Homework #3. Due, class time 2/16

1. You use a frayed rope to pull a crate across a level floor. The maximum tension that the rope can have without breaking is T_{max}, and the coefficient of kinetic friction is μ_k Find the maximum mass of crate that you can pull at constant speed, and the angle of the rope that allows you to pull this maximum weight.

2. Rather stupidly, you try and move a large crate of mass m by pulling using a rope at an angle of Θ below the horizontal. What force (in terms of m,g, Θ and μ_s) is necessary to get the crate started? If μ_s is greater than some critical value, you cannot pull the crate this way. What is this critical value?

3. You are a distance d away from a wall (measured along the x-axis). A window is a height h up the wall (y-axis). Starting from the ground level, you want to throw a ball to hit the window. What angle allows you to do this with the least initial velocity? (Neglect air resistance).