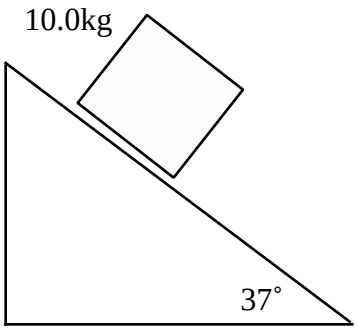
Name:_____ Posting Code: _____ _____ _____

Physics 4A **FINAL EXAM** **Fall 1992**

Solve the following problems in the space provided. Use the back of the page if needed. Each problem is worth 10 points. You must show your work in a logical fashion starting with the correctly applied physical principles which are on the last page. Your score will be maximized if your work is easy to follow because partial credit will be awarded.

1. A football is kicked at a speed of 25.0m/s at an angle of 60˚ above the horizontal. Find the time of flight and the distance the ball travels before striking the ground.

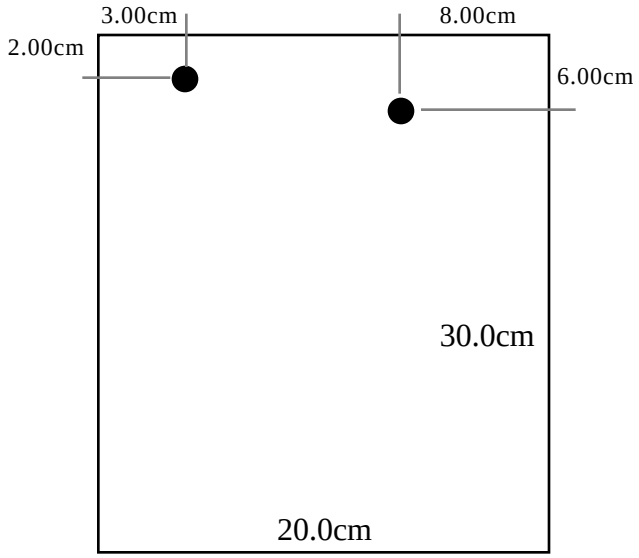
2. A 10.0kg box slides down a ramp at a constant speed of 2.00m/s. The ramp makes a 37˚ angle with the horizontal. In the diagram below draw the forces that act on the box and then find their magnitudes.



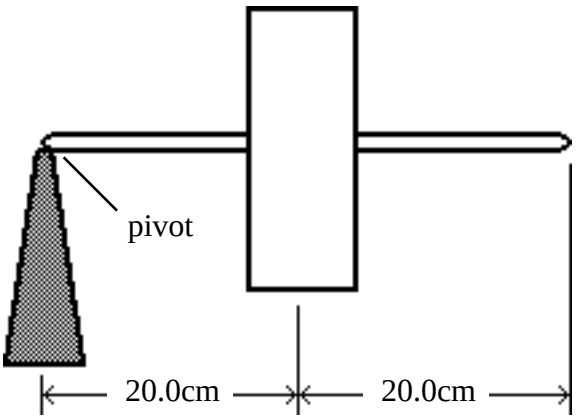
3. A 500kg Geo Metro heading north at 80.0km/h collides with a stationary 75.0kg deer. Find the speed of the wreckage just after the collision assuming that the deer sticks to the car.

4. An 18.0cm long pencil standing vertically on its point tips over. Find the velocity of its center of mass when it strikes the table.

5. A 5.00g page of paper is mounted on a bulletin board with two thumb tacks as shown below. Find the vertical forces exerted by each tack.

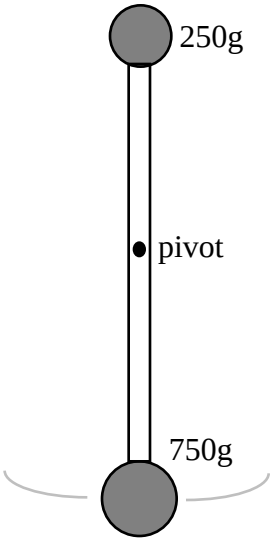


6. The 3.00kg gyroscope shown below is horizontal and in the plane of the paper. It spins at 600rpm with the part facing you moving downward and has a rotational inertia of $0.0500 kg \cdot m^2$. (a)Find the angular momentum of the gyroscope and indicate its direction in the sketch below. (b)Name the forces that act on the gyroscope and indicate them in the sketch. (c)Find the torque on the gyroscope about the pivot and indicate the direction of the torque. Make sure the direction of the vectors is made clear.



7. A mass of 100±2g is placed on a spring. When the spring reaches equilibrium, the stretch is measured to be 5.2±.3cm. Find the spring constant of the spring and its uncertainty.

8. A light meterstick has a 250g mass at the top and a 750g mass at the bottom. It is pivoted about the center as shown at the right. Find (a)the center of mass of the system, (b)the rotational inertia of the system about the center of mass, and (c)the period of small oscillations if it is slightly disturbed from the vertical.



9. A 300kg satellite is in a circular orbit 500km above the earth's surface. Find (a) the velocity of the satellite and (b)the minimum energy required to put it into orbit.

10. A frog is placed in a hemispherical bowl with a 10.0cm diameter. The bowl is then placed in water and it just barely floats. Find the mass of the frog.