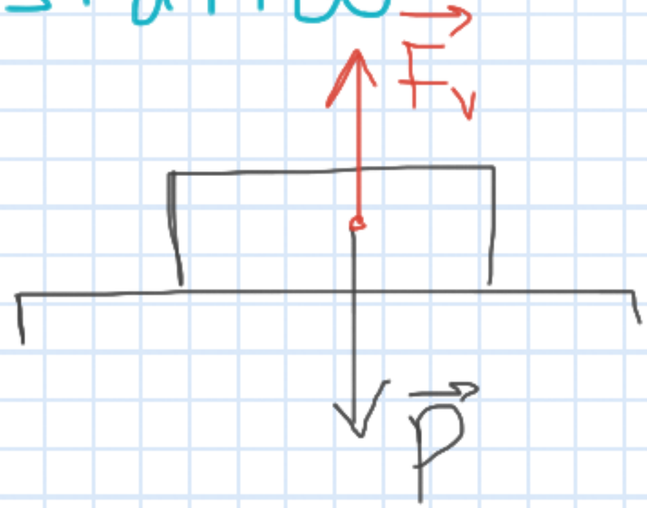
Esercizi Equilibrio statico

N1

$P = 100\ N$



$$\vec{R} = \vec{F}_v + \vec{P} = \vec{0}$$

$$\vec{F}_v = -\vec{P}$$

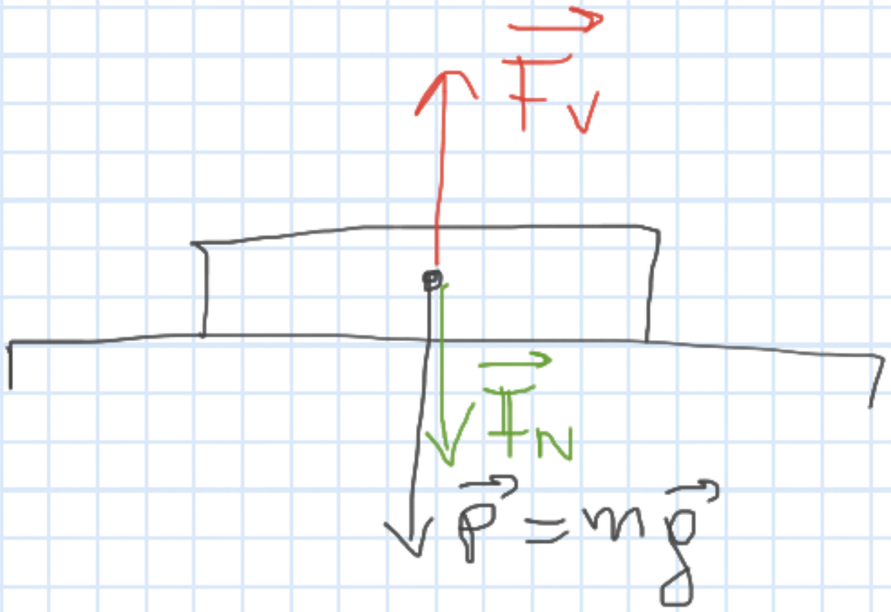
$$F_v = P = 100\ N$$

N 2

$m = 1{,}2\ kg$

$F_N = 25\ N$

$F_V = ?$



$$\vec{R} = \vec{P} + \vec{F}_N + \vec{F}_V = \vec{0}$$

$$\vec{F}_V = -(\vec{P} + \vec{F}_N)$$

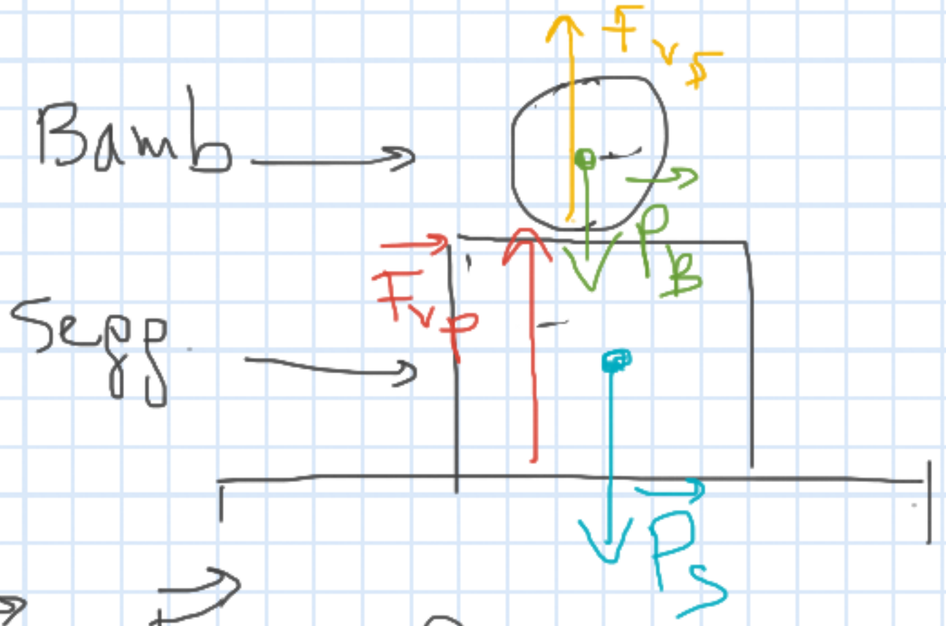
$$F_V = +mg + F_N = 1{,}2\ kg \cdot 9{,}81\ \frac{m}{s^2} + 25\ N$$

