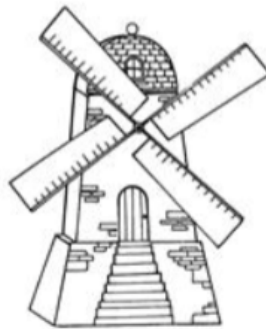


Homework 9: Energy and Angular Momentum

Due: Tuesday November 27th, 16:00

Policy: Collaboration is allowed, but every student is required to hand in his/her own version of the solutions. Please include your name and student number on the solutions.

Problem 1. We consider a windmill with four wings. See the picture below. We assume that each wing is rectangular with length L , width W and mass M . Each wing is attached to the pivot point by a massless rod of length $\ell + L$, which extends along the length of the wing. Determine the moment of



inertia of the four wings around their axis of rotation (the axis through the pivot point and orthogonal to the wings).

Problem 2. (K. & K. 7.30) A bowling ball is thrown down the alley with speed v_0 . Initially it slides without rolling, but due to friction it begins to roll.

1. (30%) Show that its speed when it rolls without sliding is $\frac{5}{7}v_0$.
2. (20%) How much of the initial kinetic energy is dissipated by the friction force?

Hint: Recall that the moment of inertia I_0 of a solid sphere (mass M , radius R) with respect to an axis through its center of mass, equals $\frac{2}{5}MR^2$.