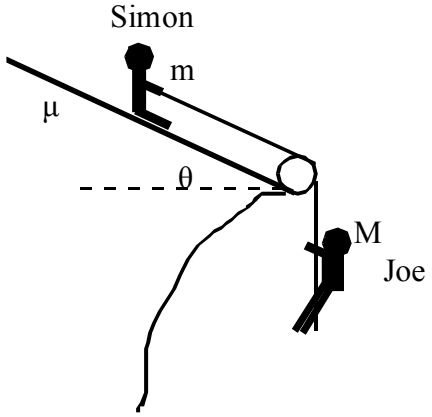
Physics 1135 Homework for Recitation 7: Friction

1. A worker is pushing a box of mass *M* up a rough incline by applying a **horizontal** pushing force of constant magnitude *P*. The incline makes an angle θ with respect to the **vertical**, and the coefficient of kinetic friction between the slope and the box is μ. Derive an expression for the acceleration of the box.

2. A large cube of mass *M* is pushed along a frictionless horizontal surface. A small block of mass *m* is held to the vertical front of the cube. The coefficient of static friction between the cube and the block is μ_s. What is the minimum acceleration of the cube that ensures the small block does not slide down? If the cube is accelerated by means of a horizontal pushing force *P*, what is the smallest magnitude of *P* that ensures the block does not slide?

3. Two climbers are on a mountain. Simon, of mass *m*, is sitting on a snow covered slope that makes an angle θ with the horizontal. The coefficient of static friction between his body and the snow is μ. He is tied into one end of a massless rope that runs over a frictionless pulley. Joe, of mass *M*, is at the other end of the rope. He has fallen and is hanging motionless below an overhang. Derive an expression for the maximum value of Joe's mass *M* so that Simon is not pulled down the slope, in terms of relevant system parameters.



4. A small block of mass *m* is on the rough inclined side of a wedge shaped block of mass *M* which makes an angle θ with the horizontal. The coefficient of static friction between block and wedge is μ. The wedge is on a frictionless horizontal surface. Find the **maximum** magnitude *P* of the horizontal force that can be applied to the wedge so that the block *m* does not slide up the incline. (Hint: begin with fully labeled free-body diagrams for the small block and for the block+wedge combined, respectively.)