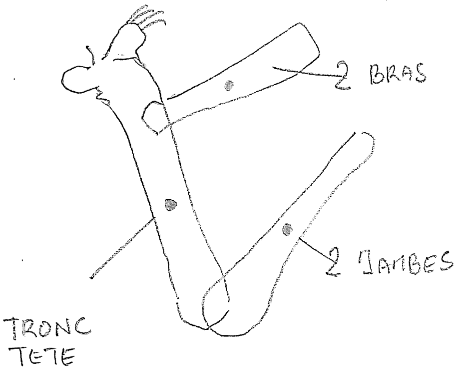
45



$\boxed{60\,kg}$

2 JAMBES	32%
2 BRAS	10%
LE RESTE	100% − 42% = 58%

$$\overbrace{\begin{bmatrix}x\\y\end{bmatrix}}^{\text{CENTRE DE MASSE}} = \overbrace{\begin{bmatrix}0{,}3\\0{,}32\end{bmatrix}}^{\vec{x}_1}\overbrace{0{,}32}^{\frac{m_1}{m}} + \overbrace{\begin{bmatrix}0{,}21\\0{,}53\end{bmatrix}}^{\vec{x}_2}\overbrace{0{,}1}^{\frac{m_2}{m}} + \overbrace{\begin{bmatrix}0{,}08\\0{,}27\end{bmatrix}}^{\vec{x}_3}\overbrace{0{,}58}^{\frac{m_3}{m}}$$

$$\boxed{\vec{x} = \sum \frac{m_i}{m}\vec{x}_i}$$

$$\begin{bmatrix}0{,}16\\0{,}31\end{bmatrix}$$

LE CENTRE DE MASSE NE DEPEND PAS DE m !
MAIS UNIQUEMENT DES RAPPORTS ENTRE LES PARTIES DU CORPS

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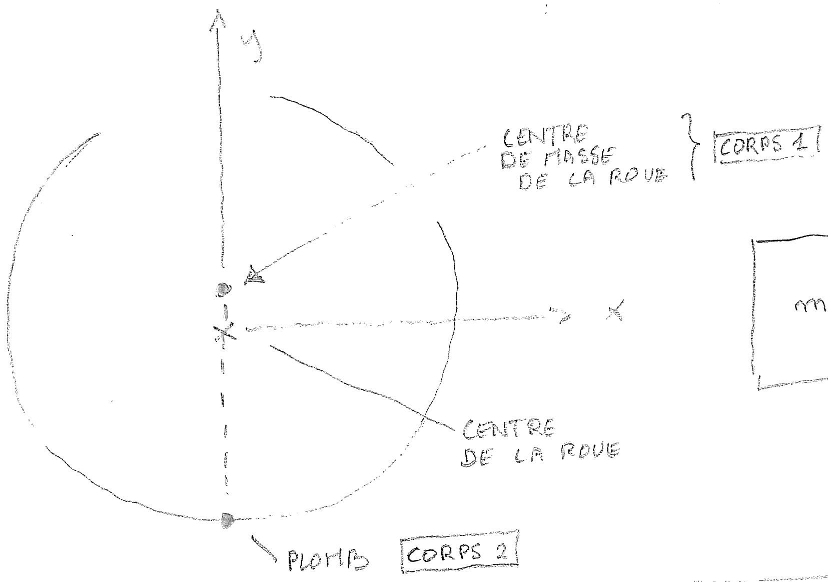
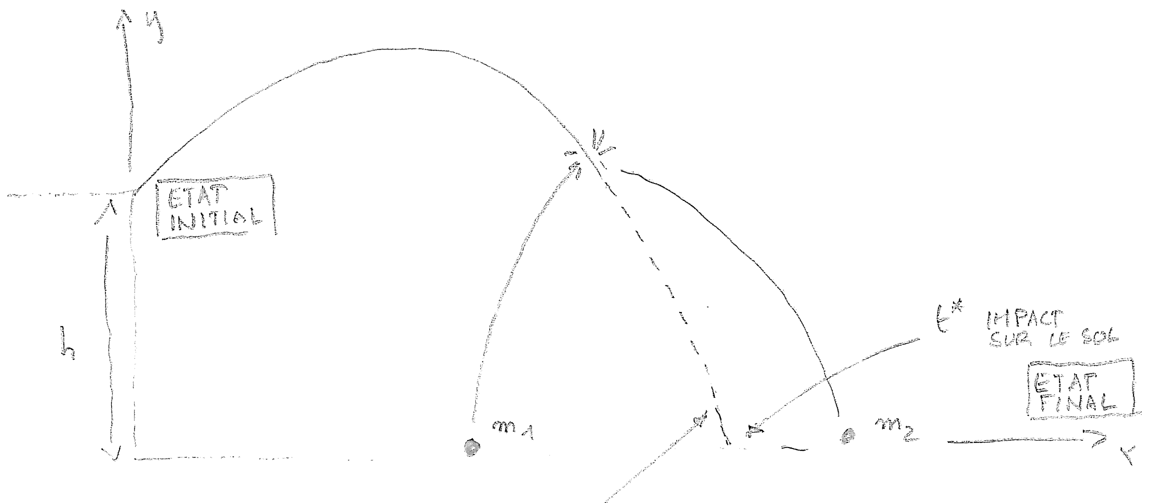


