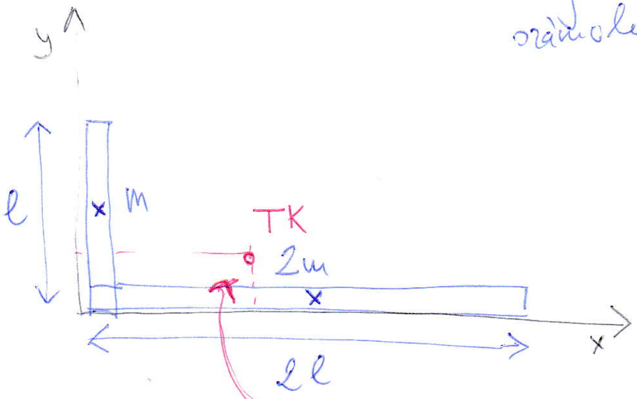
F1

TKP számolása ⟶ dirib-darabok TKP-ja, majd ezekből, mint tömegpontokból számolunk tovább.



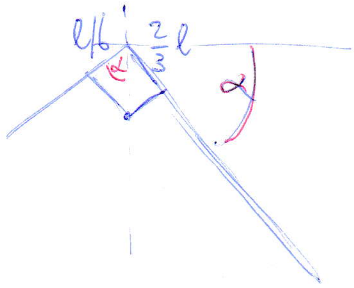
$l = 50\,cm$

Egyik szár: m, $y^{(1)}_{TK} = l/2$, $x^{(1)}_{TK} = 0$

Másik szár: $2m$, $y^{(2)}_{TK} = 0$, $x^{(2)}_{TK} = l$

⟶ $$x_{TK} = \frac{m \cdot x^{(1)}_{TK} + 2m\, x^{(2)}_{TK}}{m + 2m} = \frac{2}{3} l$$

⟶ $$y_{TK} = \frac{m\, y^{(1)}_{TK} + 2m\, y^{(2)}_{TK}}{m + 2m} = \frac{l}{6}$$



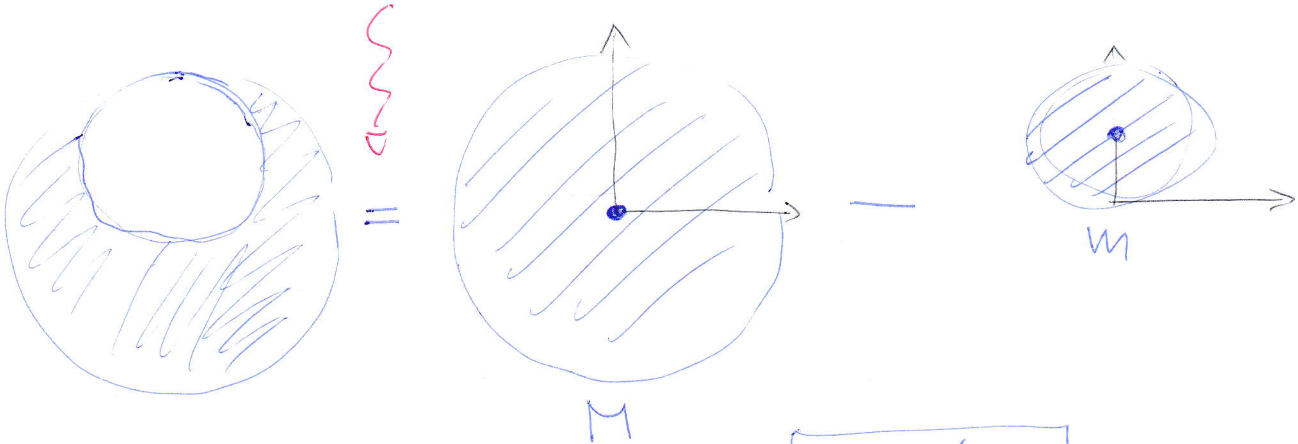
$$\boxed{tg\,\alpha = \frac{\frac{2}{3} l}{l/6} = 4}$$

