

## Phys 203 - Princeton University - Fall 2006 - Homework # 1

Due September 27th by 5 PM in Prof. Romalis mailbox on the first floor of Jadwin

1. A gun can fire shells in any direction with a fixed speed  $v_0$ . Show that by adjusting the angle of fire, it can hit any object inside a surface given by

$$z = \frac{v_0^2}{2g} - \frac{g}{2v_0^2}(x^2 + y^2) \quad (1)$$

with the origin of the coordinate system at the location of the gun.

2. Problem 2.39 from Thornton and Marion
3. A simple pendulum is made from a wooden block of mass  $M$  suspended from a string of length  $l$ . Initially the pendulum is at rest. A bullet of mass  $m$  is fired horizontally with velocity  $v_0$  and gets imbedded inside the block at  $t = 0$ . Write down an equation for subsequent motion of the block  $\theta(t)$  assuming the amplitude of oscillations is small. You can also assume  $m \ll M$ .
4. Problem 3.7 from Thornton and Marion
5. Determine the equilibrium shape  $y(x)$  of the suspension cable in a bridge shown in the figure. Assume that the mass of the roadway is much larger than the mass of the cable. The length of the vertical ropes is adjusted so there is no shear stress in the roadway. You can also assume that vertical ropes are spaced by a very small distance.

