PH 203 – Classical Mechanics
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Home Work Exercises-2.

1. A rod of mass M and length ℓ is rotating with angular velocity $\vec{\omega}$ about an axis passing normally through its center-of-mass.
   (a) Find its angular momentum $\vec{L}$ from $\vec{L} = \sum_i \vec{r}_i \times \vec{p}_i$.
   (b) Hence find its moment of inertia about the rotation axis.

2. A hollow sphere of mass M and radius R is rotating with angular velocity $\vec{\omega}$ about an axis passing through its center.
   (a) Find its angular momentum $\vec{L}$ from $\vec{L} = \sum_i \vec{r}_i \times \vec{p}_i$.
   (b) Hence find its moment of inertia about the rotation axis.

3. Take a solid sphere and answer the same questions.

4. Take a disk and answer the same questions if the axis of rotation is along its symmetry axis.

5. Take a disk and answer the same questions if the axis of rotation is along a diameter.

6. A dumbbell having equal masses m each at the two ends of a massless rod of length ℓ is rotating with angular velocity $\vec{\omega}$ about an axis passing through its center-of-mass making a constant acute angle θ with the rod.
   (a) Find its angular momentum $\vec{L}$ from $\vec{L} = \sum_i \vec{r}_i \times \vec{p}_i$.
   (b) Is $\vec{L}$ parallel to $\vec{\omega}$?.
   (c) Is a torque needed?