⇓

$$\boxed{\alpha = 1.33 = \boxed{76{,}0^\circ}}$$

TRÜKK

F2



kis kör sugara fele a nagynak ⟶ $\boxed{M = 4m}$

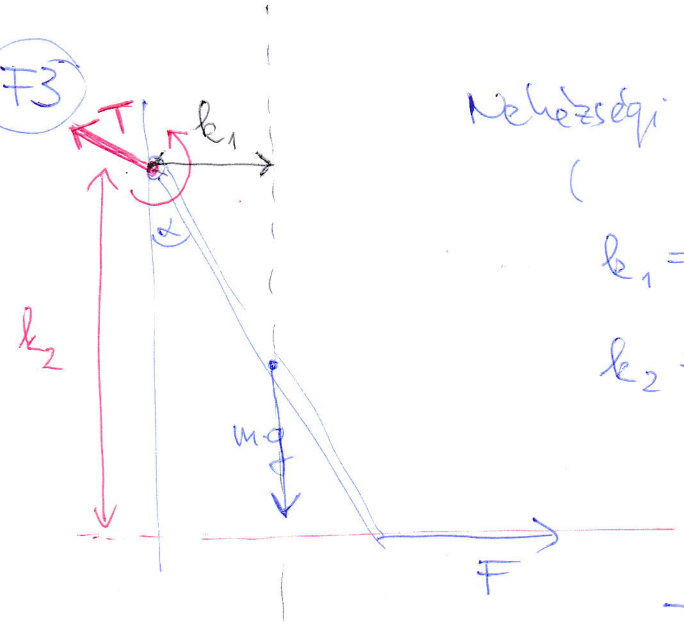
Nagy kör: $x_{TK}^{(1)} = 0 \quad y_{TK}^{(1)} = 0$

Kis kör: $x_{TK}^{(2)} = 0 \quad y_{TK}^{(2)} = \frac{R}{2}$

$$\boxed{x_{TK} = \frac{M \cdot x_{TK}^{(1)} - m \cdot x_{TK}^{(2)}}{M+m} = \emptyset}$$

$$y_{TK} = \frac{M \cdot y_{TK}^{(1)} - m \cdot y_{TK}^{(2)}}{M-m} = \frac{-m \cdot \frac{R}{2}}{3m} = \boxed{-\frac{R}{6}}$$

F3



Nehézségi erő a TK-ba helyezhető!

(

$$k_1 = \frac{L}{2} \sin \alpha$$

$$k_2 = L \cdot \cos \alpha$$

Tengelyre vonatkoztatott nyomatékok

$$-m \cdot g \cdot k_1 + F \cdot k_2 = \emptyset$$

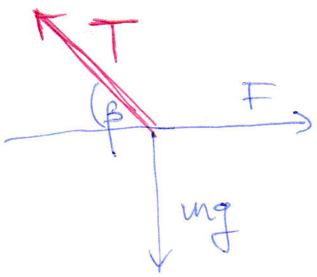
$$-mg \cdot \frac{L}{2} \sin \alpha + F \cdot L \cdot \cos \alpha = 0$$

$$\boxed{\operatorname{tg} \alpha = \frac{2F}{mg}}$$

$$\alpha = \operatorname{arctg}\left(\frac{2F}{mg}\right)$$

b.) $\sum M = 0$ ✓

$\sum \underline{F} = 0 \rightarrow$

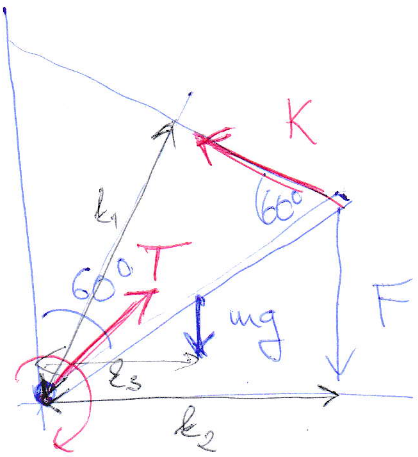


$= \emptyset$

$\rightarrow T \cdot \cos\beta = F$

$T \cdot \sin\beta = mg \rightarrow \boxed{\operatorname{tg}\beta = \frac{mg}{F}}$ $\quad T = \sqrt{F^2 + m^2 g^2}$

