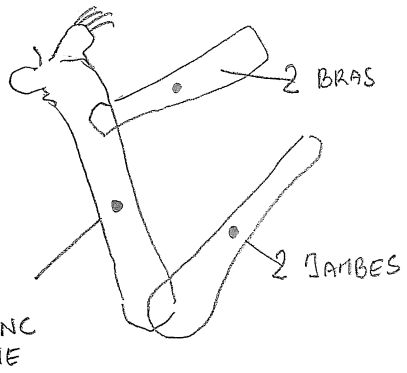
45



60 kg

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

CENTRE DE MASSE

$$\begin{bmatrix} x \\ y \end{bmatrix} = \underbrace{\begin{bmatrix} 0,3 \\ 0,32 \end{bmatrix}}_{\vec{x}_1} \underbrace{0,32}_{\frac{m_1}{m}} + \underbrace{\begin{bmatrix} 0,21 \\ 0,53 \end{bmatrix}}_{\vec{x}_2} \underbrace{0,1}_{\frac{m_2}{m}} + \underbrace{\begin{bmatrix} 0,08 \\ 0,27 \end{bmatrix}}_{\vec{x}_3} \underbrace{0,58}_{\frac{m_3}{m}}$$

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

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

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

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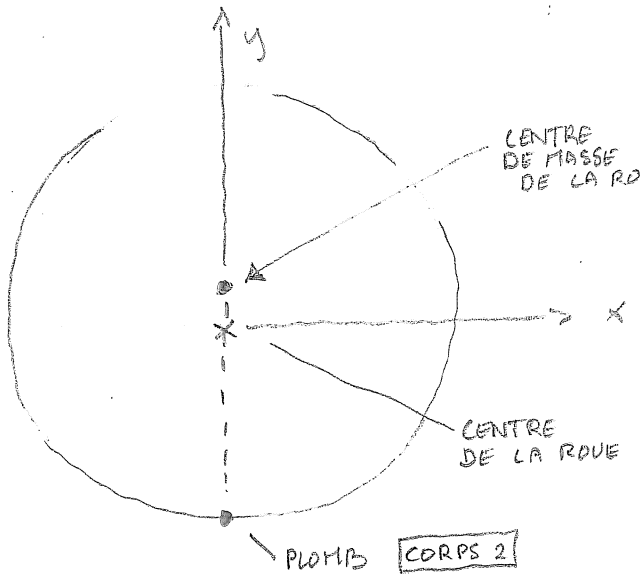

CORPS 1

CORPS 2

0,033 kg = 33 gr.

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

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

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

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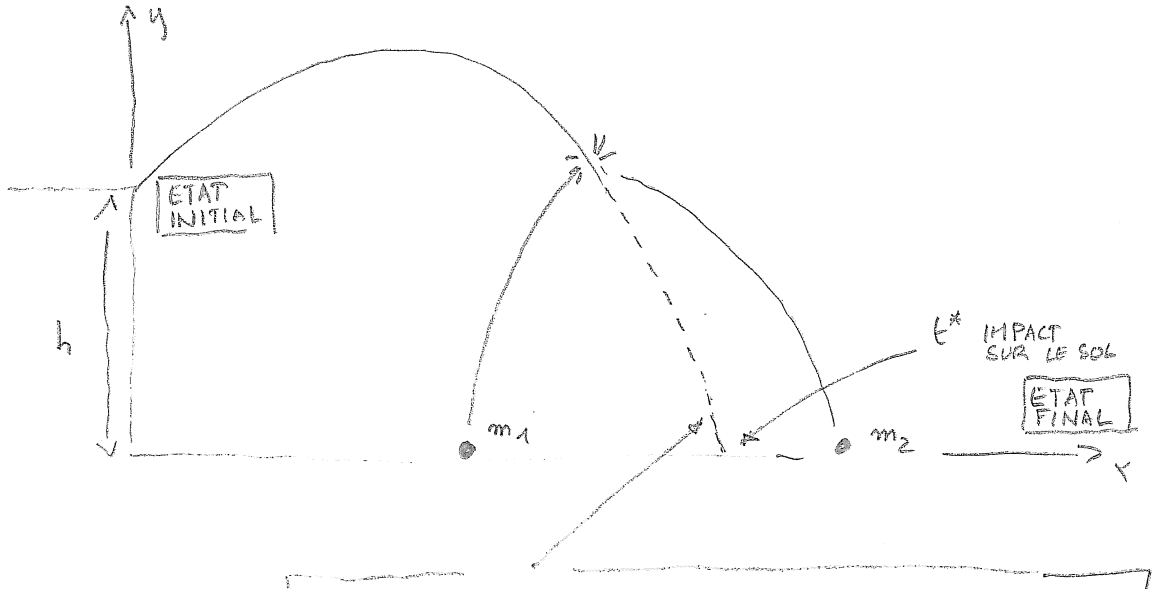

TRAJECTOIRE CENTRE DE MASSE = MRUA

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

ETAPE 1
CALCUL DE t^*

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

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

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

$t^* = 10{,}15$ seg

$t^* = -2{,}01$ seg (no)

