Physics 201 Fall 2012 Practice Test 3

1. A ladder of length \( L \) and mass \( M \) is propped against a frictionless wall at an angle \( \theta \) from horizontal. The ladder/ground interface has coefficient of static friction \( \mu_s \). Find an expression for the maximum distance \( d \) that a man of mass \( m \) can climb the ladder before it slips (assuming that it will slip).

2. An object of mass \( m \) is dropped from altitude \( h \) above the surface of a planet of mass \( M \) and radius \( R \). Find an expression for the object's speed \( v \) as it hits the ground.

3. A cylinder of height \( h \) and density \( \rho \) floats in water of density \( \rho_w \) with its long axis vertical. Find an expression for the ratio \( z/h \) of the exposed height to the total height.

4. A large water tank has a hole at height \( y \). The tank is kept full of water at height \( h \). Find an expression for the value of \( y \) at which the range of the water stream \( x \) is maximized.

5. A mass \( m \) is held by two stretched rubber bands of length \( L \) on a frictionless surface. (The diagram shows the view looking down at the surface.) At equilibrium, the bands have tension \( T \). Find an expression for the frequency \( \omega \) of small oscillations perpendicular to the bands. Assume that the magnitude of \( T \) is constant throughout the oscillations.