

INERTIA

▷ SHOCKER

LINK



$$z_{COM} = \frac{m_1 \cdot d_1 + m_2 \cdot d_2}{m_1 + m_2}$$

1 and 2 same VOLUME, same MATERIAL $\Rightarrow m_1 = m_2$

$$d_1 = -h/2 \quad d_2 = 0$$

$$z_{COM} = (m \cdot (-h/2) + m \cdot 0) / 2m = -\frac{h}{2} \cdot \frac{1}{2} = -\frac{h}{4}$$

(1) ROTATE AROUND Z

$$I_{xx} = \frac{1}{12} m (3r^2 + h^2)$$

$$I_{yy} = \frac{1}{12} m (3r^2 + h^2)$$

$$I_{zz} = \frac{1}{2} m r^2 + m z_{COM}^2$$

(2) ROTATE AROUND Y

$$I_{xx} = \frac{1}{12} m (3r^2 + h^2)$$

$$I_{yy} = \frac{1}{2} m r^2$$

$$I_{zz} = \frac{1}{12} m (3r^2 + h^2)$$

~~1 is not in COM ORIGIN~~

$$I_1^{SHIFED} = I_1 + \Delta I$$

$$\Delta I = m_1 \cdot \begin{bmatrix} h_1^2/4 & 0 & 0 \\ 0 & h_1^2/4 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$I_1^{SHIFED} = \frac{1}{12} m (3r^2 + h^2) + m \frac{h^2}{4} = m \left(\frac{1}{12} (3r^2 + h^2) + \frac{h^2}{4} \right) = m \left(\frac{3r^2 + 4h^2}{12} \right) = \frac{1}{12} m (3r^2 + 4h^2)$$

$$I_1^{SHIFED} = \frac{1}{12} m (3r^2 + h^2) + m \frac{h^2}{4} = \frac{1}{12} m (3r^2 + 4h^2)$$

$$I_1^{SHIFED} = \frac{1}{2} m r^2$$

$$I_{xx} = I_{1xx}^S + I_{2xx} = \frac{1}{12} m (3r^2 + 4h^2) + \frac{1}{12} m (3r^2 + h^2) = \frac{1}{12} m (6r^2 + 5h^2)$$

$$I_{yy} = I_{1yy}^S + I_{2yy} = \frac{1}{12} m (3r^2 + 4h^2) + \frac{1}{2} m r^2 = \frac{1}{12} m (9r^2 + 4h^2)$$

$$I_{zz} = I_{1zz}^S + I_{2zz} = \frac{1}{2} m r^2 + \frac{1}{12} m (3r^2 + h^2) = \frac{1}{12} m (9r^2 + h^2)$$