$$= 36{,}77\ N \approx 37\ N$$

N3

$m_B = 9{,}3\ kg$

$m_s = 15{,}5\ kg$



Bambino $\quad \vec{R} = m_B \vec{g} + \vec{F}_{vs} = 0$

$F_{vs} = m_B g = 9{,}3\ kg \cdot 9{,}81\ \frac{m}{s^2} = 91{,}23\ N$

Bambino + seggiolare $\quad \vec{R} = m_B \vec{g} + m_s \vec{g} + \vec{F}_{vp} = 0$

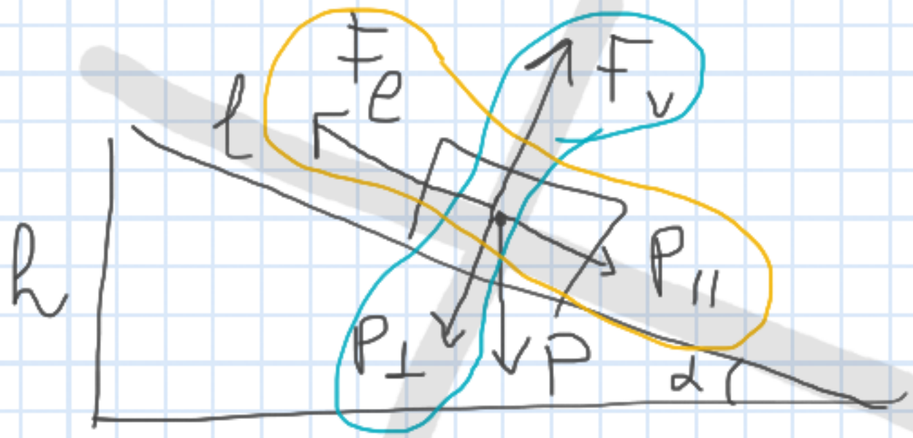
$F_{vp} = (m_B + m_s)\, g = 243{,}29\ N$

N7

$m = 25\,kg$

$\ell = 3\,m$

$h = 40\,cm = 0,4\,m$



$h = \ell \cdot \operatorname{sen}\alpha$

$b = \ell \cos\alpha$

$\vec{F}_v$?

$$\vec{R} = \vec{F}_v + \vec{P} + \vec{F}_E = \vec{0}$$

$$\vec{F}_v + \vec{P}_\perp + \vec{P}_{//} + \vec{F}_E = 0$$

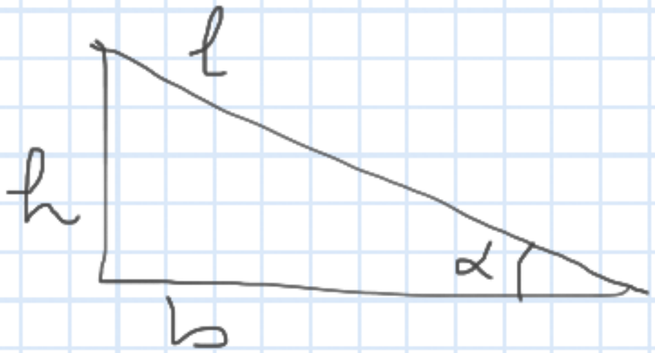
$$\begin{cases} \vec{F}_v = -\vec{P}_\perp \\ \cancel{\vec{F}_E = -\vec{P}_{//}} \end{cases} \longrightarrow F_v = P_\perp = P \cdot \cos\alpha =$$

$$= P \cdot \frac{b}{\ell}$$

$l = 3m$

$h = 0,4m$

$m = 25kg$



$h = l \operatorname{sen}\alpha$

$b = l \cos\alpha$

$$F_v = P_\perp = P\cos\alpha = P\frac{b}{l}$$

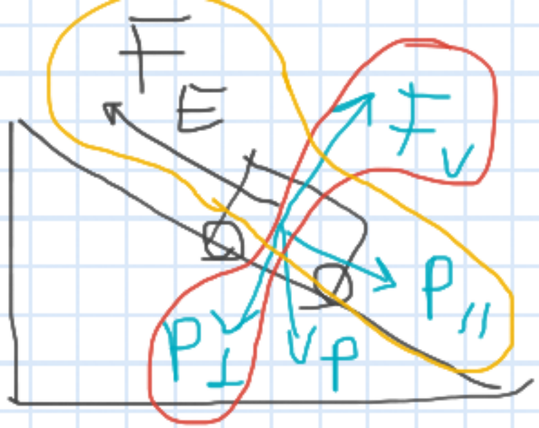
$$b = \sqrt{l^2 - h^2} = \sqrt{(9 - 0,16)\,m^2} = \sqrt{8,84\,m^2} = 2,97\,m$$

