Physics 1210
Homework 10 Written-out Problems

1.
You are hired by the Laramie Public Works to help design a new wastewater treatment centrifuge. The centrifuge has already been contracted to be a hallow cylinder of mass 110 kg and radius 4.9 m. In use a motor spins it up such that from rest at t=0 the angle turned is given by $\theta(t)=At^2+Bt^4$ where A has a numerical value 1.10 and B has a value 1.60 until it attains some maximum angular velocity.

A) Show the units for A and B
B) What is the angular momentum of the cylinder at t=4 s? Assume that it has not reached the maximum angular velocity during that 4 seconds.
C) What is the torque on the cylinder at t=4 s?

2.
A fire truck crew uses a hose on a tall ladder of height L above the ground to spray water on a fire in a tall building as seen below. The hose nozzle is inclined θ above the horizontal. The water is supplied via underground pipes to the fire hydrant by the town's municipal water tank. The municipal water tank has a water level located at height H above ground level.

A) What is the velocity of the water as it comes out of the hose assuming the municipal water tank is very large and open to air at the top. Also assume no extra pressuring of the water occurs inside the firetruck.

B) Find the maximum height s and the associated horizontal distance D that the firefighters should position their truck from the base of the building as a function of the angle of the hose and your expression for initial velocity from part A. In real life firefighters rarely attempt to shoot water more than 40 feet up.