$0{,}033\ kg = 33\ gr.$

$$\boxed{m_2 = 20\,\frac{0{,}0003}{0{,}18}}$$

$$m\begin{bmatrix}0\\0\end{bmatrix} = 20\begin{bmatrix}0\\0{,}0003\end{bmatrix} + m_2\overbrace{\begin{bmatrix}0\\-0{,}18\end{bmatrix}}^{\vec{x}_2}$$

ON VEUT QUE LE CENTRE DE MASSE DE LA ROUE EQUILIBREE SE TROUVE AU CENTRE GEOMETRIQUE



TRAJECTOIRE CENTRE DE MASSE = MRUA

$$\begin{bmatrix} x(t) \\ y(t) \end{bmatrix} = \begin{bmatrix} 0 + v_0 \cos\theta\, t \\ h + v_0 \sin\theta\, t - g t^2/2 \end{bmatrix}$$

ETAPE 1
CALCUL DE t^*

$$0 = h + v_0 \sin\theta\, t^* - g(t^*)^2/2$$

$$0 = g(t^*)^2 - 2 v_0 \sin\theta\, t^* - 2h$$

$$t^* = \frac{2 v_0 \sin\theta \pm \sqrt{4 v_0^2 \sin\theta^2 + 8gh}}{2g}$$

$t^* = $ 10,15 sec ; $\cancel{-2,0\text{ sec}}$

ETAPE 2

$$\underbrace{x(t^*)}_{\text{POSITION CENTRE DE MASSE}} = \underbrace{v_0 \cos\theta\, t^*}_{305{,}4\ \text{m}}$$

$$m x = m_1 x_1 + m_2 x_2$$

$m = 6$, $x = 305$, $m_1 = 4$, $x_1 = 200$, $m_2 = 2$

$$x_2 = \frac{6 \times 305 - 4 \times 200}{2}$$

$$x_2 = 515\ \text{m}.$$

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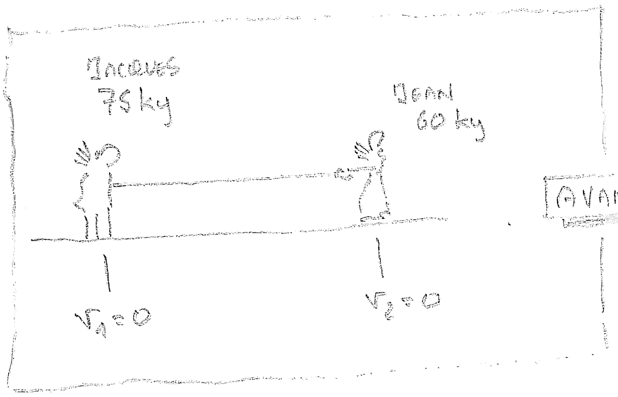
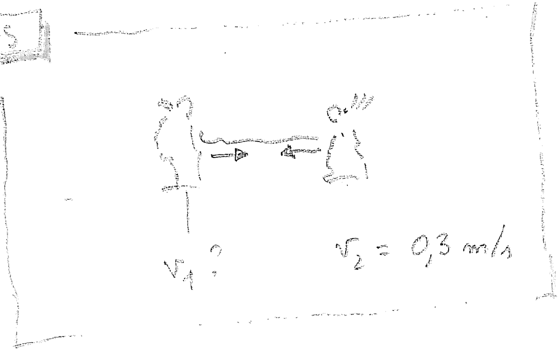


