

Due: Dec. 3

1. Inertia tensor.

A cylinder of uniform density has a mass M , radius R and height L .

(a) Compute the inertia tensor about the center of mass, with the z axis along the axis of the cylinder. Before plunging into the calculation, explain how you know that x , y and z are principal axes.

(b) Find the inertia tensor about the point at the center of the top end cap ($x = y = 0$, $z = L/2$).

(c) The cylinder is suspended from the point referred to in part (b) and allowed to swing freely under gravity. Find the frequency of small vibrations about the equilibrium position.

2. things on strings.

Show that if an object is suspended from a specific point, but allowed to swing freely, the equilibrium position (to which it eventually settles) has the center of mass directly below the point of suspension.

3. torques and accelerations.

A rod of uniform density, length L and negligible width is aligned along the y axis. If a constant force of magnitude F is applied to one end in the x direction, determine how long it takes for the rod to become aligned along the x axis. (There are no other forces, not even gravity).