

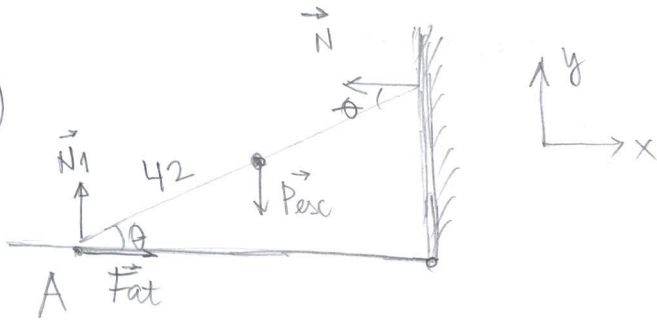
Gabarito Prova 5. Noturno.

1)

1.)

ii)

a)



$$P_{esc} = mg$$

$$F_{at} = \mu \cdot N_1$$

$$ii) \sum \vec{F}_x = \vec{0} \Rightarrow |\vec{N}| = |\vec{F}_{at}|$$

$$\sum \vec{F}_y = \vec{0} \Rightarrow |\vec{N}_1| = |\vec{P}_{esc}|$$

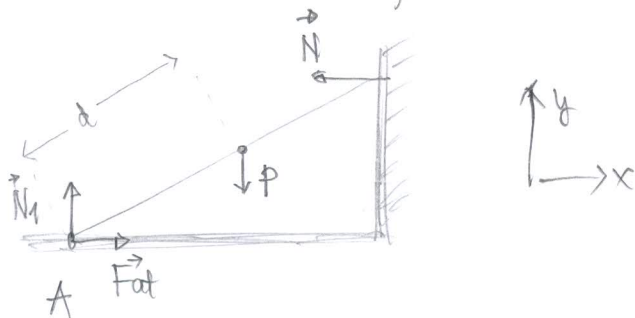
$$\sum \vec{\tau}_A = \vec{0} \Rightarrow \left(\frac{L}{2}\right) \cdot P_{esc} \cdot \cos \theta = (L) \cdot N \cdot \sin \theta \Rightarrow N = \frac{mg}{2} \cdot \frac{1}{\tan \theta}$$

$$iii) \text{ Para não escorregar : } F_{at} \geq N \therefore \mu \cdot mg \geq \frac{mg}{2} \cdot \frac{1}{\tan \theta}$$

$$\therefore \theta_{\min} = \arctg \left(\frac{1}{2\mu} \right)$$

b)

ii)



$$ii) \sum \vec{F}_x = \vec{0} \Rightarrow N = F_{at}$$

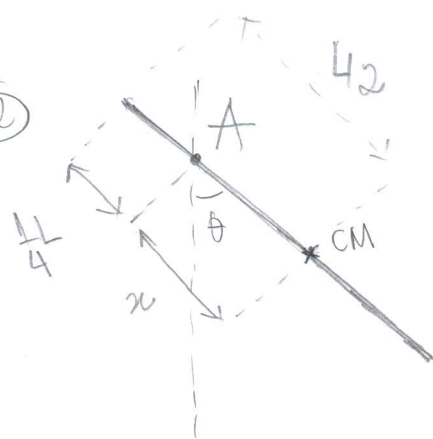
$$\sum \vec{F}_y = \vec{0} \Rightarrow P = N_1$$

$$\sum \vec{\tau}_A = \vec{0} \Rightarrow d \cdot P \cdot \cos \theta = L \cdot N \cdot \sin \theta \Rightarrow N = \left(\frac{d \cdot P}{L} \right) \cdot \frac{1}{\tan \theta}$$

$$iii) F_{at} \geq N \Rightarrow \mu N_1 \geq \left(\frac{d \cdot P}{L} \right) \cdot \frac{1}{\tan \theta} \Rightarrow \mu L \tan \theta \geq d$$

$$\therefore d_{\max} = \mu L \tan \theta$$

②



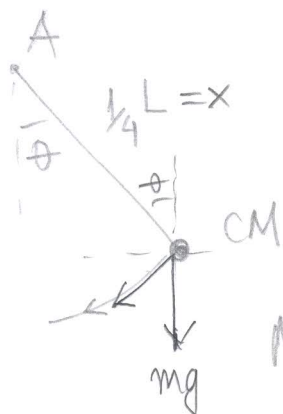
L, M

$$a) I_A = I_{CM} + M \cdot \left(\frac{1}{4}L\right)^2 = \frac{1}{12}ML^2 + \frac{1}{16}ML^2 = \frac{7}{48}ML^2$$

$$x = \frac{1}{4}L$$

b)

Massa no CM.



$$\tau_A = -I_A \alpha = -I_A \ddot{\theta}$$

$$\text{Mas } \tau_A = mg \sin \theta$$

$$\therefore mg \sin \theta \cdot x = -\frac{7}{48}ML^2 \ddot{\theta}$$

$$x = \frac{1}{4}L$$

$$\ddot{\theta} + \left(\frac{12}{7} \frac{g}{L}\right) \theta = 0$$

$$c) \omega^2 = \frac{12}{7} \frac{g}{L} \therefore \omega = \sqrt{\frac{12}{7} \frac{g}{L}}$$

$$d) \theta(t) = \theta_0 \cos(\omega t + \varphi). \text{ Se } \theta(0) = \theta_0 \therefore \varphi = 0 \text{ e}$$

$$\boxed{\theta(t) = \theta_0 \cos(\omega t)}$$

$$e) E = \frac{1}{2} I \omega^2 = \frac{1}{2} \cdot I_A \cdot (\dot{\theta})^2 = \frac{1}{2} I_A (\theta_0 \omega \sin \omega t)^2 = \frac{1}{2} I_A \theta_0^2 \omega^2 \sin^2 \omega t = E(t)$$

$$f) U = E_{cin}^{MAX}$$

$$g) \omega_0 = \omega \Rightarrow \sqrt{\frac{12g}{7L}} = \sqrt{\frac{g}{L}} \Rightarrow \boxed{L = \frac{7}{12}L}$$