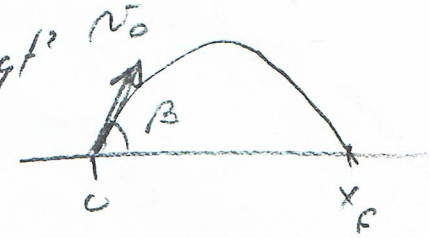
Ejercicio 1

PARTE a) $x(t) = v_x t = v_0 \cos\beta\, t$

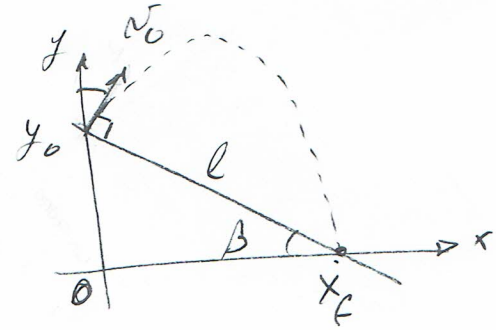
$y(t) = v_{0y} t - \frac{1}{2} g t^2 = v_0 \operatorname{sen}\beta\, t - \frac{1}{2} g t^2$




$0 = v_0 \operatorname{sen}\beta\, t_f - \frac{1}{2} g t_f^2 \Rightarrow \boxed{t_f = \frac{2 v_0 \operatorname{sen}\beta}{g}}$

$x_f = v_0 \cos\beta \cdot t_f = \boxed{\frac{2 v_0^2 \operatorname{sen}\beta \cos\beta}{g} = x_f}$

PARTE b)




$v_x = v_0 \operatorname{sen}\beta \qquad v_{y0} = v_0 \cos\beta$

$x(t) = v_x t = v_0 \operatorname{sen}\beta \cdot t$

$y(t) = y_0 + v_{0y} t - \frac{1}{2} g t^2 \qquad \tan\beta = \frac{y_0}{x_f}$

$x_f = v_0 \operatorname{sen}\beta\, t_f \;,\; y_f = y_0 + v_{0y} t_f - \frac{1}{2} g t_f^2 = 0 \Rightarrow$

$\Rightarrow 0 = x_f \tan\beta + v_0 \cos\beta\, t_f - \frac{1}{2} g t_f^2 \Rightarrow$

$0 = v_0 t_f (\operatorname{sen}\beta \cdot \tan\beta + \cos\beta) - \frac{1}{2} g t_f^2$

$\frac{\operatorname{sen}^2\beta}{\cos\beta} + \cos\beta = \frac{\operatorname{sen}^2\beta + \cos^2\beta}{\cos\beta} = \frac{1}{\cos\beta}$

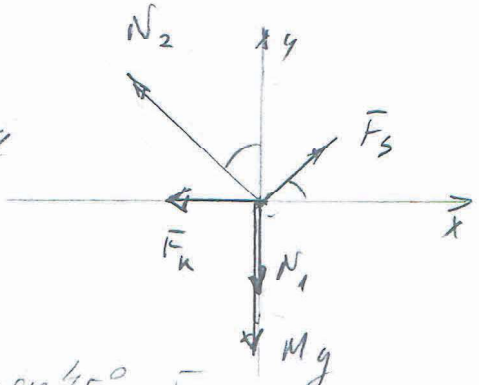
$0 = \frac{v_0}{\cos\beta} - \frac{1}{2} g t_f = 0 \Rightarrow \boxed{t_f = \frac{2 v_0}{g \cos\beta}} \quad (a)$

