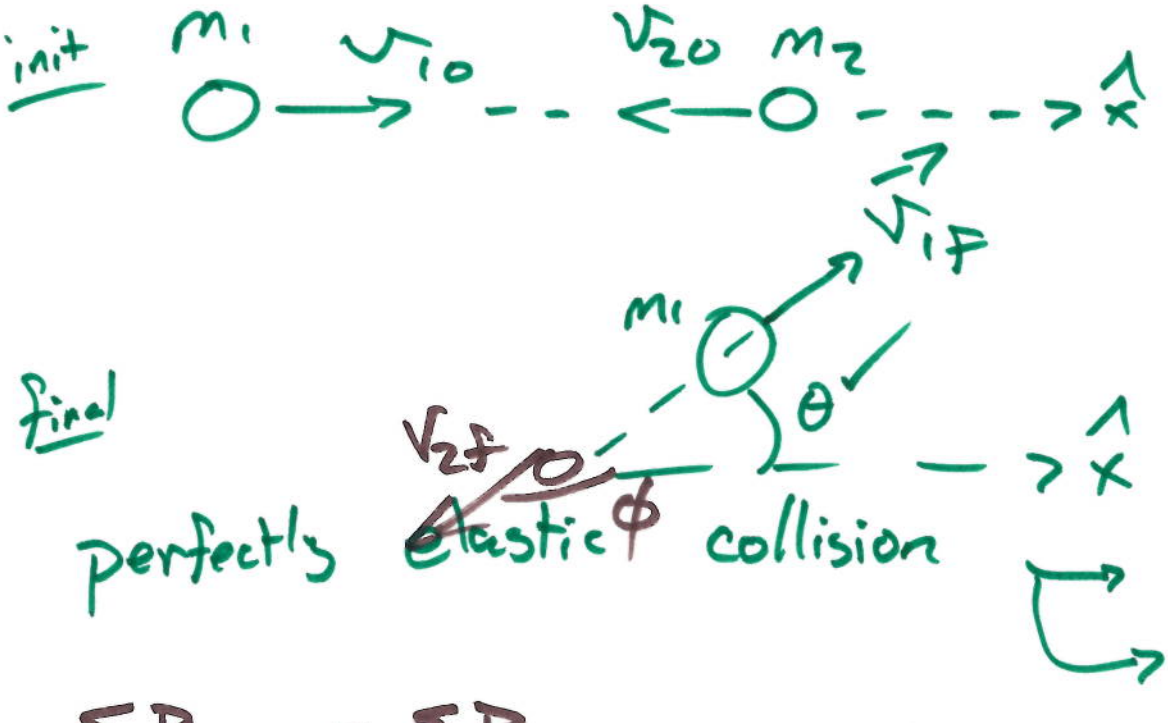
Write down 3 equ. needed to find $\vec{v}_{2f}$ and v_{1f} given:

m_1 m_2 v_{1_0} v_{2_0} θ



perfectly elastic collision

$\Sigma \vec{P}_0 = \Sigma \vec{P}_f$

energy

$$\Sigma P_{0x} = \Sigma P_{fx} \quad \star$$

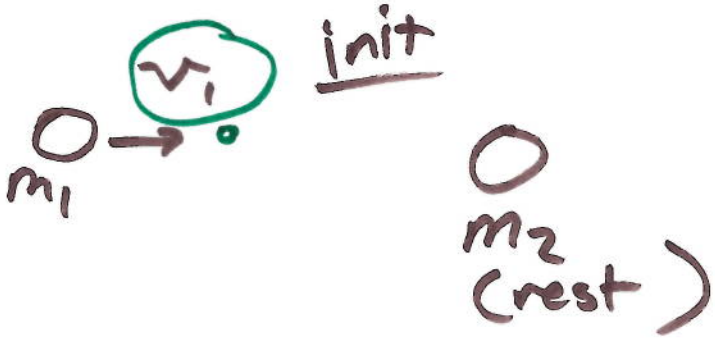
$$m_1 v_{10} - m_2 v_{20} = m_1 v_{1f} \cos\theta + m_2 v_{2f} \cos\phi \quad \star \quad \star$$