AVANT

PAS DE FORCES EXTERNES AU SYSTEME JEAN + JACQUES

APRES



$$\Delta[m\vec{v}] = 0$$

$$= m_1\vec{v_1} + m_2\vec{v_2}$$

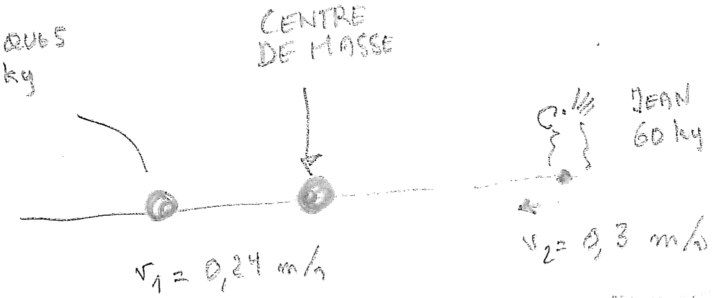
CONSERVATION QUANTITE DE MOUVEMENT

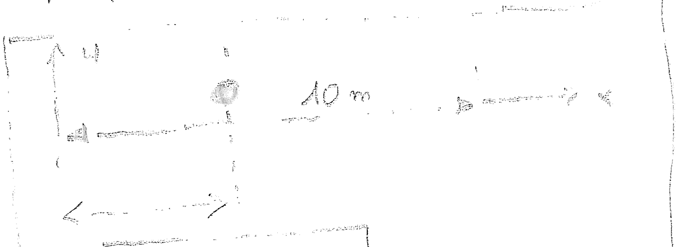
$$0 = m_1 v_1 - m_2\, 0,3$$

$$v_1 = \underbrace{\frac{60}{75}\, 0,3}_{0,24 \text{ m/s}}$$

ILS SE RENCONTRENT AU CENTRE MASSE

.... LE PLUS LEGER VA PLUS VITE !





$$\boxed{\frac{60}{135}\, 10 = 4,4 \text{ m}}$$

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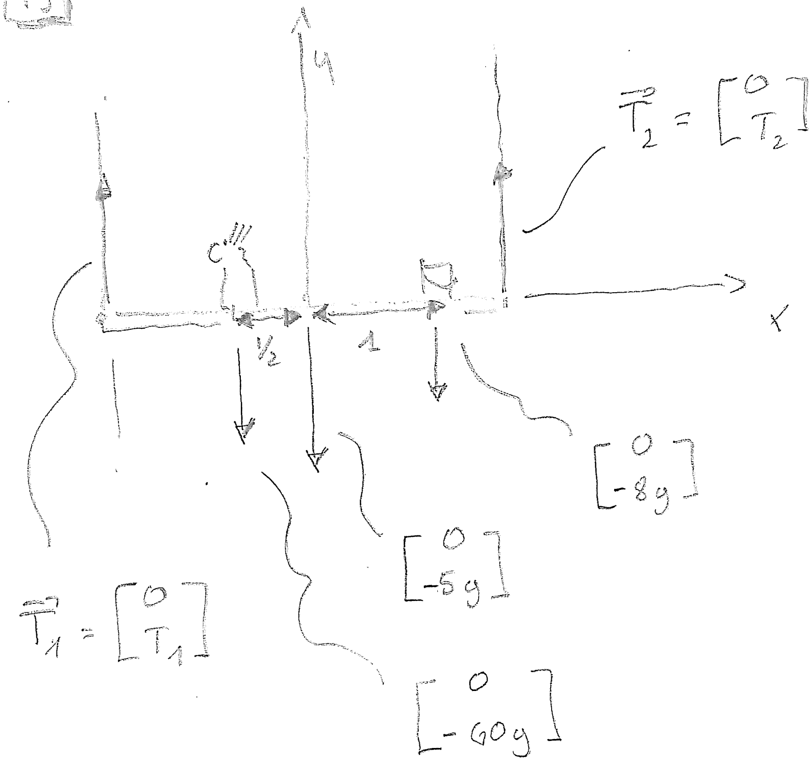
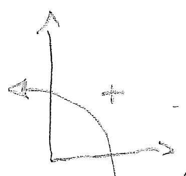
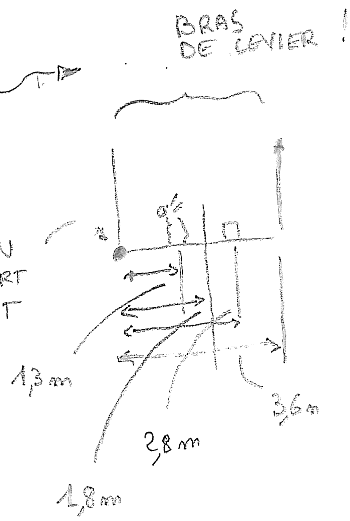


2 INCONNUES
T_1 T_2
2 EQUATIONS D'EQUILIBRE NON TRIVIALES

- $\boxed{\sum \vec{F} = 0} \longrightarrow \boxed{T_1 + T_2 = 73g}$ (1)
- $\boxed{\sum M = 0}$



