PHYSICS 603 - Winter/Spring Semester 2007 - ODU

Classical Mechanics - Problem Set 5

Problem 1)

Solve Goldstein's problem 23 (Chapter 4), p. 183 (the Foucault pendulum). Use the small-angle approximation and treat the Coriolis "force" as a small perturbation on the ordinary pendulum motion.

Problem 2)

a) Calculate the inertial tensor of a rectangular block of material with mass m, Length L, height H and width W (constant mass density). The center of mass is the origin of the coordinate system, and L, H, W are in x, z and y-direction, respectively.
b) From your result under a), derive the inertial tensor for the same block, but with the origin at one corner (front left bottom) of the block.
c) Now repeat the calculation for a), but this time assume that the y-direction is NOT along W, but rather along the diagonal of the rectangle LxW. (There is a quick and a cumbersome way to do this – I suggest the quick way!)

Problem 3)

Find the equation for the ellipsoid of inertia of an object which ITSELF is in the shape of an ellipsoid, with the following defining equation for its surface: $\frac{x^2}{l^2} + \frac{y^2}{w^2} + \frac{z^2}{h^2} = 1$. (Watch out – some clever mathematics is needed).