Ph 435 **Classical Mechanics Capstone** **Spring 2007**

Problem Set #2 Due Wednesday April 18, 2007 in class

1. Thornton and Marion, p. 91, #2.9

   In the case of a resisting force, express the time required in terms of a power series in the initial velocity, and show that the time approaches that obtained in the absence of a resisting force if (i) the velocity is very low or (ii) the constant characterizing the resisting force is very small.

2. T&M, p. 91, #2.12

3. T&M, p. 92, #2.15

   Hint: You will probably find useful the integrals E.4c and E.17b in Appendix E.

4. It was (will be) shown in class that the motion of a particle subject to a conservative force attributed to a one-dimensional potential *U*(*x*) can be written as an integral (2.98 in T&M):

$$t - t_0 = \int_{x_0}^{x} \frac{\pm dx}{\sqrt{\frac{2}{m}\left[E - U(x)\right]}} ,$$

   where x_0 is the position of the particle at the initial time t_0. Consider a particle of mass *m* falling from rest from an initial height *y* = *h* and carry out the integration to obtain the conventional expression $y(t) = h - \frac{1}{2} g(t - t_0)^2$ for the height *y* at subsequent times. (You will see that this approach, while mathematically and physically correct, is less convenient than the application of Newton's second law.)