Exercice 1

① $\sum \vec{F}_{ext} = -m\vec{g}$

② $\sum \vec{F}_{ext} = m\vec{a}$

- référentiel inertiel
- repère $(O, \vec{e_x}, \vec{e_y})$

$\Leftrightarrow m\vec{a} = -m\vec{g}$

$\Leftrightarrow \vec{a} = -\vec{g}$

$\vec{a} = \dfrac{d\vec{v}}{dt}$. On primitive

$$\vec{v} \begin{cases} v_y(t) = -gt + v_{0y} \\ v_x(t) = v_{0x} \end{cases}$$

$$\vec{v} = \frac{d\vec{OM}}{dt}$$

$$\vec{OM} \begin{cases} y(t) = -\frac{1}{2}gt^2 + h \\ x(t) = v_0 t + x_0 \end{cases}$$

$y_0 = h$

③ $-\frac{1}{2}gt^2 + h = 0$

$\Leftrightarrow t^2\left(-\frac{1}{2}g\right) + h = 0$

$\Leftrightarrow t^2\left(-\frac{1}{2}g\right) = -h$

$\Leftrightarrow t = \sqrt{\frac{h}{\frac{1}{2}g}} = \sqrt{\frac{2h}{g}}$

$x\left(\sqrt{\frac{2h}{g}}\right) = V_0\sqrt{\frac{2h}{g}}$

$d = V_0\sqrt{\frac{2h}{g}}$

$\Leftrightarrow V_0 = \frac{d}{\sqrt{\frac{2h}{g}}}$

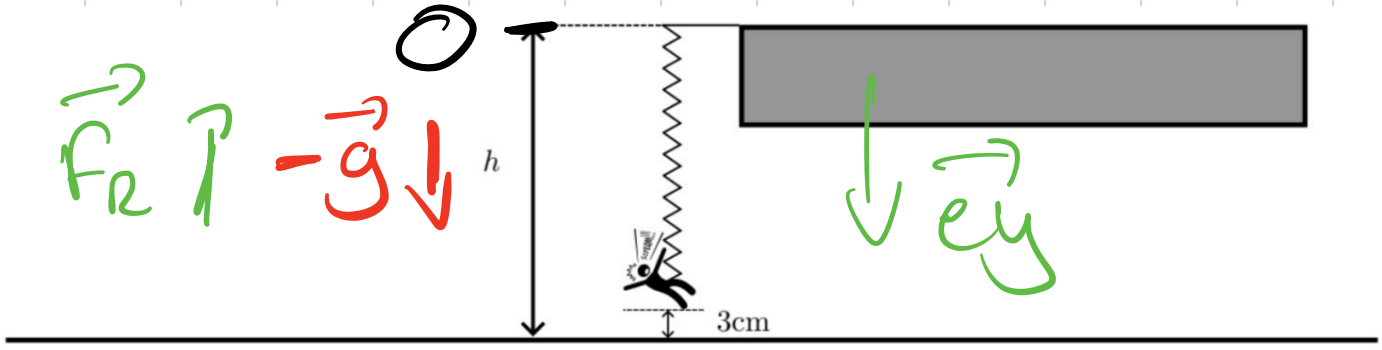
$\frac{h}{\frac{1}{2}g}$

$h \times \left(\frac{2}{1}\right) \times \left(\frac{1}{g}\right)$

Exercice 2

P1

1



$\vec{F_R}$ $\vec{P}$ $-\vec{g}$ ↓

2 $\sum \vec{F_{ext}} = m\vec{a}$

$\vec{F_R} = -k(\Delta y - l_0)\vec{e_y}$

$\vec{P} = m\vec{g}$

$\Leftrightarrow \quad m\vec{g} - k\,y(t)\,\vec{e_y} = m\vec{a}$

$\Leftrightarrow \quad \vec{g} - \frac{k}{m}\,y\,\vec{e_y} = \vec{a}$

On primitive :

$$\vec{a} = \frac{d\vec{v}}{dt}$$

$$\vec{v}_y = \vec{g}t - \frac{k}{m} t \Delta y \vec{e}_y$$

$$\vec{y} = \frac{1}{2}\vec{g}t^2 - \frac{1}{2}\frac{k}{m}t^2 \Delta y \vec{e}_y$$

$$V_y = t\left(g - \frac{k}{m}\Delta l\right)$$

$$\underline{0} = t\left(g - \frac{k}{m}\underline{\Delta l}\right)$$

Soit $t = 0$ soit

$$g - \frac{k}{m} \Delta y = 0$$

$$\Leftrightarrow g = \frac{k}{m} \Delta l$$

$$\Leftrightarrow k = \frac{g}{\Delta l} \times m$$

$$\sum \vec{F}_{ext} = m\vec{a}$$

$$\Leftrightarrow \ddot{y}m = gm - ky$$

$$\ddot{y} = \frac{-k}{m} y + g$$

$$= \frac{-k}{m} y + g$$

$$\omega = \sqrt{\frac{k}{m}} \qquad b = g$$

$$\ddot{y} = -\omega^2 y + b$$

$$= -\omega^2 \left(y - \frac{b}{\omega^2} \right)$$

$$v = y - \frac{b}{\omega^2}$$

$$\ddot{v} = -\omega^2 v$$

$$v(t) = C \cos(\omega t + \varphi_0)$$

$$\dot{v}(t) = -C\omega \sin(\omega t + \varphi_0)$$

$$\ddot{v}(t) = -C\omega^2 \cos(\omega t + \varphi_0)$$

$$\dot{y}(\infty) = 0. \qquad \dot{y}(0) = 0$$

$$y(0) = 0$$

$$y = v + \frac{b}{\omega^2}$$

$$= C\cos(\omega t + \varphi_0) + \frac{b}{\omega^2}$$

$$y(0) = C\cos(\varphi_0) + \frac{b}{\omega^2}$$

$$-C\cos(\varphi_0) = \frac{b}{\omega^2}$$

$$\dot{y}(t) = -Cw\sin(wt + y_0)$$

$$Cw\sin(y_0) = 0$$

$$\sin(\varphi_0) = 0$$

$$\Leftrightarrow \varphi_0 = 0 .$$

$$-C = \frac{b}{w^2}$$

$$\Leftrightarrow C = \frac{-b}{w^2}$$

(2) $$y = \frac{-b}{w^2}\cos(wt) + \frac{b}{w^2}$$

$$= \frac{-g}{w^2}(\cos(wt) + 1)$$

$$= g \times \frac{m}{k}\left(-\cos\left(\sqrt{\frac{k}{m}}\right)+1\right)$$

$$2g \times \frac{m}{k} = y_{max}$$

$$\frac{2gm}{k} = h - \Delta s$$

$$\Leftrightarrow \frac{k}{2gm} = \frac{1}{h-\Delta s}$$

$$\Leftrightarrow k = \frac{2gm}{h-\Delta s}$$