Contrôle périodique 1

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155/200

Q1 : 34/50
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Nom fichier -10

Question 1

A. Vrai car la somme des forces ne va pas être 0, selon la deuxième loi de newton $\Sigma \vec{F} = m\vec{a}$, mais si l'accélération est nulle alors on peut dire que c'est en équilibre statique

0/1

B. 1. $\sum F_y = 0$

$0 = N - mg\cos\theta$

$N = mg\cos\theta$

$\sum F_x = 0$

$0 = mg\sin\theta - F_s$

$f_s = mg\sin\theta$

angle max de θ bloc immobile

$U_s N = mg\sin\theta$

$N = mg\cos\theta$

$U_s\, mg\cos\theta = mg\sin\theta$

$U_s = \frac{\sin\theta}{\cos\theta}$

$U_s = \tan\theta$

$\boxed{\theta = \arctan(U_s)}$

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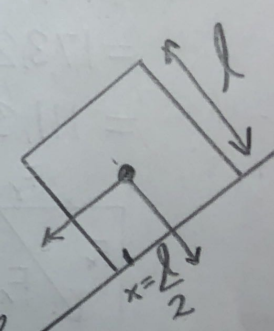
2. $x = \frac{mg_x}{N} h$



$\frac{l}{2} = \frac{mg\sin\theta}{mg\cos\theta} \frac{l}{2}$

$\tan\theta = 1$

$\theta = \arctan(1)$

$\boxed{\theta = 45°}$

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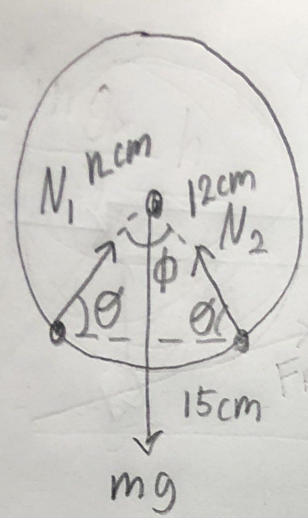
C.



loi cosinus

$$15^2 = 12^2 + 12^2 - 2(12 \cdot 12)\cos\theta$$

$$\theta = 77.36°$$

$$\phi = \cancel{180 - 77.36 - 77.36}$$

$$\phi = \cancel{25.28°}$$

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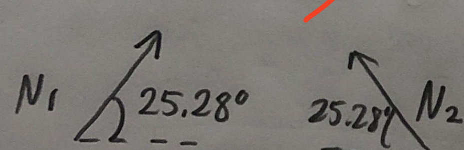
$$0 = N_1 \sin\phi + N_2 \sin\phi - mg$$

$$N_1 \sin(25.28°) + N_2 \sin(25.28°) = 14.72$$

Symétrie des 2 forces

$$2N_1 \sin(25.28°) = 14.72$$

$$N_1 = \cancel{17.23\ N}$$



Question 2 46/50

A. $F_z = F\cos\alpha$

$= 200\cos(60°)$

$= 100\,N$

Projection de F sur plan xy

$F_{xy} = F\sin(\alpha)$

$= 200\sin(60°)$

$= 173.21\,N$

Projection de F_{xy} sur l'axe x et l'axe y

$F_x = F_{xy}\sin(\theta)$

$= 173.21\sin(40°)$

$= 111.34\,N$

$F_y = -F_{xy}\cos(\theta)$

$= -173.21\cos(40°)$

$= -132.69\,N$

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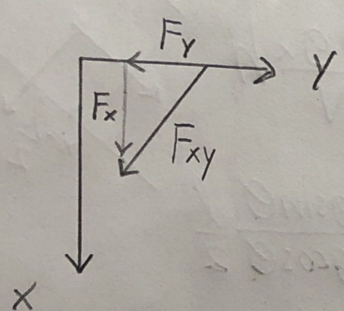
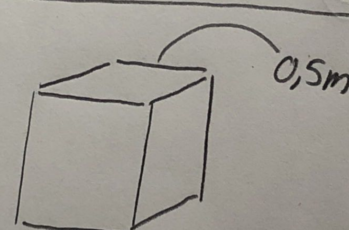


$$\boxed{\vec{F} = (111.34\vec{i} - 132.69\vec{j} + 100\vec{k})\,N}$$



B. $\Sigma M_O = \vec{r}_{OA} \times \vec{F} + \vec{r}_{OB} \times \vec{P}$

$\vec{r}_{OA} = (0\vec{i} + 0.25\vec{j} + 0.5\vec{k})\,m$

$\vec{r}_{OB} = (0.5\vec{i} + 0.25\vec{j} + 0.25\vec{k})\,m$

$$\vec{r}_{OA} \times \vec{F} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0 & 0.25 & 0.5 \\ 111.34 & -132.69 & 100 \end{vmatrix}$$

