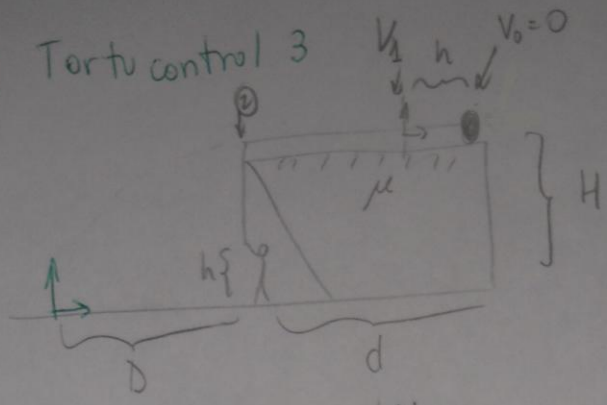
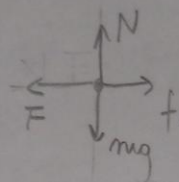
P1] Tortu control 3



$L = d + H - h$

(a) h: DCL m



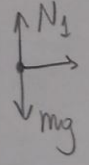
Y] $N = mg$

X] $f_1 - F = +m \cdot a_1$

$\Rightarrow -\mu \cdot N + F = +m\, a_1 \Rightarrow$ ① $a_1 = \dfrac{F - \mu mg}{m}$

$\Rightarrow V_1^2 - \cancel{V_0^2}^{\,0} = 2(+a_1)(0+h)$ ② $V_1 = \sqrt{2 a_1 h}$

(b) d-h:



Y] $N_1 = mg$

X] $fr = m \cdot a_2$

$\mu mg = m \cdot a_2 \rightarrow$ ③ $a_2 = \mu g$

$V_2^2 - V_1^2 = 2\, a_2 (X_2 - X_1)$

$V_2^2 = V_1^2 + 2a_2 (0 - (d-h))$

④ $V_2^2 = 2 a_1 h + 2\mu g (h-d)$

(c) $X(t) = D - V_2 t \Rightarrow X(t_1) = 0 \Rightarrow$ ⑤ $t_1 = \dfrac{D}{V_2}$

(tiempo que demora en llegar a la coordenada horizontal de la parrilla)

(1) $Y(t) = H - \frac{1}{2} g t^2$

$Y(t_2) = 0 \Rightarrow H = \frac{1}{2} g t_2^2 \Rightarrow$ (6) $t_2 = \sqrt{\frac{2H}{g}}$

(tiempo que tarda en llegar al suelo)

$t_1 = t_2$

$\Rightarrow \frac{D}{V_2} = \sqrt{\frac{2H}{g}} \Rightarrow$ (7) $V_2 = D\sqrt{\frac{g}{2H}}$

Pero $V_2^2 = \frac{D^2 g}{2H} = 2\frac{(F - \mu mg)}{m} h + 2\mu g (h-d)$

$\Rightarrow \frac{2Fh}{m} - 2\mu g h + 2\mu g h - 2\mu g d = \frac{D^2 g}{2H}$

$\frac{2Fh}{m} = 2\mu g d + \frac{D^2 g}{2H}$

$\Rightarrow F = \left(\frac{mg}{2h}\right)\left[2\mu d + \frac{D^2}{2H}\right]$