2. Mass m_1 sits at the point $(x, y, z) = (0, 0, 0)$, and mass m_2 at point $(0, L, 0)$.

A. (3 pts) Where is the center of mass?

$$X = \frac{m_1 x_1 + m_2 x_2}{m_1 + m_2} = 0$$

(a) $\left(\frac{m_2}{m_1+m_2}, 0, 0\right)L$.

$$Y = \frac{m_1 y_1 + m_2 y_2}{m_1 + m_2} = \frac{m_1 \cdot 0 + m_2 L}{m_1 + m_2} = \frac{m_2}{m_1+m_2} L$$

(b) $(0, L/2, 0)$.

$$Z = \frac{m_1 z_1 + m_2 z_2}{m_1 + m_2} = 0$$

(c) $\left(0, \frac{m_1}{m_1+m_2}, 0\right)L$.

**(d) $\left(0, \frac{m_2}{m_1+m_2}, 0\right)L$.

B. (4 pts) What is the rotational inertia about an axis through the center of mass and parallel to the z-axis?

distance of m_i from axis = distance of m_i from c.m. :

(a) $\frac{m_2}{m_1+m_2}L^2$.

distance of m_1 from c.m. $= Y_{cm} - 0 = \frac{m_2}{m_1+m_2} L$

**(b) $\frac{m_1 m_2}{m_1+m_2}L^2$.

distance of m_2 from c.m. $= Y_{cm} - L = \frac{m_1}{m_1+m_2} L$

(c) $m_1\left(\frac{m_2}{m_1+m_2}\right)^2 L^2$.

$$I = m_1\left(\frac{m_2}{m_1+m_2}L\right)^2 + m_2\left(\frac{m_1}{m_1+m_2}L\right)^2$$

(d) $m_2\left(1 - \frac{m_2}{m_1+m_2}\right)^2 L^2$.

$$= \frac{m_1 m_2 (m_1+m_2)}{(m_1+m_2)^2} L^2 = \frac{m_1 m_2}{m_1+m_2}$$

C. (3 pts) What is the rotational inertia about the y-axis?

(a) $m_1 L^2$.

distance of each mass from axis

**(b) 0

$\Rightarrow I = 0.$ for this axis

(c) $m_2 L^2$.