Names:

# PHYS 211: Problem Set 2

May 23, 2012

1. Two blocks are tied to a third block with two separate strings, and the assembly is strung over two pulleys on the edges of a table with the center block sitting on the table as shown. The table inclined at an angle $\theta = 10°$ and has a friction coefficient of $\mu = 0.7$, $m_1 = 5$kg, $m_2 = 7$kg and $m_3 = 3$kg. Assume that the pulleys are massless and frictionless and the strings are massless and frictionless.

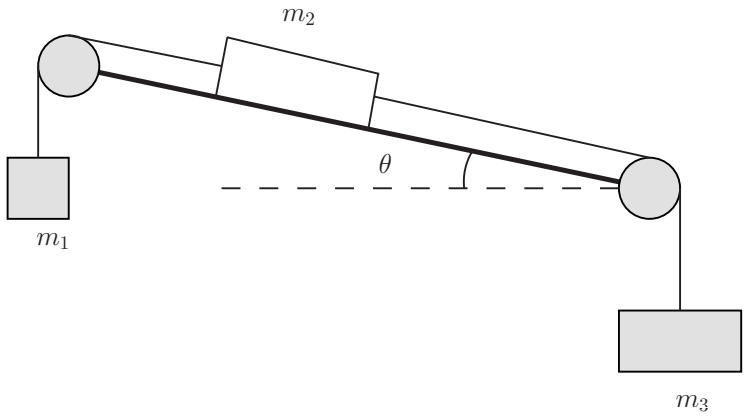


Figure 1: Three blocks and two pulleys on an inclinded plane.

   (a) Draw all the forces acting on each of the blocks.

   (b) Write down Newton's equation ($F = ma$) for each block while clearly indicating the direction of acceleration you are assuming.

   (c) Solve these equations and find the acceleration of each block and the tension in the strings.

   (d) Does the answer seem reasonable?

2. You're driving along the happily when an oblivious driver changes lanes right in front of you. You slam the brakes, and manage not to rear end this person. Later, you wonder if it was better to hit the brakes so hard that the wheels locked and the car slid to a stop, or to hit them just hard enough so you were just about not slipping. A good car's brakes can decelerate it (while not slipping) at about 8mph/second. The coefficient of friction for sliding is abot 0.9. What was a better decision, to slip or roll? What would be the difference in braking time and braking distance if you were initially moving at 60mph.

3. An airplane traveling at 600mph makes a bank of radius 0.25 mile. At what angle must it bank in order to not slip out of the turn? Does this sound like a reasonable angle for a plane to bank at? If not, what is a reasonable angle, and what radius of turn does it correspond to? Remember, draw a free body diagram showing all the forces.

4. A car moves on a road that can be approximated as an arc of a circle of radius 100m near the top. How fast can it go without losing contact with the road?

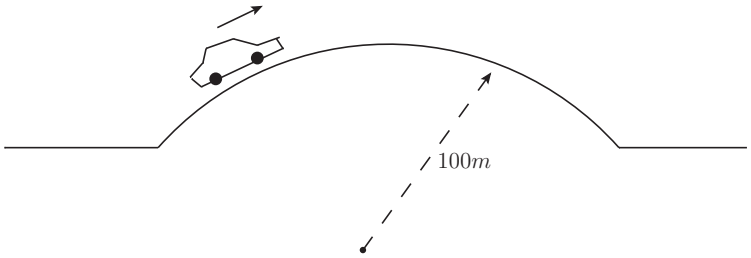


Figure 2: Car on a big bump.