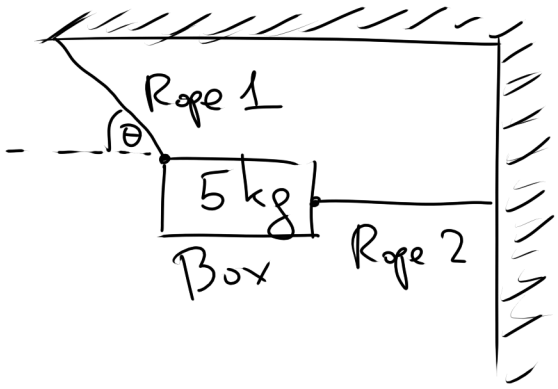
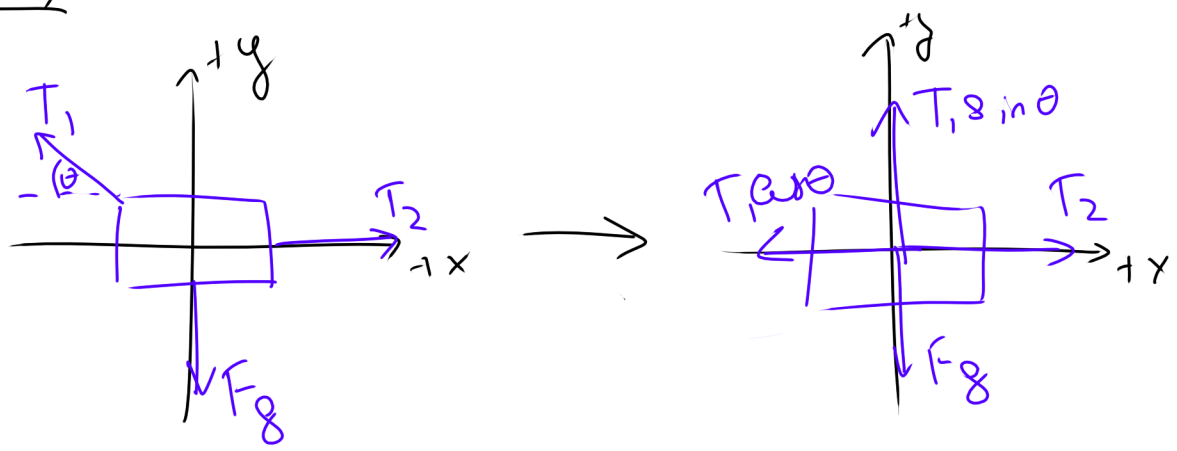
(1)



a) What's the tension in Rope 1 if $\theta = 30^\circ$

b) What's the tension in Rope 2 if θ?

Solution



$$(F_{net})_x = T_2 - T_1 \cos\theta = m a_x = 0$$

$$(F_{net})_y = T_1 \sin\theta - mg = m a_y = 0$$

$$\Rightarrow \begin{cases} T_2 - T_1 \cos\theta = 0 \\ T_1 \sin\theta - mg = 0 \end{cases} \Rightarrow \begin{cases} T_2 = T_1 \cos\theta \\ T_1 = \dfrac{mg}{\sin\theta} \end{cases}$$

$\therefore$ a) $\theta = 30^\circ \Rightarrow T_1 = \dfrac{5 \cdot 9.8}{\sin 30^\circ} = 98\,N$

b) $\theta \Rightarrow T_2 = T_1 \cos\theta = mg \cot\theta$

Seamus is racing along the Riachuelo River along avenue Don Pedro de Mendoza at 30 m/s when he approaches a turn with a radius of 50 m. If the coefficient of static friction between his tires and the road is 0.4 and the road is perfectly horizontal, what is the maximum speed (in m/s) with which he can safely negotiate the turn?

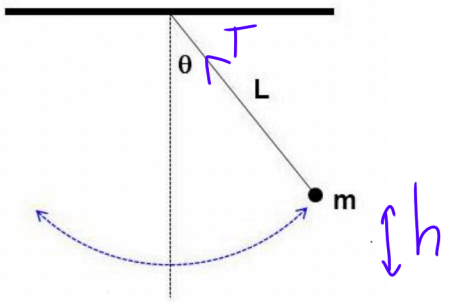
(2)

$$V_t^2 \leq \mu_s r g \Rightarrow V_t^2 \leq (0.4)(50m)\left(9.8 \frac{m}{s^2}\right)$$

$$\Rightarrow V_t^2 \leq 196 \frac{m^2}{s^2}$$

$$\Rightarrow V_t \leq 14 \, m\,s^{-1}$$

(3) A 3 kg mass is attached to a 0.5 m long massless string and swings as a pendulum as shown in the figure. The pendulum is released from rest with an angle $\theta = 60°$ relative to the vertical. What is the tension (in N) in the string when $\theta = 0°$?



(3) 1) Some sort of Energy Equation
2) Find the force equation

Part I

Notice if $\theta = 0 \Rightarrow h = 0$ cos

We can see that $h = L(1 - \cos\theta)$

Let's build the energy equation:

$$\Delta K + \Delta U = 0$$

$$\Rightarrow \left(\frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2\right) + \left(mgL(1 - \cos\theta_f) - mgL(1 - \cos\theta_i)\right) = 0$$

(− cosθ_f, + cosθ_i)

$$\Rightarrow (v_f^2 - v_i^2) + 2gL(\cos\theta_i - \cos\theta_f) = 0$$

II

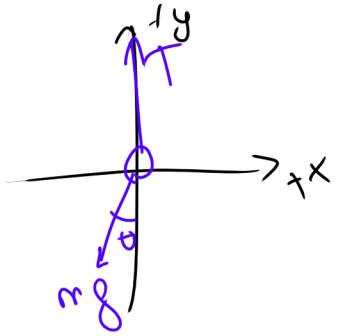
$$\Rightarrow V_f^2 + 2gL(\cos 60^\circ - \cos 0^\circ) = 0$$

$$\Rightarrow V_f^2 - 2gL(1 - \cos 60^\circ) = 0$$

$$\Rightarrow V_f^2 = 2gL(1 - \cos 60^\circ)$$

Note:
a - "a"
α - "alpha"

Prob II



$$\Rightarrow T - mg\cos\theta^\circ = ma = m\frac{v^2}{L}$$

(radius)

$$\Rightarrow T = m\frac{v^2}{L} + mg\cos\theta^\circ$$

$$= m\left(g\cos\theta^\circ + \frac{v^2}{L}\right)$$

$$= m\left(g\cos\theta + \frac{2gL(1-\cos\theta)}{L}\right)$$

$$= mg(\cos\theta + 2(1-\cos\theta))$$

$$= (3\,kg)\left(9.8\,\frac{m}{s^2}\right)(1 + 2(1-0.5))$$

$$= 58.8\,N.$$