PHY 201 Homework 4 Due Friday, Sept. 27 at SE 316 at 5:00 PM.

There will be a help session on Wednesday Sept. 25 between 8:00 and 10:00 at 3510 5th Ave. The first midterm will be on Wednesday, October 9.





The family pet, mass m, is suspended by a rope of length l. It is set into circular motion so that the rope has a constant angle ϕ with the vertical. Find the time for one rotation as a function of ϕ , l, and g. When I was young I had a pet snake. It's name was "Noodles."

2.



A man, mass m_1 , on a platform, mass m_2 , pulls himself up with a rope and pulley as shown. Assuming that he is pulling the rope at a constant rate, what is the tension on the rope? What is the normal force (Magnitude and direction) of the man against the platform? Find numerical values in the case $m_1 = 75 \text{ kg}$, and $m_2 = 15 \text{ kg}$.

3.



Find the force **F** that will pull the box at a constant speed across the floor. The coefficient of kinetic friction between the box and the floor is $\mu_k = 0.65$.

4. Many years ago, I went to Six Flags Great Adventure in Jackson, New Jersey. They had a ride called "The Rotor" which consisted of a large cylinder that rotated about its axis.

Victims would position themselves against the wall and the and the machine would start rotating, and the floor would drop, leaving you "stuck" against the wall. Let R be the radius of the cylinder and f be the rotational frequency. Find the minimum coefficient of static friction μ_s that would keep victims from sliding down the wall. Find the numerical value for μ_s for R = 2 m and f = 0.5 rotates per second.

- 5. A 2000 lb car travels 60 mph on an unbanked circular track with a radius of 300 yards.
 - (a) Find the total force of friction that the road exerts on the car.
 - (b) What is the minimum of μ_s in this case.
 - (c) Now consider the same car, moving at the same speed, on a banked circular track having the same radius. Let α be the angle of the track with respect to the horizontal. What must α be so that the frictional force is zero?



Remember, don't put numbers into your calculation until the last possible moment.

6. A car is going down a 10% grade and is accelerating. A toy in the car, mass m = 0.1 kg, hangs from the ceiling of the car. The acceleration of the car is such that the string remains exactly perpendicular to the ceiling of the car. Find the acceleration of the car and the tension on the string. What is the direction of the car's acceleration?



A 10% grade means that $tan(\alpha) = 0.1$. Hint: Start by asking yourself, "What is the acceleration of the toy?"