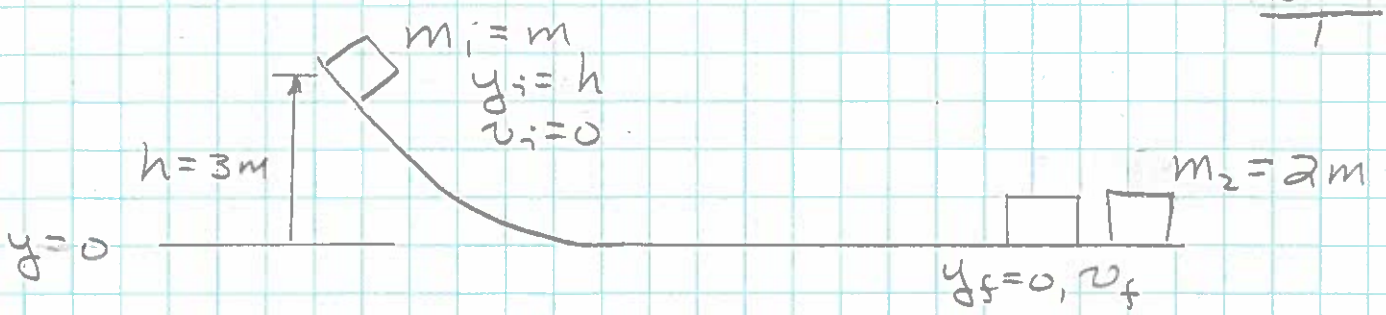


a.) find find speed of m_1 just before collision

Conserve energy $i \to f$:

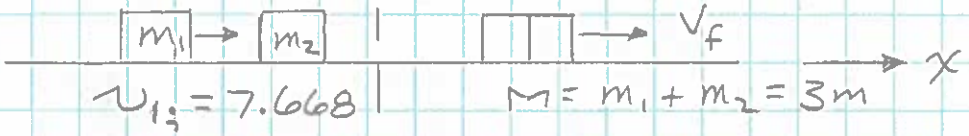
$$\Delta K + \Delta U_g = 0$$

$$\tfrac{1}{2} m_1 (v_f^2 - v_i^2) + m_1 g (y_f - y_i) = 0$$

$$\tfrac{1}{2} v_f^2 - gh = 0$$

$$v_f = \sqrt{2gh} = 7.668 \text{ m/s}$$

Now conserve initial x-comp of momentum: final



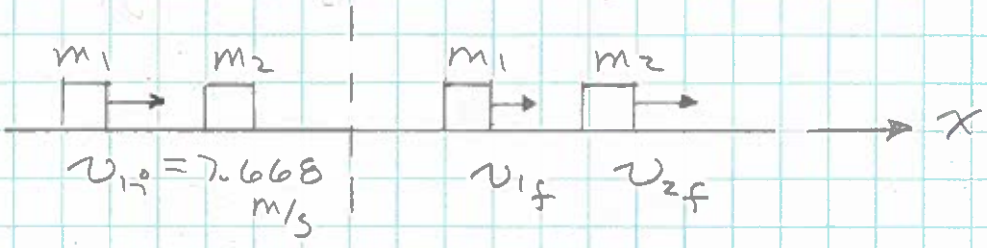
$$v_{2i} = 0$$

$$m_1 v_{1i} = M V_f$$

$$m v_{1i} = 3m V_f$$

$$\therefore V_f = \frac{1}{3} v_{1i} = \underline{2.556 \text{ m/s}}$$

b.) For a perfectly elastic collision with m_2 initially at rest

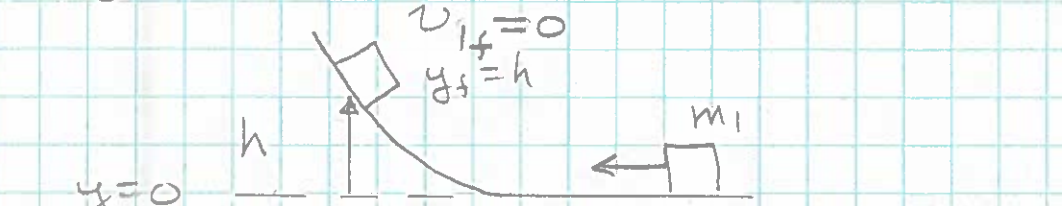


$$v_{1f} = \frac{m_1 - m_2}{m_1 + m_2} v_{1i} = \frac{m - 2m}{m + 2m} v_{1i}$$

$$= -\frac{m}{3m} v_{1i}$$

$$v_{1f} = -2.556 \text{ m/s}$$

Now:



Conserve energy $i \to f$:

$$\Delta K + \Delta U_g = 0$$

$$\frac{1}{2} m_1 (v_{1f}^2 - v_{1i}^2) + m_1 g (y_f - y_i) = 0$$

$$-\frac{1}{2} v_{1i}^2 + gh = 0$$

$$\therefore \quad h = \frac{v_{1i}^2}{2g} = \underline{0.333 \text{ m}}$$