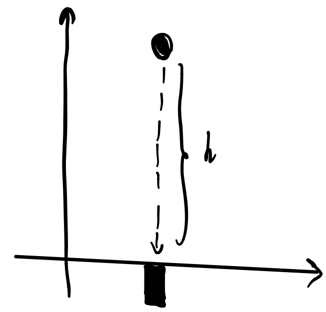
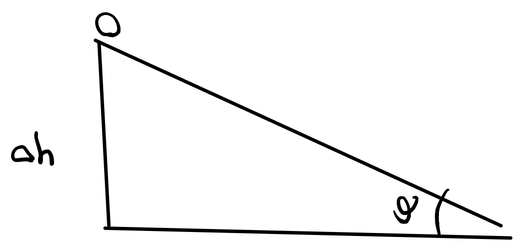
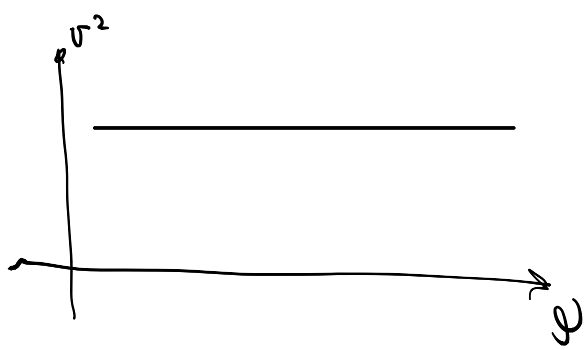
$\frac{1}{2} m v^2$ vs. $E \propto h$

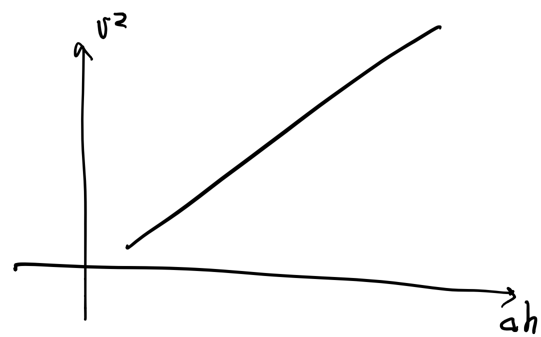
a logica

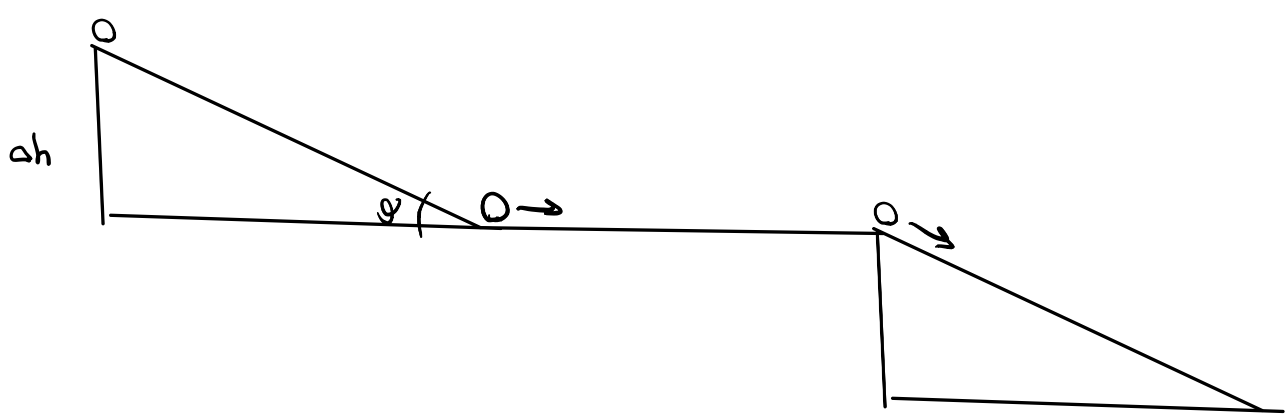
BATTIPALO











$$v_{1,f}^2 = k \cdot \Delta h$$

$$v_{2,f}^2 = v_{1_f}^2 + k \Delta h$$

$$U = k h \sim m v^2$$

$$[k] = \left[\frac{m\, v^2}{h}\right] = [kg]\left(\frac{[m]}{[s]}\right)^2 \frac{1}{[m]}$$
$$= [kg]\frac{[m]}{[s^2]}$$
$$= m \cdot \gamma$$

ANALISI DIMENSIONALE

$$[k] = [kg][\gamma]$$

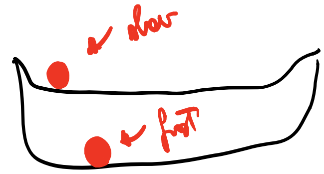
$$\gamma = \frac{\Delta v}{\Delta t} \propto \frac{\Delta p}{\Delta t}$$

ANSATZ

$$k = m\gamma \qquad U = m\gamma h$$

$$\cancel{m}\gamma h = \frac{1}{2}\cancel{m}\bar{v}_1^2 \qquad \bar{v}_1 = \sqrt{2\gamma h}$$

$$\boxed{v_f \text{ non dipende da } \vartheta \text{ ne da } m}$$



sempre alla stessa altezza

$$\frac{d}{dt}\left(\frac{1}{2}mv^2 + kx\right) =$$

$$= \frac{2}{2}mv\cdot a + k\cdot v = v\left(m\cdot a + k\right)$$

$$F = -\frac{d}{dx}(kx) = -\frac{dV}{dx} \Rightarrow \frac{dV}{dx} = \frac{m_1 m_2}{x^2}$$

$$U = \frac{m_2 m_1 G}{R+\delta z} = \frac{m_1 m_2 G}{R}\left(1-\frac{\delta z}{R}\right) \Rightarrow \Delta U \simeq \delta z\, m\cdot \overbrace{\frac{MG}{R^2}}^{g} \qquad V = \frac{m_1\cdot m_2}{x}$$

LA SOMMA $T+U$ SI CONSERVA

LA QUANTITÀ DI MOTO SI CONSERVA

COS'ALTRO SI CONSERVA?

