PHYS 1210 Discussion Worksheet 4
Newton's Second Law

Summary

Newton's second law

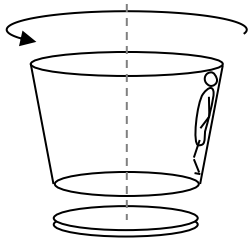
$$\vec{a} = \Sigma\vec{F}/m$$

Problems

There is not room on this worksheet for your work. Use your own scratch paper!

1. Kaden, 60.0 kg, steps onto an elevator. For reasons known only to his physics teacher, he brought a bathroom scale with him. It's a special scale calibrated in Newtons, because Kaden's physics teacher doesn't want to confuse you any more than necessary. He stands on the scale as he rides the elevator.
   a. What does the scale show as Kaden's weight as the elevator is motionless?
   b. The elevator begins to ascend (go up), accelerating upward at 1.40 m/s^2. What weight does the scale show?
   c. As the elevator ascends at a constant cruising speed of 4.20 m/s, what weight does the scale show?
   d. As the elevator nears its destination floor, it slows down at 1.40 m/s^2. What weight does the scale show?
   e. Once the elevator comes to rest at its destination floor, what weight does the scale show?
   f. Now the elevator begins to descend, accelerating downward at a rate of 1.40 m/s^2. What weight does the scale show?
   g. As the elevator descends at a constant cruising speed of 4.20 m/s, what weight does the scale show?
   h. As the elevator nears its destination floor, it slows down at 1.40 m/s^2. What weight does the scale show?

2. An amusement park ride known as the "rotor" consists of a circular capsule with sloping walls. Riders lean against the walls, the capsule spins about its axis, and then the floor of the capsule drops, leaving the riders supported only by the walls.



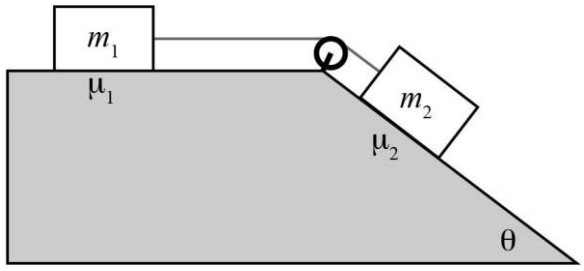
   a. Draw a free-body diagram for a rider in the spinning rotor.

b. What must the direction of the net force on the rider be?

c. Identify, for each quantity listed below, whether the quantity should be large or small to keep the rider from sliding down the wall during the ride. Assume that the other listed quantities are held fixed as the one under consideration varies.

- μ_s, the coefficient of static friction between the rider and the wall.
- ω, the angular speed (rate of rotation, °/s, rad/s, or cycles/s) of the rotor.
- α, the angle from the vertical of the wall of the capsule. (0 = vertical wall.)
- m, the mass of the rider.
- R, the radius of the spinning rotor.

3. Two blocks, connected by a light, inextensible cable running over a frictionless pulley, slide along a steel track. One block slides along a level portion of the track, while the other block slides down a portion inclined downward at an angle θ. Their masses are m_1 and m_2, and their coefficients of kinetic friction with the track are μ_1 and μ_2, respectively.



a. Find their acceleration.

b. Find their acceleration where m_1 = 1.0 kg, m_2 = 1.0 kg, μ_1 = 0.47, and μ_2 = 0.36, and θ = 50°.

c. Using the values in part b, find the angle θ at which the acceleration is zero. You'll probably need to find this numerically. A spreadsheet might help with this.