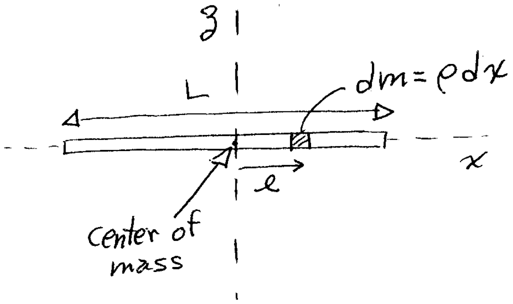
5.3-2b Find I_z of rod about center of mass.



$$I_z = \int dI_z$$

$$\int dI_z = \int \ell^2 dm = \rho \int_{-\frac{L}{2}}^{+\frac{L}{2}} \ell^2 dx$$

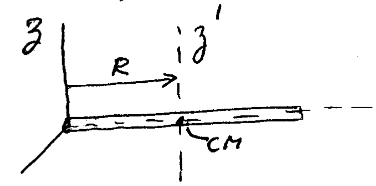
$$\ell = x$$

$$I_z = \rho \int_x x^2 dx = \rho \frac{x^3}{3} \Big|_{-\frac{L}{2}}^{\frac{L}{2}}$$

$$I_z = \frac{\rho}{3}\left[\left(\frac{L}{2}\right)^3 + \left(\frac{L}{2}\right)^3\right] = \frac{\rho}{3}\frac{2L^3}{8}$$

$$I_z = \frac{\rho L^3}{12}$$

5.3-2c Find I_z about axis thru one end of rod and $\perp$ to length.



$$I_z = I_{z'} + MR^2$$

$$= \frac{\lambda L^3}{12} + M\left(\frac{L}{2}\right)^2$$

$$= \frac{\lambda L^3}{12} + \lambda L\left(\frac{L}{2}\right)^2 = \frac{\lambda L^3}{12} + \frac{\lambda L^3}{4}$$

$$I_z = \lambda L^3\left(\frac{1}{12} + \frac{1}{4}\right) = \lambda L^3/3$$