$$F_v = m \cdot g \cdot \frac{2,97\,m}{3\,m} = 242,79\,N$$

$$\operatorname{sen}\alpha = \frac{h}{l} \rightarrow \alpha = \operatorname{sin}^{-1}\left(\frac{h}{l}\right) \rightarrow \cos\alpha = \cos\left(\operatorname{sin}^{-1}\frac{h}{l}\right) \approx 0,991$$

$$F_v = m\,g \cdot \cos\alpha = 243,06\ N$$

Ng



$F_E = 80\,N$

$l = 5\,m$

$h = 50\,cm = 0{,}5\,m$

~~$F_V = P_\perp$~~ $\quad F_E = P_{II} = P \cdot \frac{h}{l}$

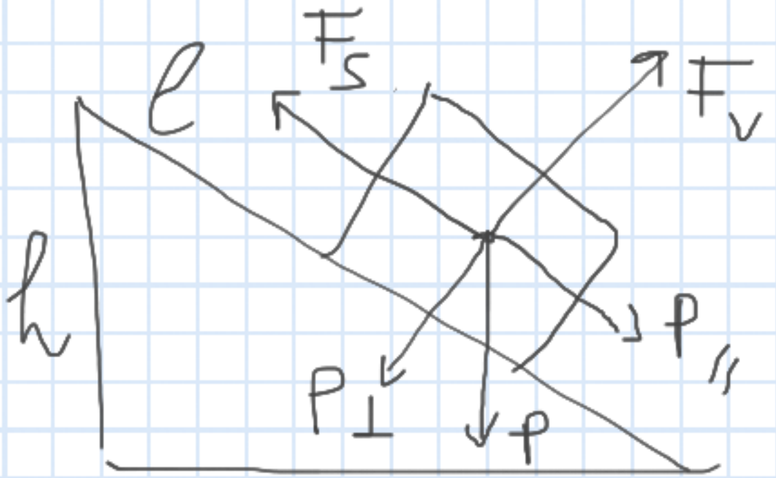
$$\frac{l\,F_E}{h\,g} = \frac{m\,g \cdot \frac{h}{l}}{g} = \frac{m\,g \cdot h \cdot 1 \cdot l}{l \cdot h \cdot g}$$

$$m = \frac{F_E\,l}{h\,g} = \frac{80\,N \cdot 5\,m}{0{,}5\,m \cdot 9{,}81\,m/s^2} = 81{,}55\,kg$$

N12)

$\ell = 340\,m$

$h = 22\,m$



$F_s = \mu_s F_\perp \rightarrow F_s = \mu_s P_\perp$

$P_\perp = P_{||}$

$P_{||} = \mu_s P_\perp$

$b = \sqrt{\ell^2 - h^2} = 339{,}28\,m$

$P \cdot \frac{h}{\ell} = \mu_s P \cdot \frac{b}{\ell} \rightarrow \mu_s = \frac{h}{b} = \frac{22\,m}{339{,}28\,m} = 0{,}065$

