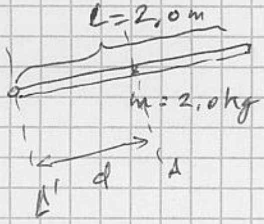
(14.56).



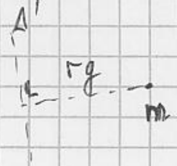
a). $I_\Delta = \frac{1}{12} m L^2$

$I_{\Delta'} = I_\Delta + m d^2 = \frac{1}{12} m L^2 + m\left(\frac{L}{2}\right)^2 = \frac{1}{12} m L^2 + \frac{1}{4} m L^2$

$= \underline{\underline{\frac{1}{3} m L^2}} = \frac{1}{3}\, 2,0 \cdot 2,0^2$

$= \underline{\underline{2,7\,kg \cdot m^2}}$

b).



$I_{\Delta'} = r_g^2\, m = \frac{1}{3} m L^2$

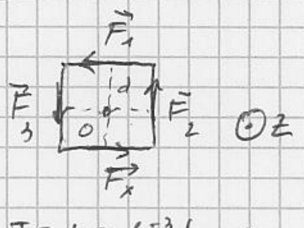
$\Rightarrow r_g^2 = \frac{L^2}{3} \Rightarrow r_g = \frac{L}{\sqrt{3}} = \frac{2,0}{\sqrt{3}} = \underline{\underline{1,2\,m}}$

c). $r_g = 1,2\,m \neq \frac{L}{2} = 1,0\,m$

$\Rightarrow$ À cause du $\underline{r}^2 . \Delta m$ qui intervient dans la définition de $I_{\Delta'}$. La position du CM dépend de $r . \Delta m$

(14.57).

$d = 5\,cm$



$I = 1,0 \cdot 10^{-3}\,kg \cdot m^2$

$\omega = 5 \frac{tours}{s} = 5,0 \cdot 2\pi \frac{rad}{s} = 10\pi \frac{rad}{s}$: vitesse angulaire

$\Rightarrow \omega = \alpha \cdot \Delta t = \alpha \cdot 0,5 = 10\pi \Rightarrow \alpha = 20\pi \frac{rad}{s^2}$

Calcul des moments par rapport à O, le centre du "soleil"

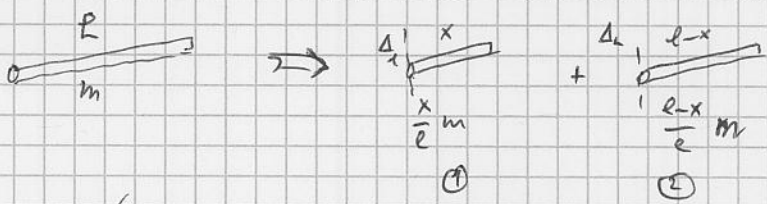
$\Sigma \vec{M} = \vec{d_1} \times \vec{F_1} + \vec{d_2} \times \vec{F_2} + \vec{d_3} \times \vec{F_3} + d_4 \times \vec{F_x} = I \vec{\alpha}$

• Sur z, en composantes :

$\Sigma M = 3dF + dF_x = I\alpha$

$\Rightarrow dF_x = I\alpha - 3dF \Rightarrow F_x = \frac{I\alpha - 3dF}{d} = \frac{1,0 \cdot 10^{-3} \cdot 20\pi - 3 \cdot 0,05 \cdot 0,30}{0,05} \simeq \underline{\underline{0,36\,N}}$

(14.58).



$I_{①} = \frac{1}{3} \frac{x}{\ell} m \cdot x^2 = \frac{m}{3\ell} x^3$

$I_{②} = \frac{1}{3} \frac{\ell - x}{\ell} m \cdot (\ell - x)^2 = \frac{m}{3\ell} (\ell - x)^3$

$\frac{I_{①}}{I_{②}} = \frac{\frac{m}{3\ell} x^3}{\frac{m}{3\ell} (\ell - x)^3} = 2 \Rightarrow x^3 = 2(\ell - x)^3$ avec $\ell - x ; x > 0$

$\Rightarrow x = 2^{1/3}(\ell - x) \Rightarrow x = 2^{1/3}\ell - 2^{1/3} x$

$\Rightarrow x(1 + 2^{1/3}) = 2^{1/3}\ell \Rightarrow \underline{\underline{x = \frac{2^{1/3}}{1 + 2^{1/3}}\,\ell}}$

$\Rightarrow \ell - x = \ell - \frac{2^{1/3}}{1 + 2^{1/3}}\ell = \ell\left(1 - \frac{2^{1/3}}{1 + 2^{1/3}}\right)$

$\underline{\underline{\ell - x = \frac{1}{1 + 2^{1/3}}\,\ell}}$