Phy131 Seventh Homework Assignment
Due Friday, March 11th

Figures for the questions can be found on the link after this homework assignment on the homework page.

Question 1.

Marius, Lara and Julian are spinning around on a carousel, whose radius is 4 meters. Each child has a mass of 40 kg, and the carousel has a mass of 240 kg. Assume that the carousel is a uniform circular disk.

Initially, all three children are sitting at the edge of the carousel, 4 meters from the center. The carousel is initially rotating with a period of 2 seconds. If all three children move to the center, what is the new period of rotation?

Question 2.

James runs towards a carousel and jumps on as shown in the figure. The carousel has a mass of $4m$ and a radius of R. James has a mass of m, and a speed before jumping on the carousel of v_0. What is the final angular velocity of the carousel? Express your answer in terms of v_0 and R, and assume that the carousel is a uniform circular disk.

Question 3.

Ray Williams, a Cal Poly Physics graduate, throws a bowling ball of mass M and radius R down the lane. The ball is thrown with an initial speed of v_0, and is initially not rotating. The coefficient of friction between the ball and the lane is μ. As the ball moves down the lane, it skids, slowing the ball down and causing it to start rotating. Eventually, the ball rolls without slipping.

What is the final speed of the ball when it rolls without slipping? Express your answer in terms of v_0.

Question 4.

A stick of mass M and length L is hanging down from one end. A bullet of mass m, traveling with a speed v_0, hits the stick directly on its side a distance $2L/3$ from the pivot point. See the figure. The bullet embeds itself in the stick and the stick

swings upward until it stops parallel to the ground. What was the initial speed of the bullet? Express your answer in terms of L, g, m, and M.

Question 5.

Calculate the rotational inertial of a thin spherical shell of radius R and mass m.