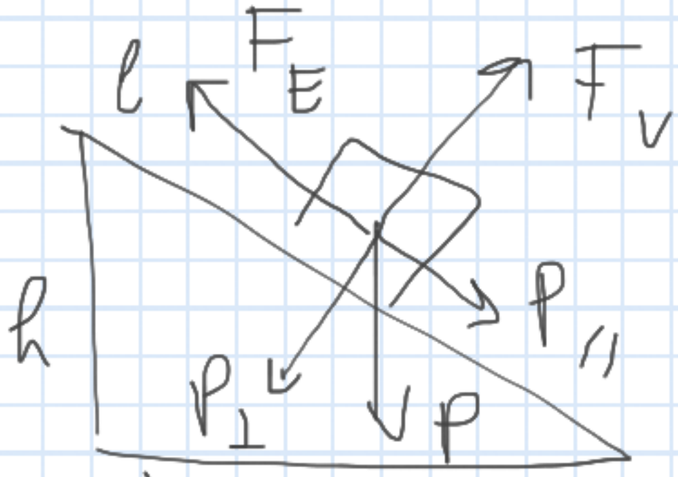
N13

$m = 35\ kg$

$h = 1,8\ m$

$l = 3,7\ m$

$\mu_s = 0,780$



$b = \sqrt{l^2 - h^2} = 3,23\ m$

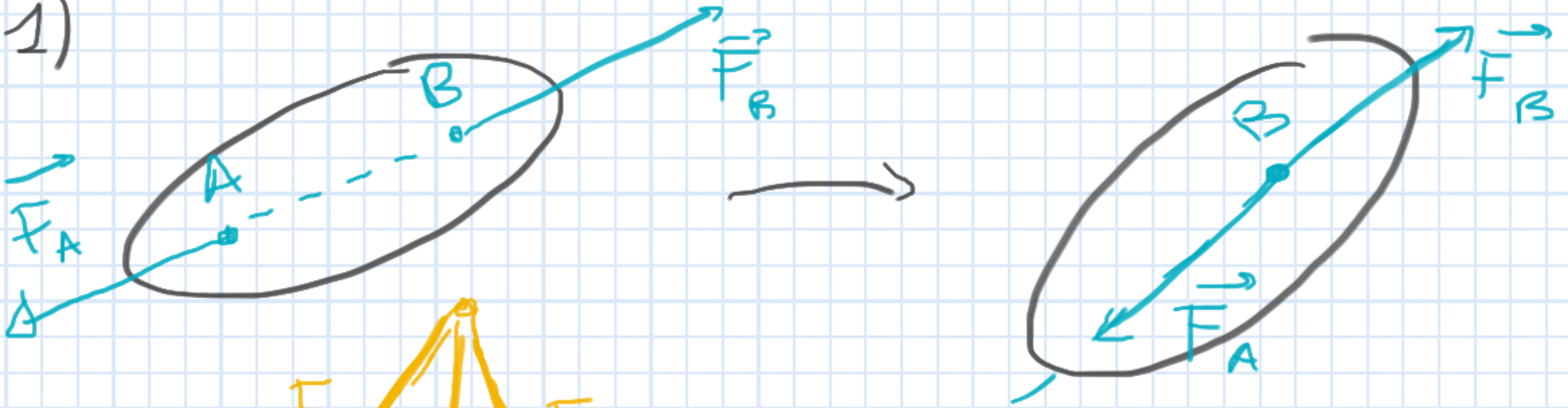
F_E ? $\rightarrow F_E = P_{//} = mg \cdot \frac{h}{l} = 35\ kg \cdot 9,81 \frac{m}{s^2} \cdot \frac{1,8\ m}{3,7\ m}$

$= 167,04\ N$

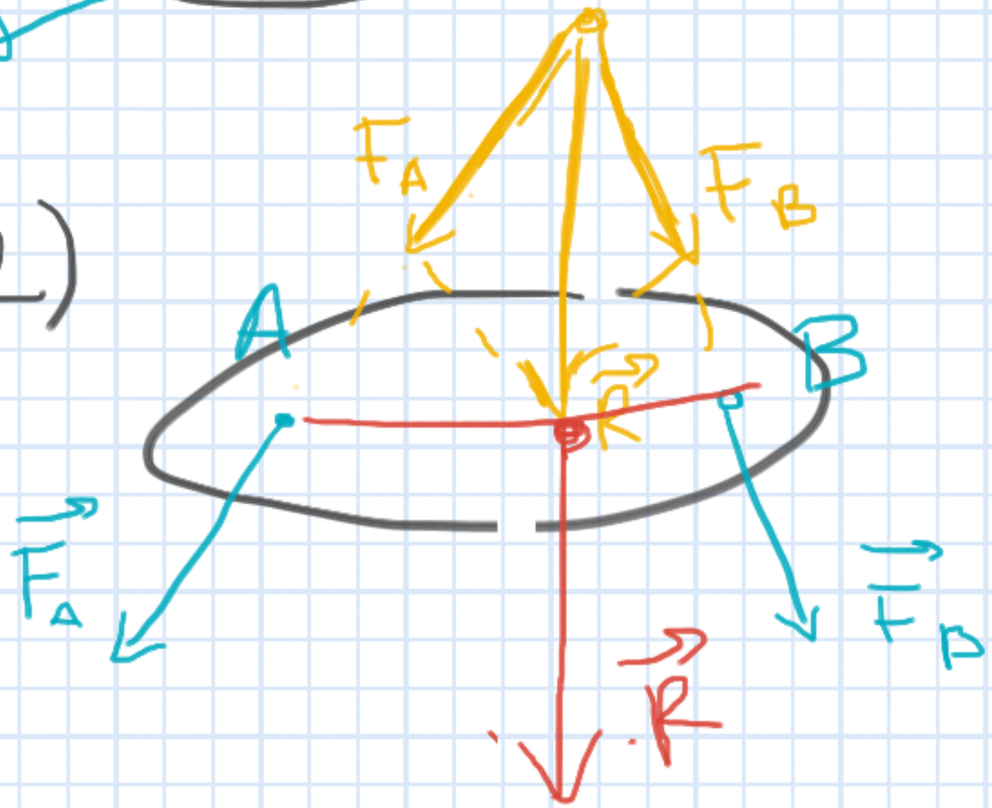
$F_s = \mu_s P_\perp = \mu_s \cdot mg \cdot \frac{b}{l} = 480,97\ N \rightarrow F_E = 0\ N$

