$$\begin{cases} Ox: \ -P\sin\theta - F_f = ma \ \rightarrow (1) \\ Oy: \ P\cos\theta - R_N = 0 \ \rightarrow (2) \end{cases}$$

$$\text{de (1)}: \ -mg\sin\theta - \mu R_N = ma \quad \text{et} \quad \text{de (2)}: \ \text{mg}\cos\theta = R_N$$

$$\Rightarrow -mg\sin\theta - \mu\text{mg}\cos\theta = ma \Rightarrow -mg(\sin\theta + \mu\cos\theta) = ma$$

$$\Rightarrow a = -g(\sin\theta + \mu\cos\theta)$$

Sachons que :

$$a = \frac{dV}{dt} = \frac{dV}{dt}\frac{dx}{dx} = \frac{dV}{dx}\underbrace{\frac{dx}{dt}}_{V} = V\frac{dV}{dx}$$

$$\Rightarrow V\,dV = -g(\sin\theta + \mu\cos\theta)\,dx \Rightarrow \int_{V_B}^{V} V\,dV = -g(\sin\theta + \mu\cos\theta)\int_0^x dx$$

$$\Rightarrow \left.\frac{V^2}{2}\right|_{V_B}^{V} = -g(\sin\theta + \mu\cos\theta)\,x|_0^x \Rightarrow V^2 = -2g(\sin\theta + \mu\cos\theta)\,x + V_B^2$$

$$\Rightarrow V\,(M_2) = \sqrt{-2g(\sin\theta + \mu\cos\theta)\,x + V_B^2}$$

$$V_B\left(\theta = \frac{\pi}{2}\right) = \sqrt{2\,gR\sin\left(\frac{\pi}{2}\right) + V_0^2} = \sqrt{2\,gR + V_0^2}$$

$$\Rightarrow V\,(M_2) = \sqrt{-2g(\sin\theta + \mu\cos\theta)\,x + 2\,gR + V_0^2}$$

3. La vitesse au point d'arrivée C :

Au point d'arrivée C : $x = l$

$$\Rightarrow V\,(C) = \sqrt{-2g(\sin\theta + \mu\cos\theta)l + 2\,gR + V_0^2}$$