EQUILIBRE DE ROTATION PAR RAPPORT A CE POINT



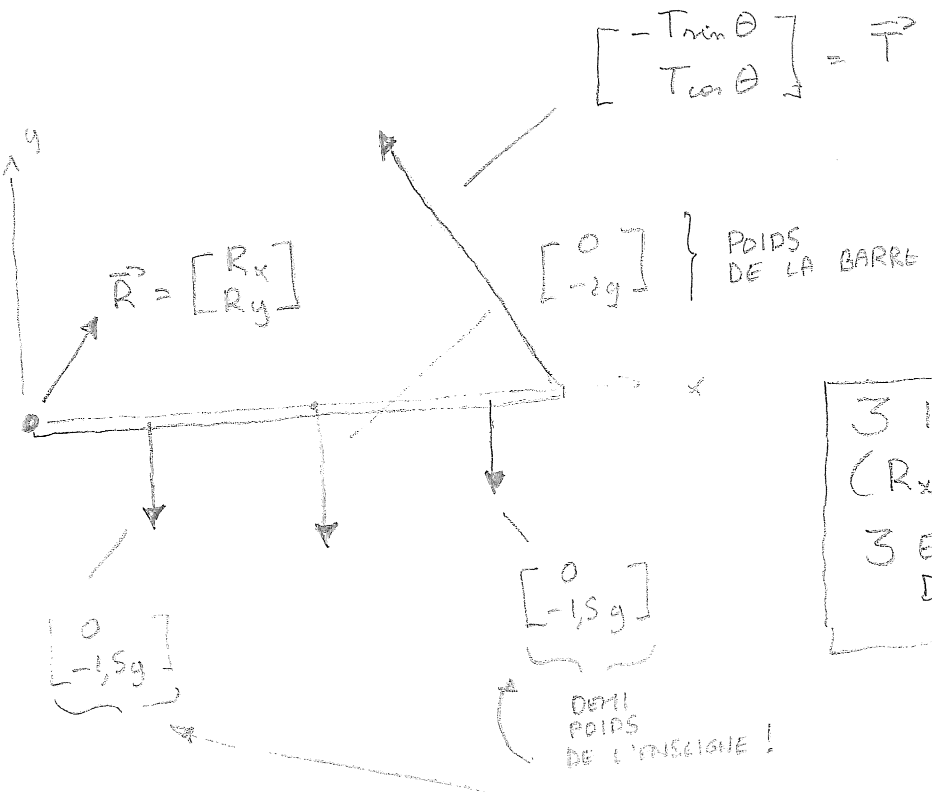
$$T_2 \, 3{,}6 = -60g \times 1{,}3 - 5g \times 1{,}8 - 8g \times 2{,}8$$

$$\boxed{T_2 = 298 \text{ N}}$$

$$\boxed{T_1 = \underbrace{73 * 9{,}81 - 298}_{418 \text{ N}}}$$

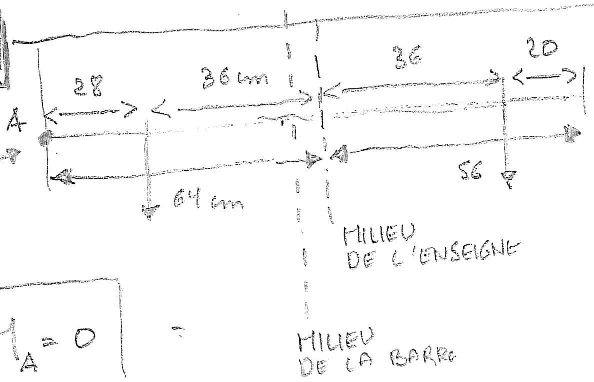
C'EST UNE BONNE IDEE DE CHOISIR UN POINT D'APPLICATION D'UNE FORCE INCONNUE !

$\boxed{50}$



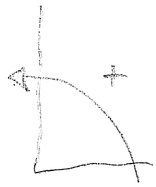
$\boxed{\text{3 INCONNUES } (R_x, R_y, T) \quad \text{3 EQUATIONS D'EQUILIBRE}}$

$\boxed{\text{EQUILIBRE ROTATION}}$



$\boxed{\sum M_A = 0}$

SOMME DES MOMENTS PAR RAPPORT A A



$$\underbrace{-0{,}6 * 2g - 0{,}28 * 1{,}5g - 1{,}00 * 1{,}5g}_{\underbrace{(-1{,}2 - 0{,}42 - 1{,}5)}_{-3{,}12}} + 1{,}2\, T\cos(\theta) = 0$$

$$\boxed{T = \frac{3{,}12\, g}{1{,}2\cos(60)} = \frac{6{,}24}{1{,}2}\, g = 51\ N}$$

$$\boxed{\begin{aligned} R_x &= T\sin\theta = 44{,}2\,N \\ R_y &= 5g - T\cos\theta = 23{,}5\,N \end{aligned}}$$

$\boxed{R = 50{,}6\,N}$

$\boxed{\text{EQUILIBRE TRANSLATION}}$

$\boxed{\sum \vec{F} = 0}$