$$\vec{r}_{OB} \times \vec{P} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 0.5 & 0.25 & 0.25 \\ 0 & 100 & 0 \end{vmatrix}$$

$$= \vec{i}\begin{vmatrix} 0.25 & 0.5 \\ -132.69 & 100 \end{vmatrix} - \vec{j}\begin{vmatrix} 0 & 0.5 \\ 111.34 & 100 \end{vmatrix} + \vec{k}\begin{vmatrix} 0 & 0.25 \\ 111.34 & -132.69 \end{vmatrix}$$

$$= (91.345\vec{i} + 55.67\vec{j} - 27.835\vec{k})\,Nm$$

$$= \vec{i}\begin{vmatrix} 0.25 & 0.25 \\ 100 & 0 \end{vmatrix} - \vec{j}\,\cancel{\begin{vmatrix} 0.5 & 0.25 \\ 0 & 0 \end{vmatrix}}^{\,0} + \vec{k}\begin{vmatrix} 0.5 & 0.25 \\ 0 & 100 \end{vmatrix}$$

$$= (-25\vec{i} + 50\vec{k})\,Nm$$

$$\boxed{\Sigma M_O = (66.35\vec{i} + 55.67\vec{j} + 22.165\vec{k})\,Nm}$$

$\vec{R} = \vec{F} + \vec{P}$ $\boxed{\vec{R} = (111.34\vec{i} - 32.69\vec{j} + 100\vec{k})N}$ 3CS 18/20

e système force-couple équivalent au point O est $\vec{R} = (111.34\vec{i} - 32.69\vec{j} + 100\vec{k})N$ et $\Sigma M_0 = (66.35\vec{i} + 55.67\vec{j} + 22.165\vec{k})$ Nm

C. $\vec{OC} = (0.5\vec{i} + 0.5\vec{j} + 0.5\vec{k})m$

$\hat{U}_{\vec{oc}} = \dfrac{(0.5\vec{i} + 0.5\vec{j} + 0.5\vec{k})}{\sqrt{0.75}}$ $\hat{U}_{\vec{oc}} = (0.577\vec{i} + 0.577\vec{j} + 0.577\vec{k})$

Projection de ΣM_0 sur $\vec{oc}$

$\dfrac{(\Sigma \vec{M}_0 \cdot \hat{U}_{\vec{oc}})\,\hat{U}_{\vec{oc}}}{\cancel{\|\hat{U}_{\vec{oc}}\|}_{1}} = 83.195(0.577\vec{i} + 0.577\vec{j} + 0.577\vec{k})$ Nm

$\boxed{\vec{M}_{oc} = (48\vec{i} + 48\vec{j} + 48\vec{k})Nm}$ 3CS

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stion 4

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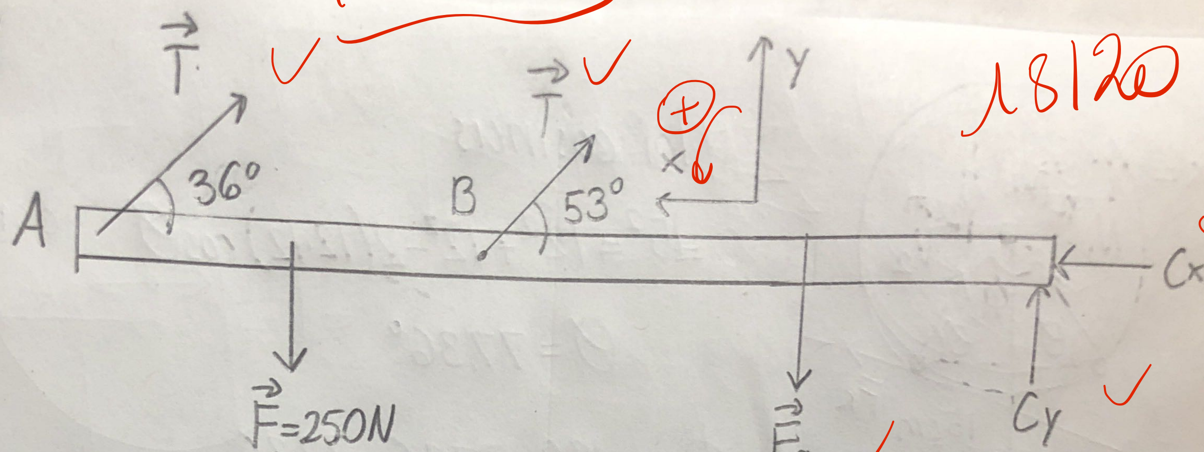
Question 3



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$\tan\theta = \frac{4}{5.5}$

