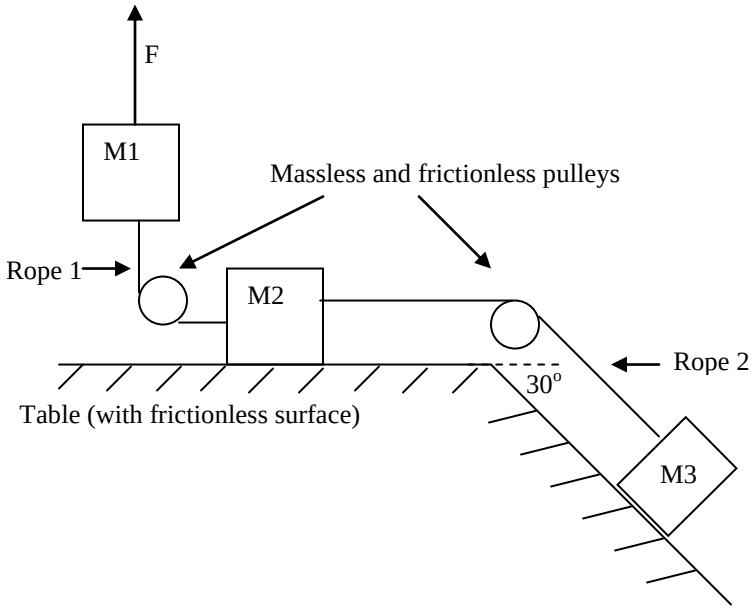
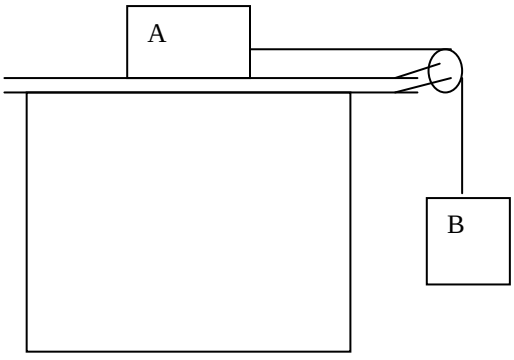
Physics 113 – Fall 2013 - workshop module 3
Newton's Laws

1. Some wacked physics professor does a demo for his class that involves three masses in the configuration sketched below. The professor pulls upward on mass M1 with a force F causing M1 to move upward with an acceleration of 0.5 m/s^2. Let the masses of M1, M2 and M3 be 2 kg, 3 kg and 4 kg, respectively. The frictionless inclined plane on which M3 slides is at an angle of 30 degrees with the horizontal. Determine the magnitude of the force F exerted by the professor on M1 and the tension in each rope. *Assume M2 slides on the table without friction and M3 slides on the inclined plane without friction and that the ropes are massless. Ignore air resistance. Assume the physics class is taking place on the Earth's surface.*



2. Consider the system shown below. The coefficient of kinetic friction between block A (with weight W_a) and the table top is μ_k. (a) Calculate the weight W_b of the hanging block required if this block is to descend at constant speed once it has been set into motion. (b) Suppose the coefficient of static friction is $\mu_s = 0.4$ and the mass of A is 30 kg and the mass of B is 2 kg. What is the force of friction on mass A now (assuming an initial condition of no motion)? How will the system move as time increases?



3. Most/All automobiles these days are constructed with “anti-lock disc brakes”. What this means is that no matter how hard you stomp on the brake pedal the wheels are slowed as much as possible so that they continue to roll as opposed to slide. The development of such brakes was a huge safety advance. Why? What is the point behind "anti-lock disk brakes"?

4. Consider the drawing below. In terms of m_1, m_2 and g, find the acceleration of each block in the system. Assume there is no friction anywhere in the system. Check your solution with limiting cases.