Name: _____

HW 4: Chapter 4

1. The Snowboarder

A snowboarder, with a mass of 54kg, starting from rest, slides down a snow-covered incline that is 30^0 from the horizontal. After sliding down a distance $d = 20m$ she immediately ascends another incline angled 45^0 from the horizontal. The coefficient of kinetic friction is 0.03. Neglect air resistance.

I. What is her final velocity coming off the ramp?

II. Assume that the final velocity that you calculated in part I is her initial velocity as she begins her ascent up the incline. How far up the ramp does she go?
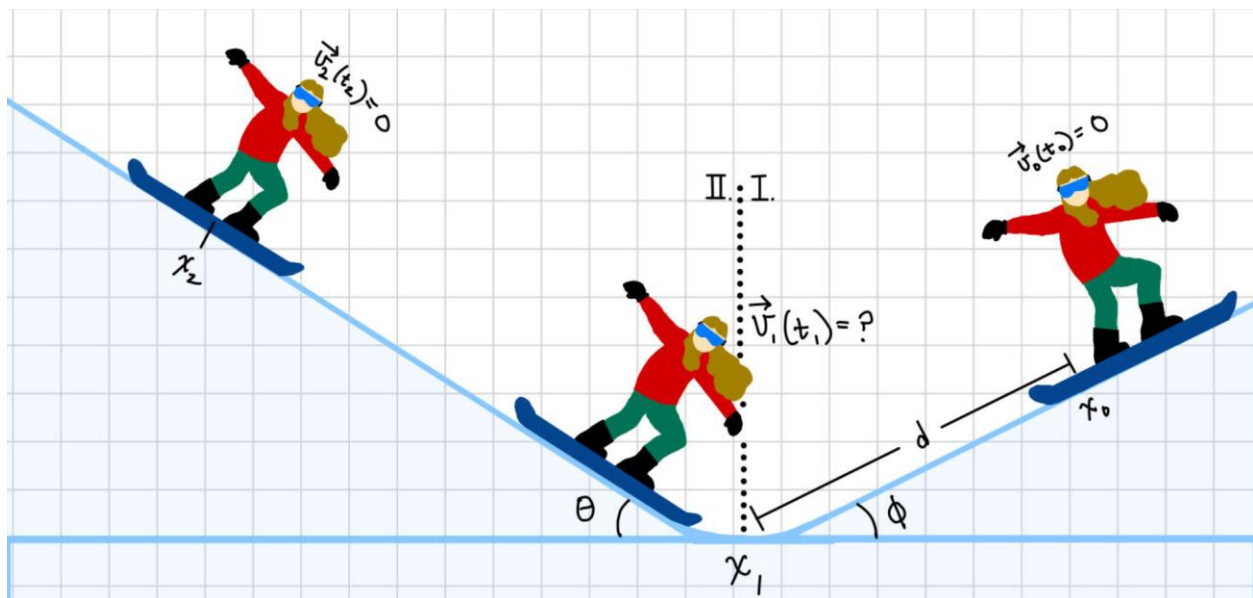
2. A Dire Situation

Bellatrix, a labrador, and her friend, Larry the Orangutan, are in a dire situation. Due to hijinks, Larry has found himself hanging from a rope attached to a pulley that is on an incline on the edge of a cliff. Bellatrix stands on the incline holding the other end of the rope as shown in the diagram below. The incline is at an angle of 30^0. Larry's weight is 500 N and Bellatrix's weight is 445 Newtons. Neglect air resistance.

a) What must the maximum coefficient of static friction be so that this pair of misfits stays in equilibrium?

b) If $\mu_k = 0.1$, and they are no longer in equilibrium, what is Bellatrix's acceleration up the ramp?
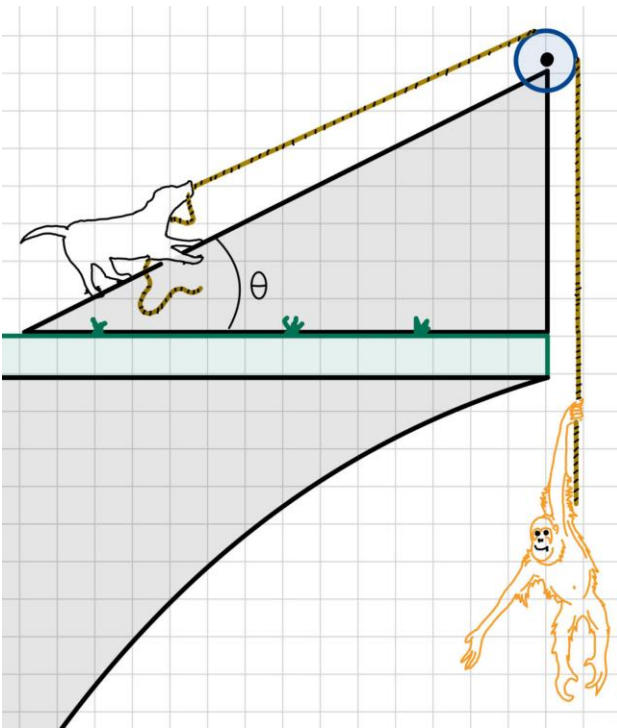
3. Blackhole vs Newton

Isaac Newton finds himself in a predicament - falling into a blackhole! The mass of the blackhole is 1000 times more massive than the mass of Earth, $m_E = 6 \times 10^{24} kg$. Suppose he is located $10 km$ from the center of the blackhole – also known as "the singularity".

a) What is the gravitational acceleration that Newton experiences?
b) How many times greater is it to the gravitational acceleration he would feel an equivalent distance from Earth?
c) The distance from the center of the blackhole and the boundary of no return, called the event horizon, is about 9km. How long will it take Newton to cross that boundary? Assume that he starts from rest.