$\theta = 36°$

$\tan\phi = \frac{4}{3}$

$\phi = 53°$

$\Sigma F_x = 0$

$0 = C_x - T\cos(36°) - T\cos(53°)$

$C_x = T(\cos(36°) + \cos(53°))$

$T = \frac{C_x}{\cos(36°)+\cos(53°)}$

$\Sigma F_y = 0$

$0 = T\sin(36°) + T\sin(53°) + C_y - mg - 250$

$T = \frac{250 + mg - C_y}{\sin(36°)+\sin(53°)}$

$\Sigma M_c = 0$

$0 = 4 \cdot 250 + 0.8mg - (5.5T\sin(36°)) - (3T\sin(53°))$

$5.5T\sin(36°) + 3T\sin(53°) = 1000 + 0.8mg$

$T = \frac{1000 + 0.8mg}{5.5\sin(36°) + 3\sin(53°)}$

$T = 289\ N$

$$\frac{C_x}{\cos(36°)+\cos(53°)} = 289$$

$$\frac{250+mg-C_y}{\sin(36°)+\sin(53°)} = 289$$

$$C_x = 289(\cos(36°)+\cos(53°))$$

$$C_x = 407.\cancel{73}\,N \longleftarrow$$ ✓

$$C_y = 634.\cancel{12}\,N$$

3 chiffres significatifs

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$$\vec{C} = (407.73\vec{i} + 634.12\vec{j})N$$

$$\|\vec{C}\| = \sqrt{(407.73)^2+(634.12)^2}$$

$$= 753.89\,N$$

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$$\hat{u}_c = \frac{(407.73\vec{i} + 634.12\vec{j})}{753.89} = (0.54\vec{i}+0.84\vec{j})$$

Ça ne va pas supporter car la norme de $\vec{C}$ est plus grand que 700N. ✓

Question 4

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$$\vec{OA} = (0.24\vec{i} + 0.24\vec{j} - 0.12\vec{k})$$

$$\vec{OP} = \frac{2}{3}\vec{OA}$$

$$= \frac{2}{3}(0.24\vec{i} + 0.24\vec{j} - 0.12\vec{k})$$

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$$\vec{OP} = (0.16\vec{i} + 0.16\vec{j} - 0.08\vec{k})$$

$$\vec{OP} = (P_x - 0, P_y - 0, P_z - 0)$$

$$\boxed{P = (0.16\vec{i} + 0.16\vec{j} - 0.08\vec{k})}$$ m −2

notation vecteur, pas coordonnées −1

b) $$\vec{PC} = ((0.18-0.16)\vec{i} + (0.24-0.16)\vec{j} + (0.24+0.08)\vec{k})$$

$$\vec{PC} = (0.02\vec{i} + 0.08\vec{j} + 0.32\vec{k})$$

$$\hat{u}_{\vec{PC}} = \frac{(0.02\vec{i} + 0.08\vec{j} + 0.32\vec{k})}{0.33} = (0.06\vec{i} + 0.24\vec{j} + 0.97\vec{k})$$

longueur

$$T = k(L - L_0)$$

$$= 200(0.33 - 0.2)$$

$$\boxed{T = 26\text{ N}}$$ norme

ok

$$\vec{T} = T \cdot \hat{u}_{\vec{PC}}$$

$$\boxed{\vec{T} = (1.56\vec{i} + 6.24\vec{j} + 25.22\vec{k})\text{ N}}$$

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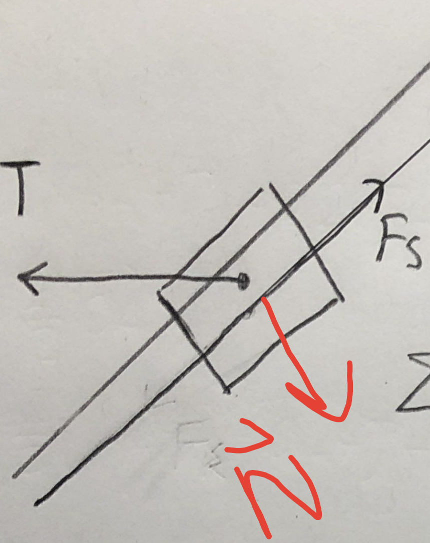

équilibre statique car immobile

$\sum F_x = 0 \quad \sum F_y = 0 \quad \sum F_z = 0 \quad \sum M = 0$

$\sum F_x = \vec{T}_x + \vec{F}_{sx} \qquad \sum F_y = \vec{T}_y + \vec{F}_{sy}$

$T_x = F_{sx} \qquad \vec{T}_y = \vec{F}_{sy}$

$\sum F_z = \vec{T}_z + \vec{F}_{sz}$

$\vec{T}$ et $\vec{F}$ pas //

pas le temps de calculer comment $\sum \vec{F} = 0$?

mais si c'est immobile $\vec{F}_s$ a la même norme avec sens opposé de $\vec{T}$ pour annuler les forces

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