1. A child’s merry-go-round can be approximated as a uniform thin disk free (that is, no friction) to rotate about a fixed vertical axis. The disk has mass \( M = 120 \text{ kg} \) and radius \( R = 2 \text{ m} \). The merry-go-round is at rest when you jump on it. Prior to jumping on it you were running at \( v = 5 \text{ m/s} \) on a line tangent to the rim of the merry-go-round. Assume your mass is \( m = 60 \text{ kg} \) and that you are a point mass. That is, ignore your moment of inertia about your own center of mass.

a) While you are standing at the rim of the merry-go-round, what is the common angular velocity of you and the merry-go-round? (6 points)

b) \textbf{ESTIMATE} (a precise answer is not required) the fractional error you made in part (a) by assuming you were a point mass. Be sure to give a reason for your estimate. (4 points)

Rewrite and sign the Honor Pledge: \textit{I pledge my honor that I have not violated the Honor Code during this examination.}

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Signature

(OVER)
2. Two identical pucks, which are uniform disks of mass $M$ and radius $R$, rest on a horizontal frictionless surface. Initially, puck 2 is at rest and puck 1 is moving towards puck 2 with velocity $v_0$. If the pucks didn’t collide, the centers of the two pucks would pass each other at a distance $b$ ($b < 2R$). Neither puck is rotating. The pucks collide, stick together, and move as a rigid body after the collision. Express all your answers below in terms of $M$, $R$, $v_0$, and $b$.

![Diagram of pucks before and after collision]

a) What is the linear velocity, $v$, of the two puck system after the collision? (2 points)

b) What is the angular momentum of the two puck system about the center of mass of the two pucks, before the collision? (3 points)

c) What is the moment of inertia of the two puck system after the pucks have collided and stuck together? Use an axis through the center of mass, perpendicular to the plane of the paper. (3 points)

d) What is the angular velocity, $\omega$, of the two puck system after the collision? (2 points)