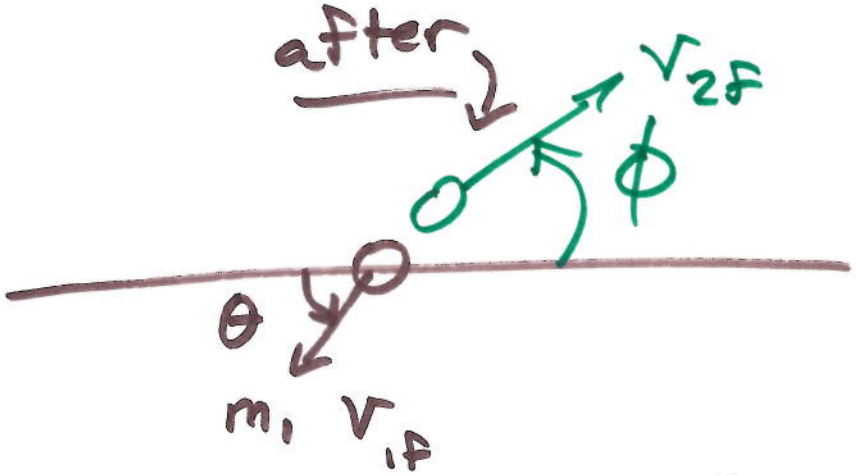
$$\Sigma P_{0y} = \Sigma P_{fy}$$

$$0 + 0 = m_1 v_{1f} \sin\theta - m_2 v_{2f} \sin\phi \quad \star \quad \star$$

$$\Sigma E_0 = \Sigma E_f \quad \star \quad \star$$

$$\frac{1}{2} m_1 v_{10}^2 + \frac{1}{2} m_2 v_{20}^2 = \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2$$





given: $m_1 \; v_1 \; m_2 \; \theta \; v_{1f}$

find: $\vec{v}_{2f}$ of m_2.

$$m_1 v_1 = m_2 v_{2f} \cos\phi - m_1 v_{1f} \cos\theta$$

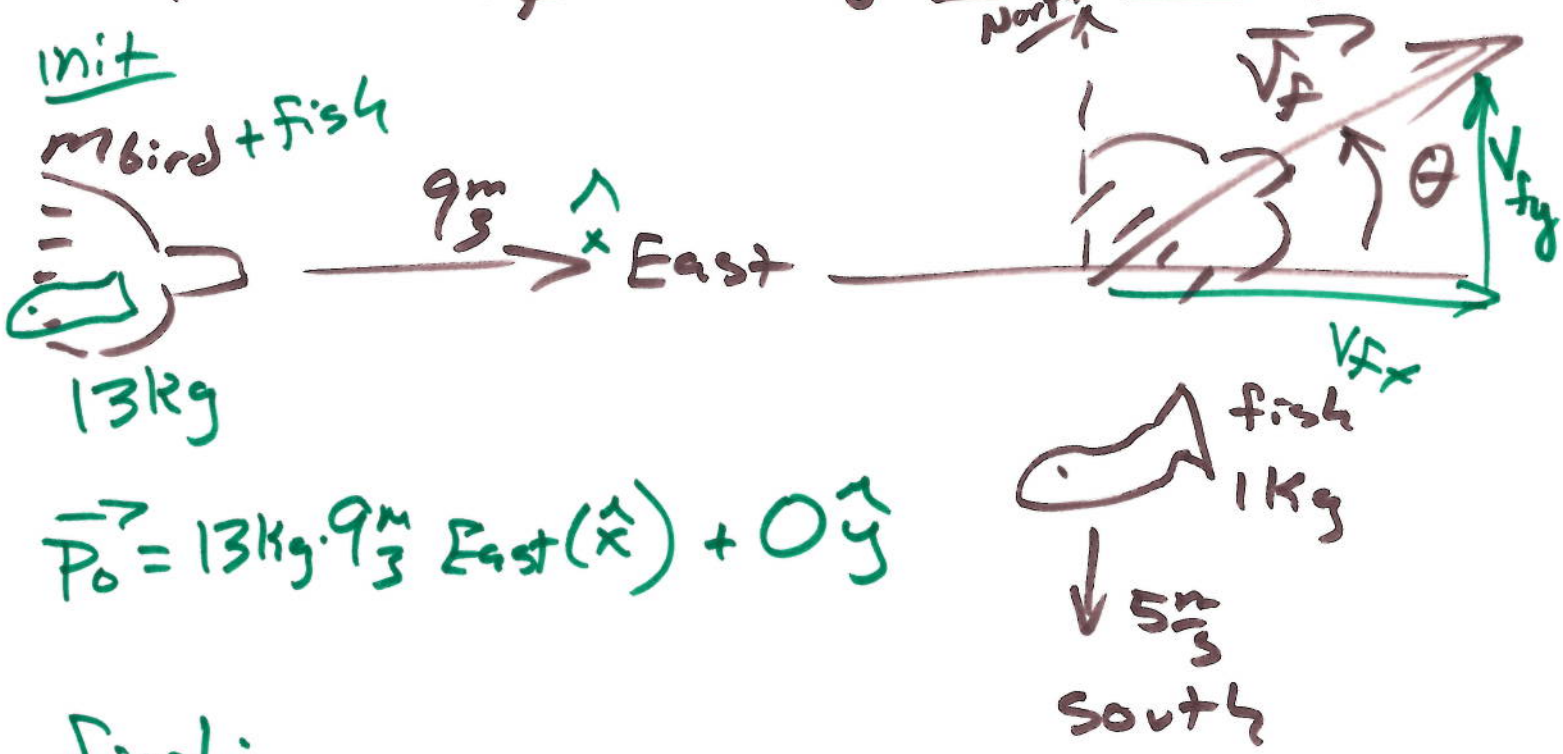
$$0 = m_2 v_{2f} \sin\phi - m_1 v_{1f} \sin\theta$$

$$\frac{m_2 v_{2f} \sin\phi}{m_2 v_{2f} \cos\phi} = \left(\frac{m_1 v_{1f} \sin\theta}{m_1 v_1 + m_1 v_{1f} \cos\theta} \right)_{\text{given}}$$

$$\tan\phi =$$

a 12kg bird flying right (East) at $9\frac{m}{s}$ ~~drops~~ throws a 1kg fish down page (South) at $5\frac{m}{s}$.

