Engineering 137, Advanced Engineering Mechanics
Sem. II, '06-'07
Homework Set No. 9
Instr: Rod Clifton

Due: in class Wednesday, April 12, 2006
or on 6th floor by noon on Thursday, April 13

1. **While observing the free motion of an axially symmetric body, the following characteristics are noted:**
   - **(a.)** $\boldsymbol{\omega}$ **and H are separated by** $30°$**;**
   - **(b.) the precession rate** $\dot{\psi}$ **is larger than the magnitude** ω **of the angular velocity;**
   - **(c.) the axis of symmetry changes its direction in space by** $90°$ **during half of a precession cycle.**

   Solve for the ratio I_a/I_t **and evaluate** $\dot{\psi}$ **and the relative spin** $\dot{\phi}$ **in terms of** ω**.**

2. **A circular cone of mass** m**, base radius** r**, and height** $h = 4r$ **is rotating in free space with angular velocity components** $\omega_a = \Omega_0$ **and** $\omega_t = 0.5\Omega_0$**. Its center of mass has zero velocity initially.**
   - **(a.) What is the free precession rate** $\dot{\psi}$**?**
   - **(b.) Next, the vertex of the cone is suddenly fixed, but the cone is otherwise unconstrained. What is the new precession rate?**