F4



$$\ell_1 = L \cdot \sin 60^\circ$$

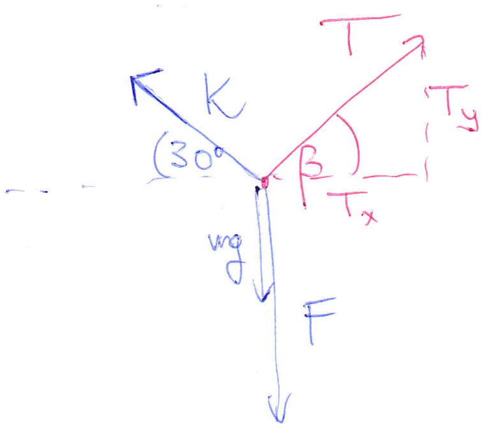
$$\ell_2 = L \cdot \sin 60^\circ = \ell_1$$

$$\ell_3 = L/2 \, \sin 60^\circ = \ell_1/2$$

Forgatónyomaték?

$$m \cdot g \cdot \ell_3 + F \cdot \ell_2 - K \cdot \ell_1 = \varnothing$$

$$\boxed{K = F + \frac{mg}{2}}$$



$$T_y + K \cdot \overset{1/2}{\sin 30^\circ} = mg + F$$

$$T_x - K \cdot \underset{\frac{\sqrt{3}}{2}}{\cos 30^\circ} = \varnothing$$

$$\hookrightarrow T_x = K \cdot \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{2} F + \frac{\sqrt{3}}{4} mg$$

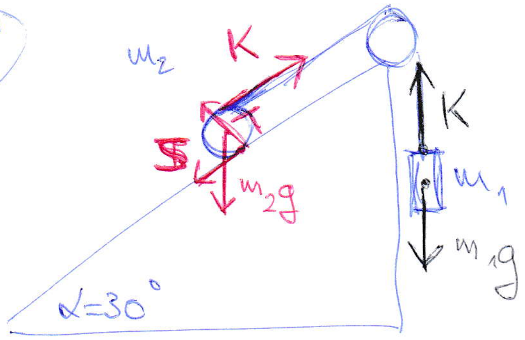
$$\hookrightarrow T_y = mg + F - \frac{F}{2} - \frac{mg}{4} =$$

$$= \frac{F}{2} + \frac{3}{4} mg$$

$$\boxed{tg\beta = \frac{T_y}{T_x} = \frac{\frac{F}{2} + \frac{3}{4} mg}{\frac{\sqrt{3}}{2} F + \frac{\sqrt{3}}{4} mg}}$$

$$|T| = \sqrt{T_x^2 + T_y^2} = \ldots$$

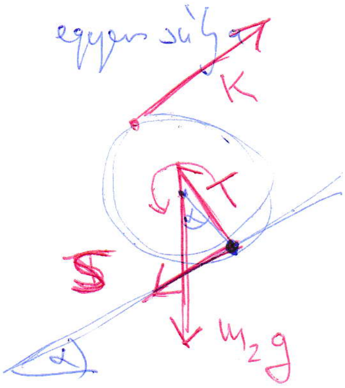
F5



→ 1-es test egyensúlya: $m_1 g - K = \emptyset$

$\hookrightarrow \boxed{K = m_1 g}$

→ 2-es test egyensúlya



Forgatónyomatékok: milyen tengelyre?

A : TKP-ra

B : érintkezési pontra.

$k_K = 2R$

$k_{m_2 g} = R \cdot \sin\alpha = \frac{R}{2}$

$m_2 g R \cdot \sin\alpha - K 2R = \emptyset$

$\frac{m_2 g R}{2} - 2KR = \emptyset$

$\hookrightarrow \boxed{K = \frac{m_2 g}{4}}$

egyensúly, ha $m_1 g = \frac{m_2 g}{4}$

$\boxed{m_2 = 4 m_1}$

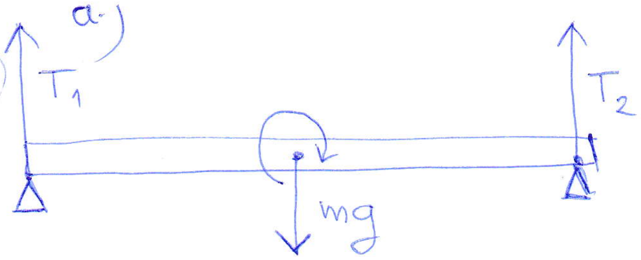
Tapadási erő:

