The University of Alabama at Birmingham (UAB)
Department of Physics

PH 461/561 – Classical Mechanics I – Fall 2005

Assignment # 4   Due: **Thursday, September 8**
                                (Turn in for credit!)

Activities based on previous lecture:

1.   (30 pts) A particle of mass m moves in one dimension under the force:

$$F = -\frac{GMm}{x^2} \quad \text{(G, M, m are positive constants)}$$

a) Discuss the effect of this force on the total mechanical energy of the particle. Is it appropriate to define a potential energy for the motion of this particle? Why?

b) Find an expression for the potential energy $V(x)$ of the particle (Choose a reference point such that any arbitrary constants vanish)

c) Draw by hand a sketch of the potential energy $V(x)$ (No computer use upfront, please!) *(You may check with a computer afterwards)*

d) For which values of the total energy will the motion be:
-Bound (i.e., confined). Find the turning points.
-Unbound, with change of direction. Find the turning points.
-Unbound, with no change of direction.

e) Find $x(t)$ for the case when $E=0$ (This corresponds to the launch of a particle with mass m with escape speed from the surface of a planet with mass M).