Composizione di Forze su un Corpo Rigido

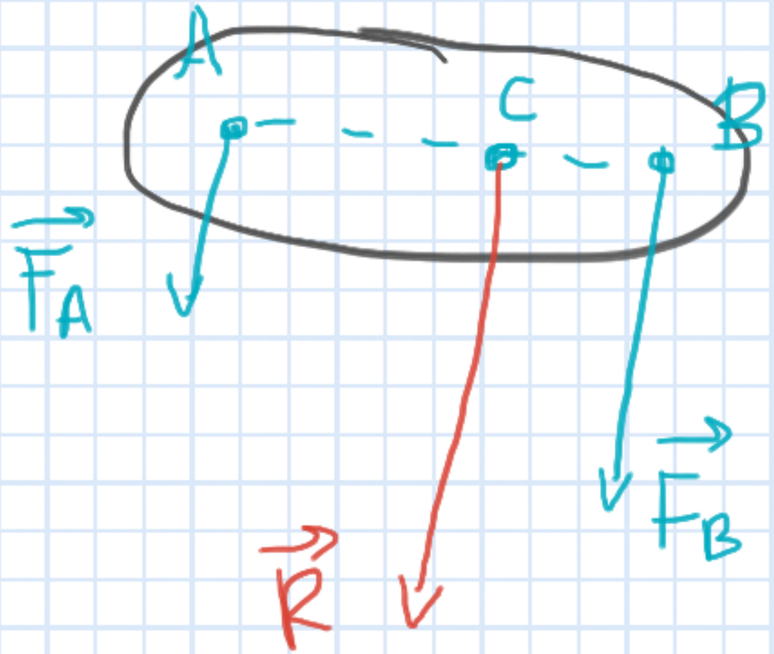
1)



2)



3) Forze parallele e concordi

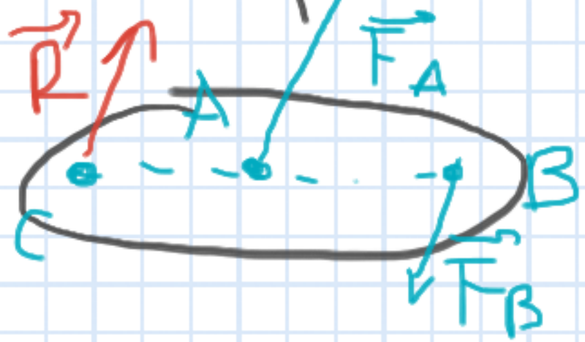


$\vec{R}$ interna ad A e B (in C)

$AC : CB = F_B : F_A$

$R = F_A + F_B$

4) Forze parallele DISCORDI



$\vec{R}$ esterna ad A e B (in C)

$AC : CB = F_B : F_A$

$R = F_A - F_B$

Esercizio 14

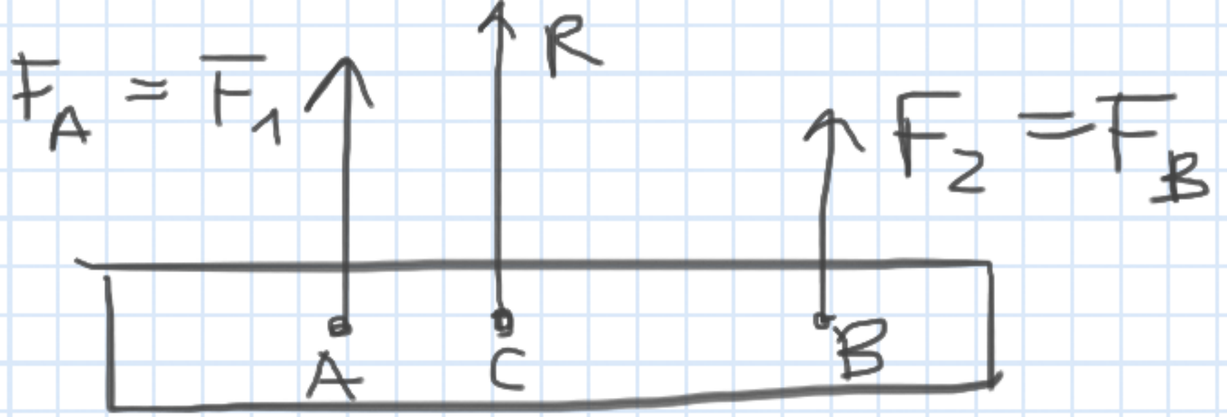
$F_1 = 135\,N$

$F_2 = 92\,N$

$\overline{AC} = 32\,cm = 0{,}32\,m$

$\overline{AB} = ?$

$R = ?$



$AC : CB = F_2 : F_1$

$CB = \dfrac{AC \cdot F_1}{F_2}$

$AB = AC + CB$

$= AC + AC\dfrac{F_1}{F_2} = AC\left(1 + \dfrac{F_1}{F_2}\right)$

$= 0{,}32\,m\left(1 + \dfrac{135\,\cancel{N}}{92\,\cancel{N}}\right) = 0{,}79\,m$