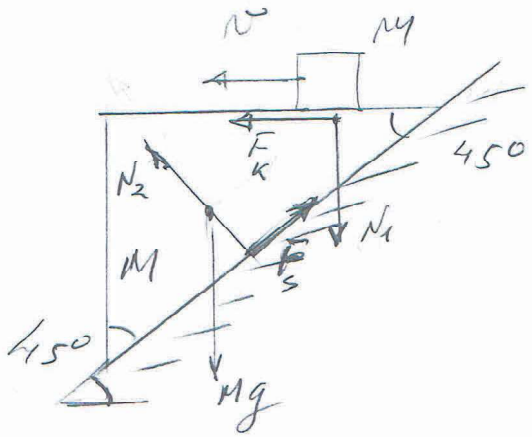
$\ell = \sqrt{x_f^2 + y_0^2} \qquad x_f = v_0 \operatorname{sen}\beta\, t_f = \frac{2 v_0^2}{g} \tan\beta$

$y_0 = x_f \tan\beta = v_0 \operatorname{sen}\beta\, t_f \cdot \tan\beta = \frac{2 v_0^2}{g} \tan^2\beta$

$\Rightarrow \ell = \frac{2 v_0^2}{g} \tan\beta \sqrt{1 + \tan^2\beta} = \boxed{\frac{2 v_0^2}{g} \frac{\tan\beta}{\cos\beta} = \ell} \quad (b)$

Ejercicio 2




$$F_k = \mu_k N_1 = \mu_k mg$$

$$F_{s\,max} = \mu_s N_2$$

$$F_x = F_s \cos 45° - N_2 \operatorname{sen} 45° - F_k$$

$$F_x = \frac{F_s}{\sqrt{2}} - \frac{N_2}{\sqrt{2}} - \mu_k mg = \boxed{\frac{\mu_s N_2}{\sqrt{2}} - \frac{N_2}{\sqrt{2}} - \mu_k mg = 0} \quad (i)$$

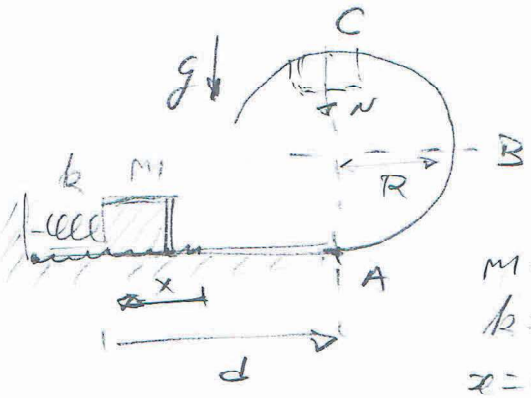
$$F_y = F_s \operatorname{sen} 45° + N_2 \operatorname{sen} 45° - N_1 - Mg$$

$$F_y : \frac{F_s}{\sqrt{2}} + \frac{N_2}{\sqrt{2}} - (m+M)g = \boxed{\frac{\mu_s N_2}{\sqrt{2}} + \frac{N_2}{\sqrt{2}} - (m+M)g = 0} \quad (ii)$$

De (i), (ii) $\quad \dfrac{\mu_s - 1}{\mu_s + 1} = \mu_k \dfrac{m}{m+M} \Rightarrow$

$$\boxed{\mu_s = \frac{1 + \dfrac{\mu_k m}{m+M}}{1 - \dfrac{\mu_k m}{m+M}}}$$

# Ejercicio 3




$$\frac{1}{2}kx^2 = \underbrace{\bar{F}_k}_{\mu_k M g} d + Mg2R + \frac{1}{2}Mv_c^2$$

$$\Rightarrow v_c = \sqrt{\frac{k}{M}x^2 - 2\mu_k g - 4gR}$$

$M = 0,20\ kg$

$k = 100\ \frac{N}{M}$

$x = 0,25\ M$

$\mu_k = 0,25$

$R = 0,30\ M$

(a) $v_c \simeq 3,82\ \frac{M}{S}$

$$N_c + Mg = F_{cp} \Rightarrow N_c + Mg = \frac{Mv_c^2}{R} \Rightarrow N_c = \frac{Mv_c^2}{R} - Mg$$

(b) $N_c \simeq 7,77\ N$