Find $\vec{V_f}$ bird just after.



$\vec{P_0} = 13kg \cdot 9\frac{m}{s}\ East(\hat{x}) + 0\hat{y}$

final:

$\hat{x}$: $12kg\ V_{fx}$

$\hat{y}$: $12kg\ V_{fy} - 1kg\ 5\frac{m}{s}$

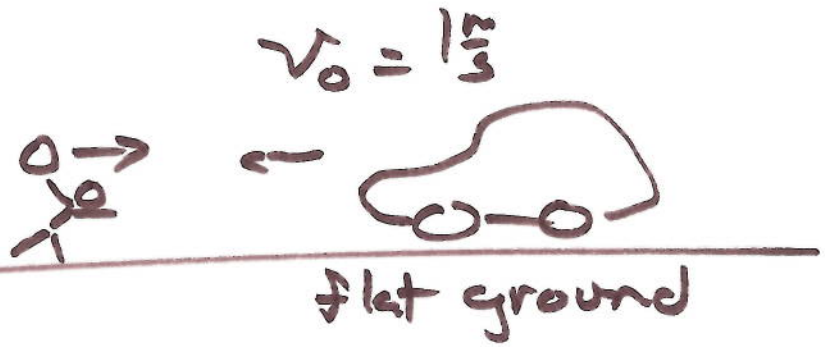
$13kg\ 9\frac{m}{s} = 12kg\ V_{fx}$ $\quad V_{fx} = 9.75\frac{m}{s}$

$12kg\ V_{fy} - 5kg\frac{m}{s} = 0$

$V_{fy} = \frac{5}{12}\frac{m}{s} = 0.42\frac{m}{s}$

$\tan\theta = \frac{0.42}{9.75}$ $\quad \theta = 2.5°$

your car rolling left at $1\frac{m}{s}$.
mass car 570kg. You can throw
1kg balls of clay at $6\frac{m}{s}$. They
stick to the car. How many to
stop car?



$\vec{p} = m\vec{v}$

$\Sigma \vec{p}_0 = \Sigma \vec{p}_f$

$m_{car} v_{0\,car} = 0$

$-N \cdot 1kg\left(6\frac{m}{s}\right)$

↑

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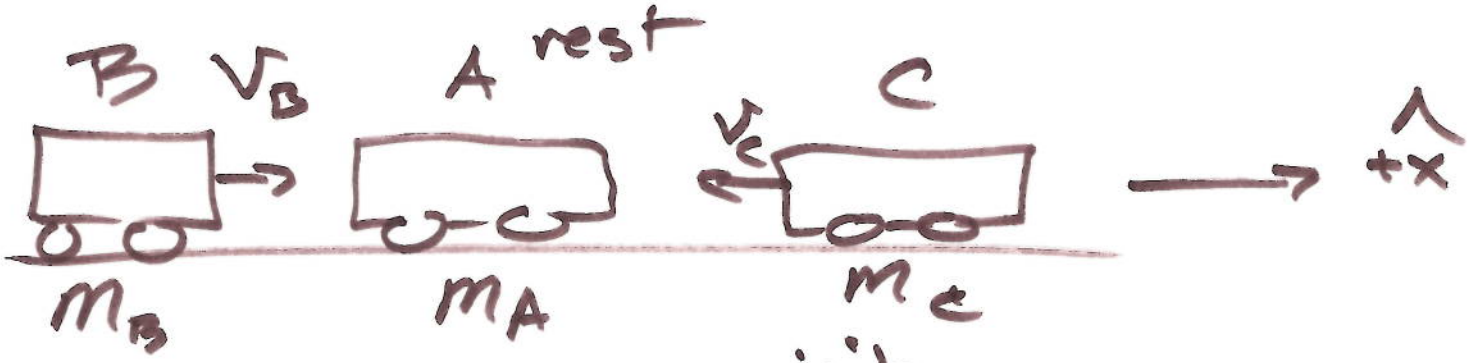
$m_{car} v_{0\,car} = N\ 6kg\frac{m}{s}$

$570kg \cdot 1\frac{m}{s} = N$

$6kg\frac{m}{s}$

$95 = N$



If:	m (kg)	v^{init} $(\frac{m}{s})$
A	100	0
B	200	$1\frac{m}{s}$
C	300	$2\frac{m}{s}$

and they all stick, find $\vec{v}_f$ of total object.

$$\Sigma P_0 = \Sigma P_f = (m_A + m_B + m_C)\, v_f^*$$

$$100kg \cdot 0 + 200kg\, 1\tfrac{m}{s} - 300kg\,(2\tfrac{m}{s}) = (600kg)\, v_f^*$$

$$-400\ kg\tfrac{m}{s} = 600kg\, v_f$$

$$-0.67\tfrac{m}{s} = v_f$$

↑ going left at $0.67\frac{m}{s}$.