$R = F_1 + F_2$

$= 227\,N$

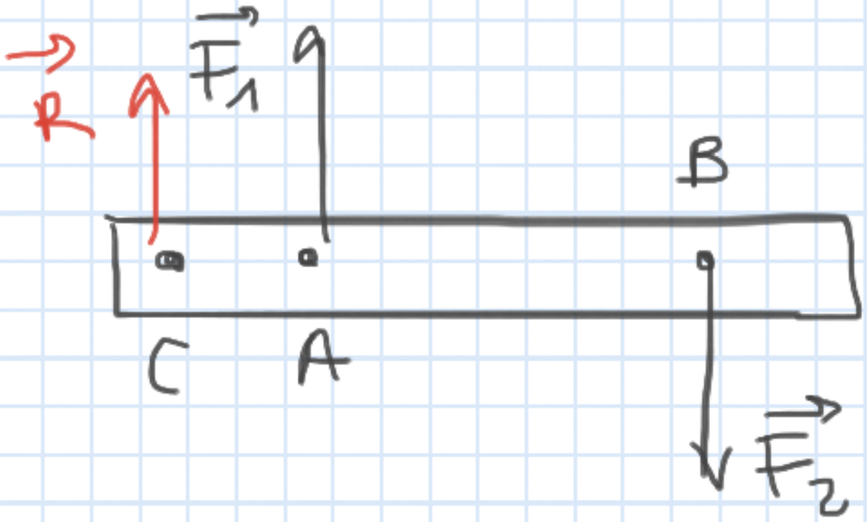
$= 0{,}227\,KN$

N15) $F_1 = 135\,N$

$F_2 = 92\,N$

$R = ?$ $\qquad AB = 0{,}79\,m$

$\overline{AC} = ?$



$$R = F_1 - F_2 = 135\,N - 92\,N = 43\,N$$

$$AC : CB = F_B : F_A$$

$$AC : (AC + AB) = F_B : F_A$$

$$\overline{AC} + \overline{AB} = \overline{AC} \cdot \frac{F_A}{F_B} \qquad \overline{AC}\left(1 - \frac{F_A}{F_B}\right) = -\overline{AB}$$

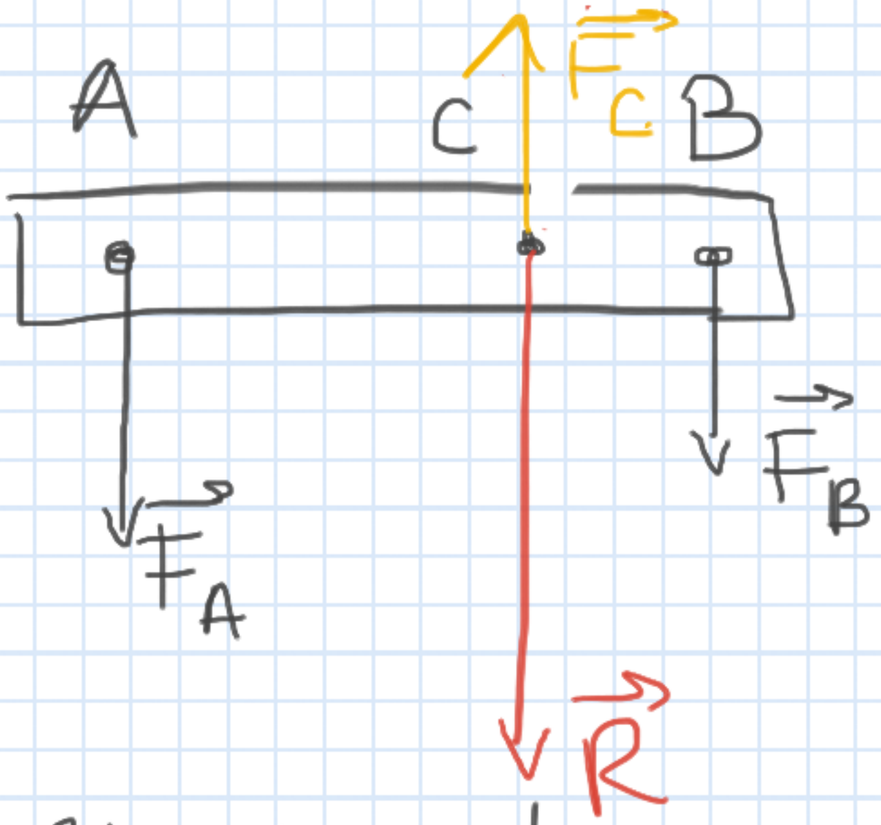
$$\overline{AC} = \frac{-\overline{AB}}{\left(1 - \frac{F_A}{F_B}\right)} = \frac{-0{,}79\,m}{\left(1 - \frac{135\,N}{92\,N}\right)} = 1{,}69\,m$$

