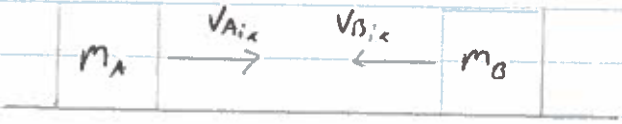
Ex 8-10
p257

Before



After

Equate approaching & separating relative velocities.

$$v_{Ai_x} - v_{Bi_x} = -(v_{Af_x} - v_{Bf_x})$$

Rearrange for v_{Af_x}: $v_{Af_x} = v_{Bf_x} - v_{Ai_x} + v_{Bi_x}$ (1)

Conserve momentum: $\Delta \vec{p}_{tot} = 0 \rightarrow \Delta p_{tot_x} = 0$ in 1D

$$\Delta p_{A_x} + \Delta p_{B_x} = p_{Af_x} - p_{Ai_x} + p_{Bf_x} - p_{Bi_x} = 0$$

$$m_A v_{Af_x} - m_A v_{Ai_x} + m_B v_{Bf_x} - m_B v_{Bi_x} = 0$$

Sub in (1):

$$m_A (v_{Bf_x} - v_{Ai_x} + v_{Bi_x}) - m_A v_{Ai_x} + m_B v_{Bf_x} - m_B v_{Bi_x} =$$

$$m_A v_{Bf_x} - m_A v_{Ai_x} + m_A v_{Bi_x} - m_A v_{Ai_x} + m_B v_{Bf_x} - m_B v_{Bi_x} = 0$$

Collect:

$$(m_A + m_B) v_{Bf_x} - 2 m_A v_{Ai_x} + (m_A - m_B) v_{Bi_x} = 0$$

$$v_{Bf_x} = \frac{2 m_A v_{Ai_x} - (m_A - m_B) v_{Bi_x}}{(m_A + m_B)}$$

$$v_{Bf_x} = \frac{2(0.50\,kg)(2.0\,m s^{-1}) - ((0.50\,kg) - (0.70\,kg))(-2.0\,m s^{-1})}{(0.50\,kg + 0.70\,kg)}$$

$$V_{B_{f_x}} = 3.0\ ms^{-1}$$

Subsinto ①

$$V_{A_{f_x}} = V_{B_{f_x}} - V_{A_{i_x}} + V_{B_{i_x}}$$

$$= 3.0 ms^{-1} - 2.0 ms^{-1} + (-2.0 ms^{-1})$$

$$V_{A_{f_x}} = -1.0 ms^{-1}$$