to check your nullclines but should be sure to compute and draw them by hand.