8.01 Math Review Night 2: N Equations N Unknowns
Worked Example: Three Blocks

- In the system shown above $m_1 > m_2$. The pulleys are massless, the contact surfaces are frictionless, and the rope joining the blocks has is massless. The coefficient of kinetic friction is $\mu_k$ and the coefficient of static friction is $\mu_s$ with $\mu_s > \mu_k$.

  a) Imagine that when the system is released from rest body 3 accelerates downward at a constant rate of magnitude $a$, but only one of the other blocks moves. Which block does not move, and what is the magnitude and direction of the friction force holding it back.

  b) Now consider the case where, when released from rest, all three blocks begin to move. Find the accelerations of all three blocks and the tension in the rope.
Worked Example: Car on Banked Turn

a) At what speed $v_o$ should the car enter the banked turn if the road is very slippery in order not to slide up or down the banked turn?

b) Now suppose the coefficient of friction between the wheels and the road is $\mu$. What is the maximum speed $v_{\text{max}}$ with which the car can enter the banked turn so that it does not slide up the banked turn?

c) Suppose the car enters the turn with a speed such that $v_o < v < v_{\text{max}}$. Find an expression for the magnitude of the friction force.
Table Problem: Blocks and Pulleys on Table

Two blocks rest on a frictionless horizontal surface. They are connected by 3 massless strings and 2 frictionless, massless pulleys as shown above. A force $F$ is applied to block 1. What is the resulting acceleration of block 1?
A car moves at constant speed around a curved section of highway with radius $R$. The car has mass $m$. Its center of mass is a height $h$ above the road. The span between the tires on the inside and outside of the turn is $w$. What is the maximum speed the car can maintain without rolling over?