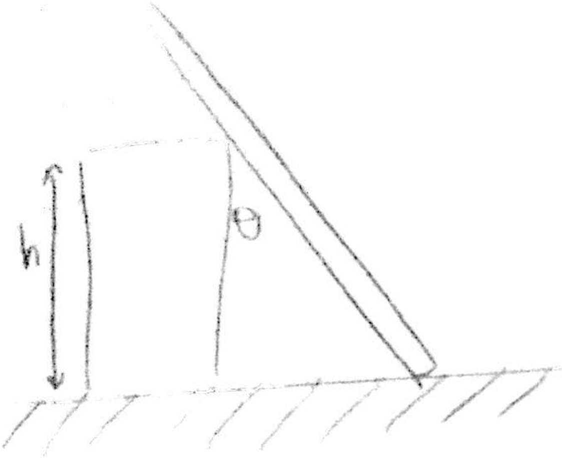
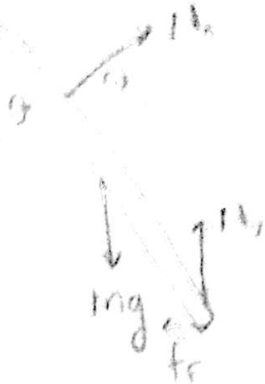


a)



$$\Sigma F_y = N_1 \operatorname{sen}\theta + N_2 - mg = 0 \quad (1)$$

$$\Sigma F_x = -f_r + N_1 \operatorname{sen}\theta = 0 \quad (2)$$

De (2) encontramos N_1

$$N_1 = \frac{f_r}{\operatorname{sen}\theta} = \frac{\mu N_2}{\operatorname{sen}\theta} \quad (3)$$

Reemplazando (3) en (1)

$$\frac{\mu N_2}{\operatorname{sen}\theta} + N_2 - mg = 0$$

$$N_2\left(\frac{\mu}{\operatorname{sen}\theta} + 1\right) = mg$$

$$\boxed{N_2 = \frac{mg}{\frac{\mu}{\operatorname{sen}\theta} + 1}}$$

De (3) obtenemos entonces

$$\boxed{N_1 = \left(\frac{\mu mg}{\frac{\mu}{\operatorname{sen}\theta} + 1}\right)\frac{1}{\operatorname{sen}\theta}}$$

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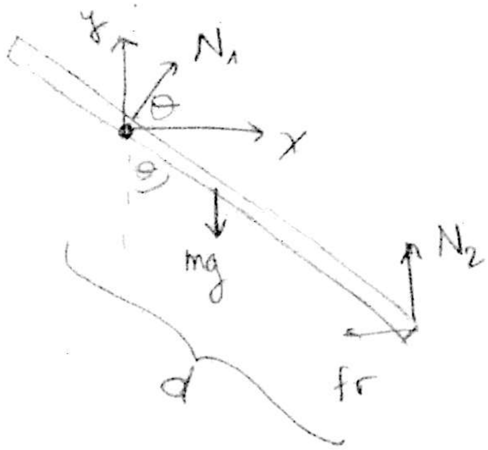
$$\Rightarrow \boxed{f_r = \frac{\mu m g}{\frac{\mu}{\text{sen}\theta} + 1}}$$

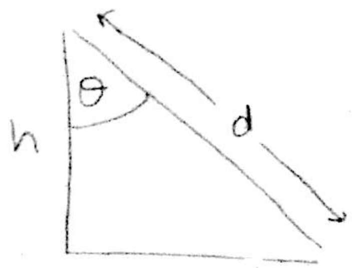
b) Para esto usamos la otra condición de estática.

$\sum \vec{\tau} = 0$.



$$\vec{\tau}_{N_1} = 0$$

$$\vec{\tau}_{N_2} = \vec{d} \times \vec{N}_2$$



$$\cos\theta = \frac{h}{d}$$

$$\Rightarrow d = \frac{h}{\cos\theta}$$

$$mg = \left(d - \frac{L}{2}\right)(-\cos\theta\,\hat{y} + \text{sen}\theta\,\hat{x}) \times mg(-\hat{y})$$

$$= \left(\frac{L}{2} - d\right)\text{sen}\theta\, mg\,\hat{z}$$

$$\Rightarrow \vec{\tau}_{N_2} = \frac{h}{\cos\theta}(-\cos\theta\,\hat{y} + \text{sen}\theta\,\hat{x}) \times N_2\,\hat{y}$$

$$\vec{\tau}_{N_2} = \frac{h}{\cos\theta}\text{sen}\theta N_2\,\hat{z}$$

$$\vec{\tau}_{fr} = d(-\cos\theta\,\hat{y} + \text{sen}\theta\,\hat{x}) \times fr(-\hat{x})$$

$$= -d\cos\theta\, fr\,\hat{z} = -h fr\,\hat{z}$$

$$\Rightarrow \frac{h}{\cos\theta}\text{sen}\theta N_2 + \left(\frac{L}{2} - d\right)\text{sen}\theta\, mg - h fr = 0$$

$$\left(\frac{L}{2} - d\right)\text{sen}\theta\, mg = h fr - \frac{h\,\text{sen}\theta N_2}{\cos\theta}$$

$$\frac{L}{2} - d = \frac{h}{mg\,\text{sen}\theta}\left(fr - \frac{\text{sen}\theta N_2}{\cos\theta}\right)$$

$$\Rightarrow \boxed{L = 2\left(\frac{h}{mg\,\text{sen}\theta}\left(fr - \frac{\text{sen}\theta N_2}{\cos\theta}\right) + d\right)}$$

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