N16

$F_A = 4{,}2\,N$

$AC = 3\,cm$

$CB = 1\,cm$



$AC : CB = F_B : F_A$

$F_B = \dfrac{AC \cdot F_A}{CB} = \dfrac{3\,\cancel{cm}}{1\,\cancel{cm}} \cdot 4{,}2\,N = 12{,}6\,N$

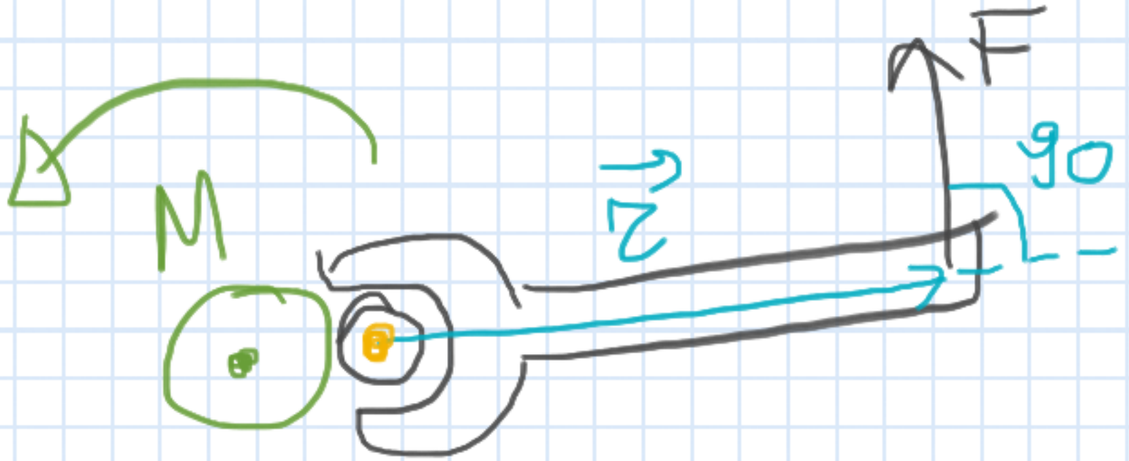
$F_C = R = F_A + F_B = F_A + F_A\left(\dfrac{AC}{CB}\right) = F_A\left(1 + \dfrac{AC}{CB}\right)$

$= 4{,}2\,N + 12{,}6\,N = 16{,}8\,N$

N17)

