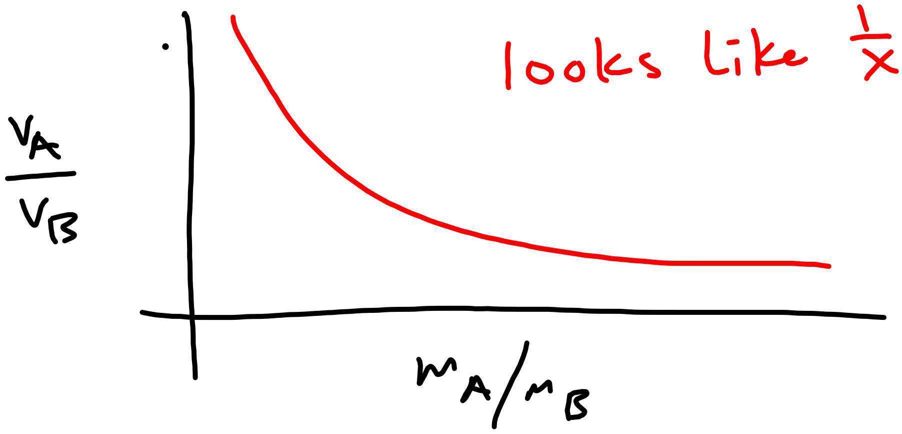
Cart Explosion Lab

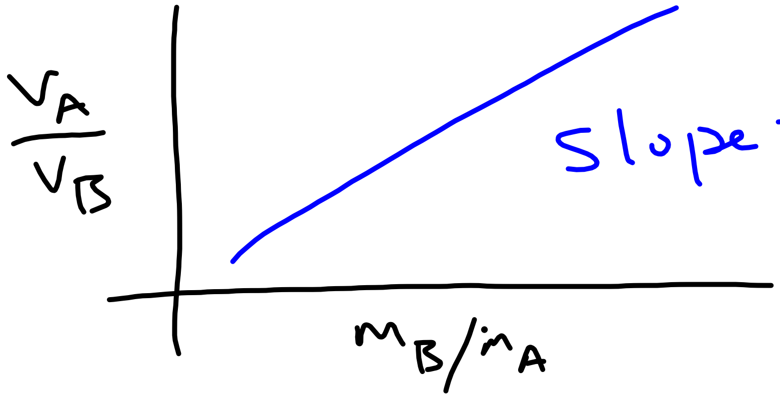
- Measure/Calculate:
  - Displacement of carts
  - Velocity of each
  - Acceleration of each
  - Mass of each
  - Energy
- Graph:
  - Y-axis: $\frac{V_A}{V_B}$
  - X-axis: $\frac{m_A}{m_B}$

[1:1, 2:1, 1:2, 3:1, 1:3]



looks like $\frac{1}{x}$

use this function to linearize



slope = 1

$$\frac{1}{m_A/m_B} = \frac{m_B}{m_A}$$

$$\text{slope} = 1 = \frac{V_A/V_B}{m_B/m_A}$$

$$\frac{m_B}{m_A} = \frac{V_A}{V_B}$$

$$m_A V_A = m_B V_B$$

$$\bar{P} = m\bar{v}$$

(momentum) = (mass)(velocity)

$$\bar{P}_i = \bar{P}_f$$

conservation of momentum

$$\bar{P}_{Ai} + \bar{P}_{Bi} + \ldots = \bar{P}_{Af} + \bar{P}_{Bf} + \ldots$$

$$m_A\bar{v}_{Ai} + m_B\bar{v}_{Bi} + \ldots = m_A\bar{V}_{Af} + m_B\bar{V}_{Bf} + \ldots$$

- Impulse-Momentum Theorem

$$\underbrace{\bar{F}\Delta t}_{\text{Impulse}} = \underbrace{\Delta \bar{p}}_{\text{momentum}}$$

$$\bar{F} = \frac{\Delta \bar{p}}{\Delta t} = \frac{d\bar{p}}{dt}$$

$$= \frac{d}{dt}\left(m\bar{v}\right)$$

$$= \underbrace{\left(\frac{dm}{dt}\right)}_{\text{changing mass}}\underbrace{\left(\frac{d\bar{v}}{dt}\right)}_{\text{changing velocity} = \text{acceleration}}$$

$$\bar{F} = m\bar{a}$$