Ex 8-9
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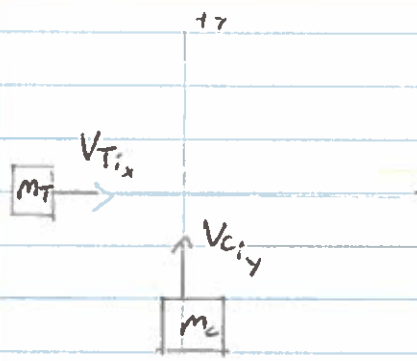
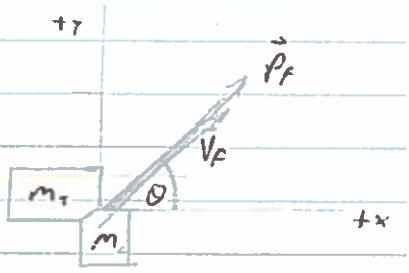
Before



After



Conserve momentum: $\Delta \vec{p}_{tot} = 0$

Components: $\Delta p_{tot_x} = \Delta p_{C_x} + \Delta p_{T_x} = p_{f_{C_x}} - p_{i_{C_x}} + p_{f_{T_x}} -$

$\Delta p_{tot_y} = \Delta p_{C_y} + \Delta p_{T_y} = p_{f_{C_y}} - p_{i_{C_y}} + p_{f_{T_y}} -$

or $m_C v_{f_{C_x}} - m_C v_{i_{C_x}} + m_T v_{f_{T_x}} - m_T v_{i_{T_x}} = 0$

$m_C v_{f_{C_y}} - m_C v_{i_{C_y}} + m_T v_{f_{T_y}} - m_T v_{i_{C_y}} = 0$

Before: $v_{C_{i_x}} = v_{T_{i_y}} = 0$

After: $v_{C_{f_x}} = v_{T_{f_x}} = v_{f_x}$ & $v_{C_{f_y}} = v_{T_{f_y}} = v_{f_y}$

giving: $m_C v_{f_x} + m_T v_{f_x} - m_T v_{i_{T_x}} = 0$

$m_C v_{f_y} + m_T v_{f_y} - m_C v_{i_{C_y}} = 0$

or $(m_C + m_T) v_{f_x} = m_T v_{i_{T_x}}$

$(m_C + m_T) v_{f_y} = m_C v_{i_{C_y}}$

$$V_{fx} = \frac{m_T V_{ix}}{(m_c + m_T)} = \frac{(2000\,kg)(10\,ms^{-1})}{(2000\,kg + 1000\,kg)} = 6.67\,ms^{-1}$$

$$V_{fy} = \frac{m_c V_{iy}}{(m_c + m_T)} = \frac{(1000\,kg)(15\,ms^{-1})}{(2000\,kg + 1000\,kg)} = 5\,ms^{-1}$$

~~$\vec{F}_{NET} = |R_{F_y}|$~~

~~R_{F_x}~~

$$|\vec{v}| = \sqrt{V_{fx}^2 + V_{fy}^2} = \sqrt{(6.67\,ms^{-1})^2 + (5\,ms^{-1})^2}$$

$$|\vec{v}| = 8.3\,ms^{-1}$$

$$\tan\theta = \frac{|V_{fy}|}{|V_{fx}|} = \frac{5\,ms^{-1}}{6.67\,ms^{-1}}$$

$$\theta = 37^\circ$$