$M = 15\ N \cdot m$

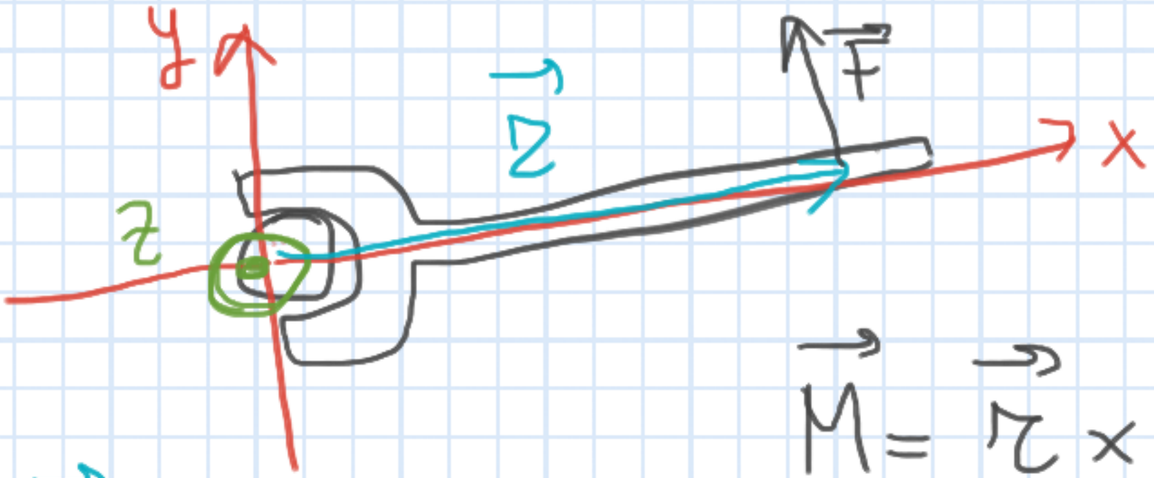
$r = l = 25\ cm = 0{,}25\ m$



$$\vec{M} = \vec{r} \times \vec{F}$$

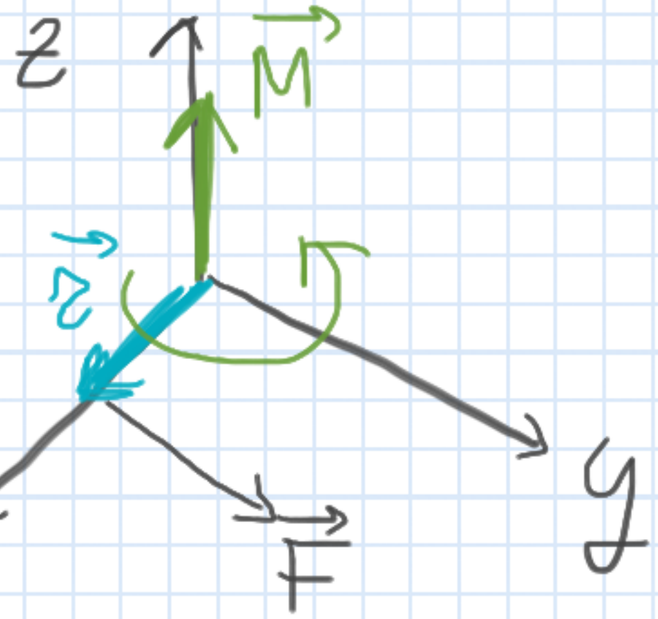
$$M = r F \operatorname{sen}(90) \rightarrow F = \frac{M}{r} = \frac{15\ N \cdot m}{0{,}25\ m} = 60\ N$$

($\operatorname{sen}(90) = 1$)



$$\vec{r} = (r, 0, 0)$$

$$\vec{F} = (0, F, 0)$$



$$\vec{M} = \vec{r} \times \vec{F} =$$

$$= \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ r & 0 & 0 \\ 0 & F & 0 \end{vmatrix} =$$

$$= \vec{i}(0) - \vec{j}(0) + \vec{k}(rF)$$

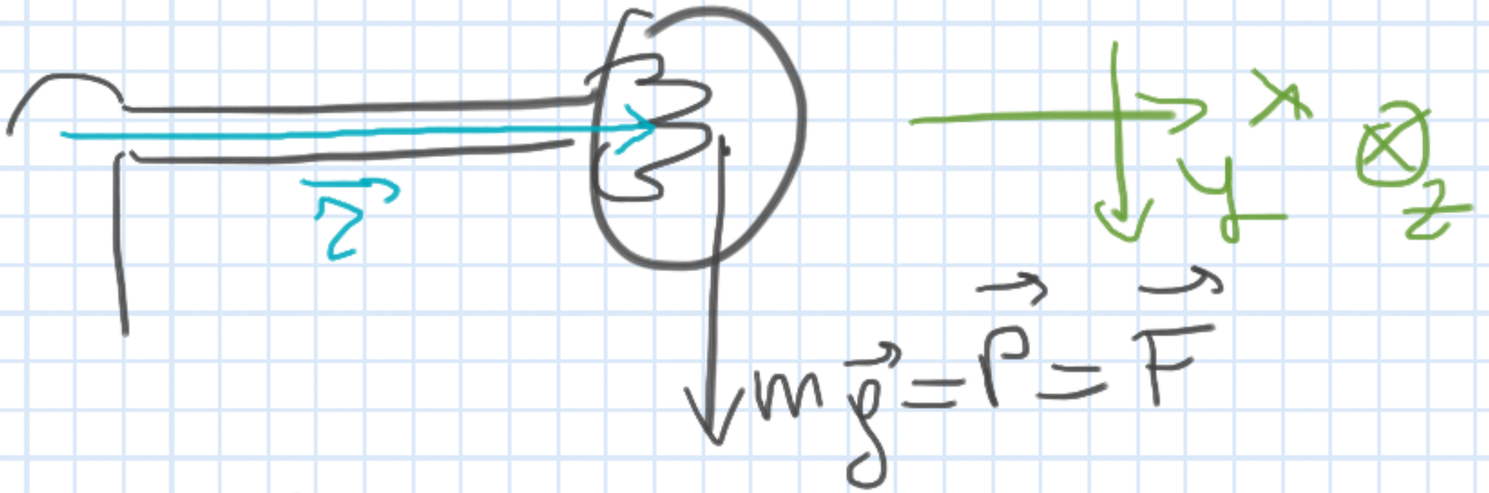
$$= (rF)\,\vec{k}$$

$$\vec{M} = (0, 0, rF)$$

N18

$m = 8\ kg$

$r = d = 0,55\ m$



$$M = mg \cdot d \cdot \cancel{\operatorname{sen}(90)}$$

$$= 8\ kg \cdot 9,81\ \frac{m}{s^2} \cdot 0,55\ m =$$

$$= 43,16\ N \cdot m$$