È UNA DOMANDA MOLTO PROFONDA E DARE UNA RISPOSTA IN GENERALE È ASSAI DIFFICILE

PERÒ SI PUÒ STABILIRE UN CRITERIO,

UNA LEGGE GENERALE

Ex 1

$\overbrace{2\ m/s + 3\ m/s}^{5\ m/s}$ $\qquad$ $\overbrace{0\ m/s + 3\ m/s}^{3\ m/s}$

$\bullet \rightarrow$ M $\qquad$ $\bullet$ M

$$P_{in} = v_{in} \cdot \cancel{M}$$

$$P_{out} = \cancel{M} v_1 + \cancel{M} v_2$$

$$=$$

$$K_{in} = \cancel{\tfrac{1}{2}} \cancel{M} v_{in}^2$$

$$K_{out} = \cancel{\tfrac{1}{2}} \cancel{M} v_1^2 + \cancel{\tfrac{1}{2}} \cancel{M} v_2^2$$

$$=$$

$$\begin{cases} \vec{v}_{in} = \vec{v}_1 + \vec{v}_2 \\ v_{in}^2 = v_1^2 + v_2^2 \end{cases}$$

$$\begin{cases} \vec{v}_1 = \vec{v}_{in} - \vec{v}_2 \\ 0 = (-v_{in} + v_2)\, v_2 \\ 0 = -\cancel{2} \vec{v}_{in} \vec{v}_2 + \cancel{2} v_2^2 \end{cases}$$

Ex 2

$5\ m/s$ $\qquad$ $3\ m/s$

$\bullet \longrightarrow$ M $\qquad$ $\bullet \rightarrow$ M

$$P_{in} = v_{in} M + v'_{in} M$$

$$=$$

$$P_{out} = (v_1 + v_2) M$$

$$K_{in} = \tfrac{1}{2} M \left(v_{in}^2 + v'^2_{in}\right)$$

$$=$$

$$K_{out} = \tfrac{1}{2} M \left(v_1^2 + v_2^2\right)$$

$$\begin{cases} \vec{v}_{in} + \vec{v}'_{in} = \vec{v}_1 + \vec{v}_2 \\ v_{in}^2 + v'^2_{in} = v_1^2 + v_2^2 \end{cases}$$

$$\begin{cases} \vec{v}_1 = v_{in} + \overbrace{v'_{in} - \vec{v}_2}^{\vec{v}_2} \\ 0 = \cancel{2} v_2^2 + \cancel{2} \vec{v}_{in} \vec{v}'_{in} - \cancel{2} v_2 v_{in} \end{cases}$$

$$\begin{cases} \bar{v}_1 = 0 & \Delta v_1 = -v_{in} \\ \bar{v}_2 = \bar{v}_{in} & \Delta v_2 = v_{in} \end{cases}$$

$-\cancel{2}v_2 v_{in}'$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

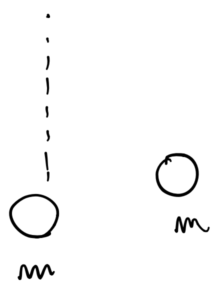
$v_2 = 2\,m/s$ $+3\,m/s$

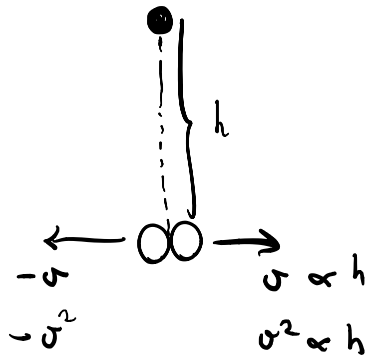
$v_1 = 0\,m/s + 3\,m/s$

$$v_2 = \frac{(v_{in} + v_{in}') \pm \sqrt{v_{in}^2 + v_{in}'^2 + 2v_{in}v_{in}' - 4v_{in}v_{in}'}}{2}$$

$$= \frac{(v_{in} + v_{in}') \pm (v_{in} - v_{in}')}{2}$$

$$v_2 = \begin{cases} \oplus \; v_{in} \Rightarrow v_1 = v_{in}' & \Delta v_2 = v_{in} & \Delta v_1 = -v_{in} \\ \ominus \; v_{in}' \Rightarrow v_1 = v_{in} & \Delta v_2 = 0 & \Delta v_1 = 0 \end{cases}$$





$$\cancel{m}v + \cancel{m}\cdot\cancel{0} = \cancel{m}v_1' + \cancel{m}v_2'$$

$$v_1' = v - v_2'$$

$$\cancel{m}v^2 = \cancel{m}v_1'^2 + \cancel{m}v_2'^2$$

$$\cancel{v^2} = \cancel{v^2} + v_2'^{\cancel{2}} - 2v\cancel{v_2'} + v_2'^{\cancel{2}}$$

$$v_2' = v$$

$$v_1' = v - v_2' = 0$$