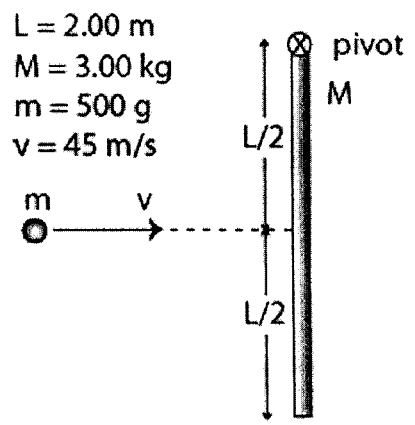
Phys101 – Quiz # 8 (Ch.11) – Sec # 37

Name: (Key) **ID #**

1- A thin uniform rod of mass $M = 3\ kg$ and length $L = 2\ m$ is suspended vertically from a frictionless pivot at its upper end (use $I=I_{com}+Mh^2$). An object of mass $m = 0.5$ kg, traveling horizontally with a speed $v = 45\ m/s$ strikes the rod at its center of mass and sticks there. What is the angular velocity of the system just after the collision? (I_{com} (for a thin rod) = $\frac{1}{12}ML^2$)



$L_i = L_f$

$mr_1 v + 0 = I\,\omega_f$

$m\left(\frac{L}{2}\right)v = \left(\frac{1}{12}ML^2 + M\left(\frac{L}{2}\right)^2 + m\left(\frac{L}{2}\right)^2\right)\omega_f$

divide by $\left(\frac{L}{2}\right)$ all over.

$mv = \left(\frac{1}{6}ML + \frac{1}{2}ML + \frac{1}{2}mL\right)\omega_f$

$\omega_f = \dfrac{0.5\,(45)}{\frac{1}{6}(3)(2) + \frac{1}{2}(3)(2) + \frac{1}{2}(0.5)(2)}$

$\omega_f = \dfrac{22.5}{1+3+0.5} = \dfrac{22.5}{4.5} = \boxed{5\ \frac{rad}{s}}$

2- What is the net torque about the origin on an object located at (0, -5, 5) m when forces $\mathbf{F_1}$ = (- 6 **k**) N and $\mathbf{F_2}$ = (2 **j**) N act on the object?

$\vec{\tau}_{net} = \vec{r} \times \vec{F}$

$= (-5\hat{j} + 5\hat{k}) \times (2\hat{j} - 6\hat{k})$

$= 30\hat{i} - 10\hat{i} = \boxed{(20\ \hat{i})\ N \cdot m}$