$S + m_2 g \sin\alpha = K$

$\boxed{S = K - \frac{m_2 g}{2} = -\frac{m_2 g}{4}}$

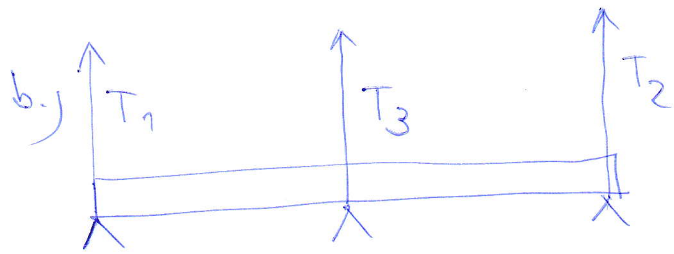
F6

a)



$$mg = T_1 + T_2$$
$$T_1 \cdot \frac{L}{2} - T_2 \cdot \frac{L}{2} = 0$$
$$\Rightarrow \boxed{T_1 = T_2 = \frac{mg}{2}}$$

b)

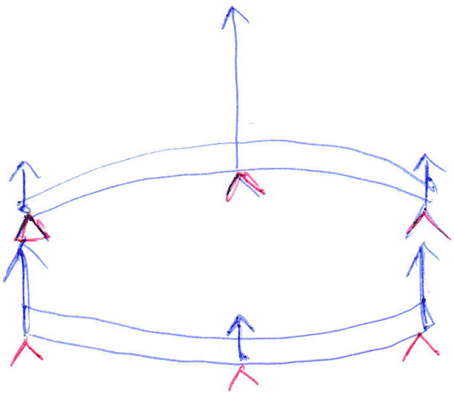


$$mg = T_1 + T_2 + T_3$$
$$T_1 \frac{L}{2} - T_2 \frac{L}{2} = 0$$

BAJ

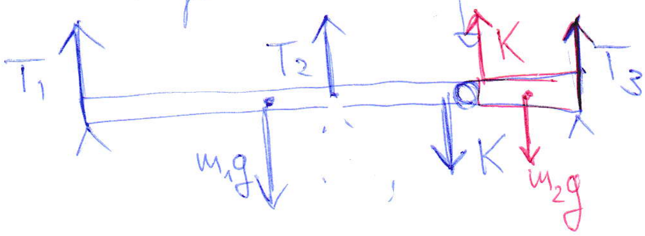
túl sok ismeretlen!

"Mechanikailag túl határozott" rendszer



Mérnöki megoldás:

könnyű forgó csukló



$$m_1 = \frac{3}{4} m$$
$$m_2 = \frac{1}{4} m$$

1-es darab:

$$m_1 g + K = T_1 + T_2$$
$$T_1 \cdot \frac{3}{4} L + T_2 \cdot \frac{1}{4} L - m_1 g \frac{3}{8} L = 0$$

2-es darab:

$$m_2 g = K + T_3$$
$$K \cdot \frac{L}{8} - T_3 \cdot \frac{L}{8} = 0$$

$$\boxed{K = T_3 = \frac{m_2 g}{2} = \frac{m \cdot g}{8}}$$

$$m_1 g + K = T_1 + T_2$$

$$T_1 + T_2 = \frac{7}{8} m g$$

$$\frac{3}{4} T_1 + \frac{1}{4} T_2 - \frac{3}{8} m_2 g = \emptyset$$

$$3T_1 + T_2 = \frac{9}{8} m g$$

$$\to 2T_1 = \frac{1}{4} m g$$

$$\boxed{T_1 = \frac{1}{8} m g}$$

$$\boxed{T_2 = \frac{3}{4} m g}$$