1. On an inebriated run across campus, the Pillsbury Doughboy dashes across a table with a speed $v = 10 \text{ m/s}$, then bumps into a fully sober student in Wheeler House, knocking her through the third floor window, and leaving her with a smell of alcohol that will later mislead Student Life reporters. Approximate the Pillsbury Doughboy (mass $m = 0.5 \text{ kg}$) and the sober student (mass $M = 50 \text{ kg}$) as particles.

(a) If the coefficient of restitution between the Pillsbury Doughboy the inebriated student is $e = 0.8$, what is the velocity of the student after the impact?

(b) What is the velocity vector of the student when she reaches the ground?

(c) The Pillsbury Doughboy runs outside, and catches the student as he squishes over a time interval of $\Delta t = 0.03 \text{ s}$, allowing her to escape physical injury. What is the average force vector that the squishing exerts on the student?
2. Students streak straight out of the shower to chase the questionably clothed Pillsbury Doughboy, who catches his feet in that chewing gum by the grate at the library, and snares a fishing line on his hat as he falls. The Pillsbury Doughboy has a mass \( m = 0.5 \text{ kg} \); the fishing line has insignificant mass, and the friction at the grate is negligible. Immediately after his toes are caught, the velocity of his center of gravity is \( v_0 = 1 \text{ m/s} \).

What is the minimum mass of the fish on the end of the line to prevent him from hitting his face on the ground? Neglect the Pillsbury Doughboy’s thickness in this calculation, and treat him as rigid.
3. The Pillsbury Doughboy rises up on a platform to start another of those late night food fights in the Bears' Den. Each arm is 0.5 m, and is hinged at its endpoints. The Pillsbury Doughboy is rising at a constant speed of 1 m/s. When $\theta = \tan^{-1}(3/4)$, what are the angular velocity and angular acceleration of arm AB?
4. The food fight ends when an airborne banana strikes the Pillsbury Doughboy while he is jumping upwards at \( v = 1 \text{ m/s} \) in the \( \mathbf{j} \) direction, exerting a force of 100N as shown. What are the accelerations of the Pillsbury Doughboy and his angular acceleration at this instant? The mass of the Pillsbury Doughboy is \( M = 0.5 \text{ kg} \).