Physics 3344 **Professor Scalise**
Spring 2000 **Assignment #12**

Due: 25 April 2000

1. Derive Marion & Thornton equations (3.63) and (3.72) by carrying out the differentiations yourself.

2. Marion & Thornton 3-9.

3. A critically damped oscillator with initial speed $v(0) = 0$ and initial displacement $x(0) = 0$ is subjected to a constant force F_0 beginning at time $t = 0$.

   (a) What is the particular solution for times $t > 0$?

   (b) What is the response (i.e. the displacement, i.e. the general solution) of the system for times $t > 0$?

   (c) What is the response of the system after a very long time?

   (d) Sketch the displacement vs. time.

4. (a) Consider an oscillator driven with a linearly increasing force, $F(t) = J_0 t$. Find a particular solution for $t > 0$ to
$$\ddot{x} + 2\beta\dot{x} + \omega_0^2 x = \frac{J_0 t}{m}$$
by guessing a solution of the form $x_p(t) = At + B$ and solving for A and B.

   (b) What is the general solution for an underdamped oscillator with $\beta = \omega_0/3$ and initial conditions $x(0) = 0$ and $v(0) = v_0$.

   (c) Plot the general solution and the velocity, taking reasonable values for the unknown parameters.

5. Make the corrections listed under "Errata" on the Web page to your copy of Marion & Thornton, and find at least one error not listed. If more than one person finds the same error, the homework points will be divided among the finders.