ETAPE 2

$x(t^*) = v_0 \cos\theta\, t^*$

$x(t^*)$: POSICIÓN CENTRE DE MASSE

$= 305{,}4$ 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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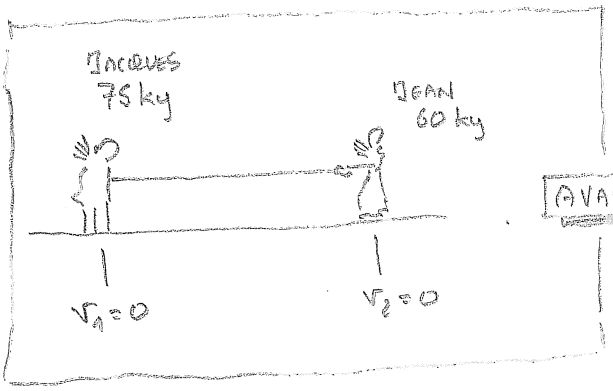
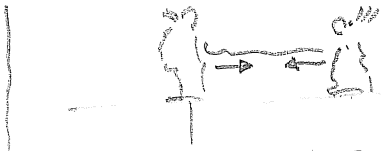


AVANT

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

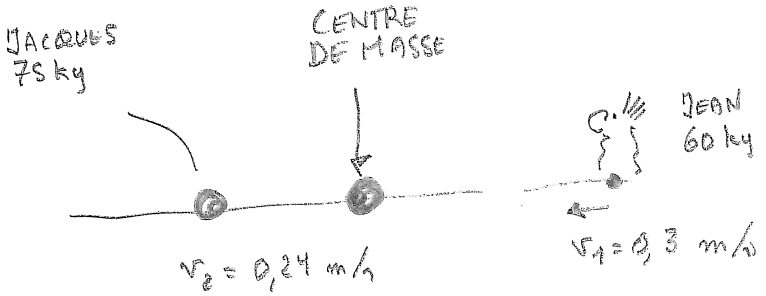
$$0 = m_1 v_1 - m_2\ 0,3$$

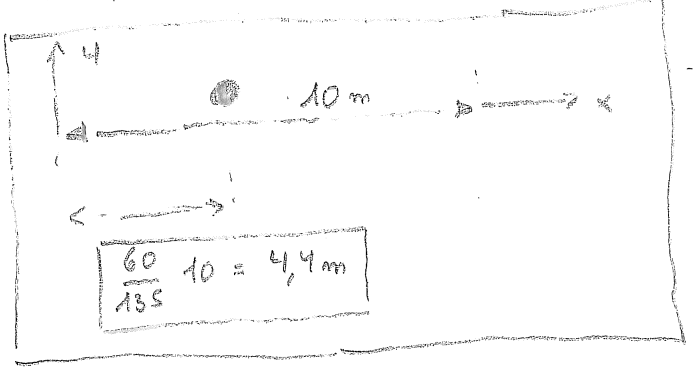
$$v_1 = \frac{60}{75}\ 0,3$$

$$0,24 \text{ m/s}$$

ILS SE RENCONTRENT AU CENTRE MASSE

.... LE PLUS LEGER VA PLUS VITE !





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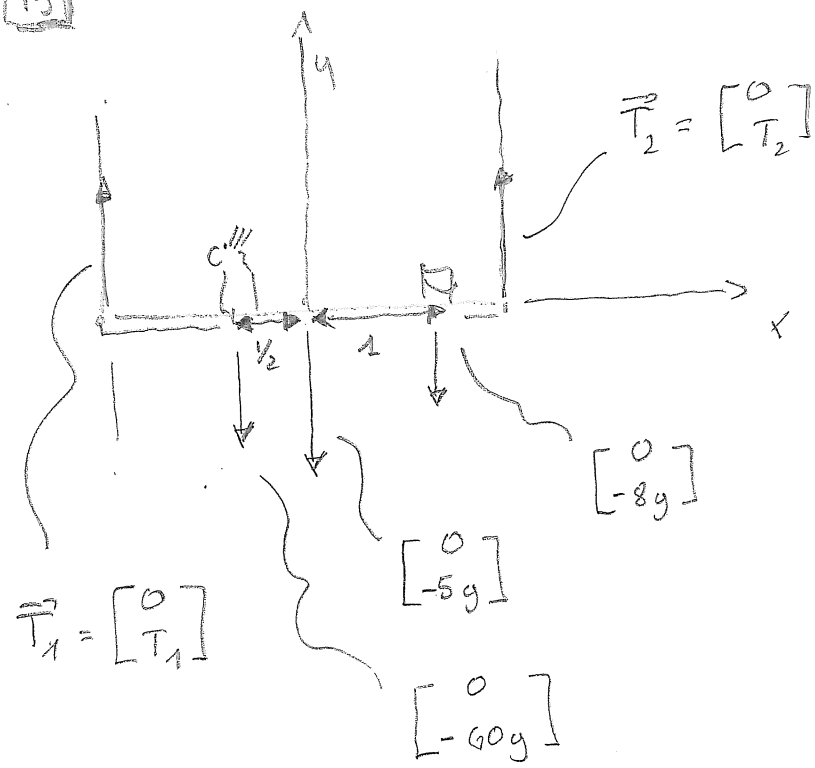
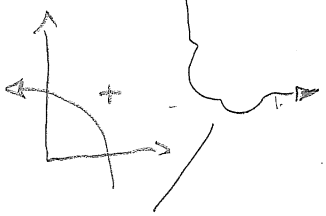


2 INCONNUES
T_1 T_2

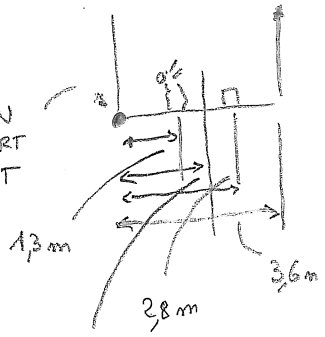
2 EQUATIONS D'EQUILIBRE NON TRIVIALES

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



BRAS DE LEVIER !

EQUILIBRE DE ROTATION PAR RAPPORT A CE POINT



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

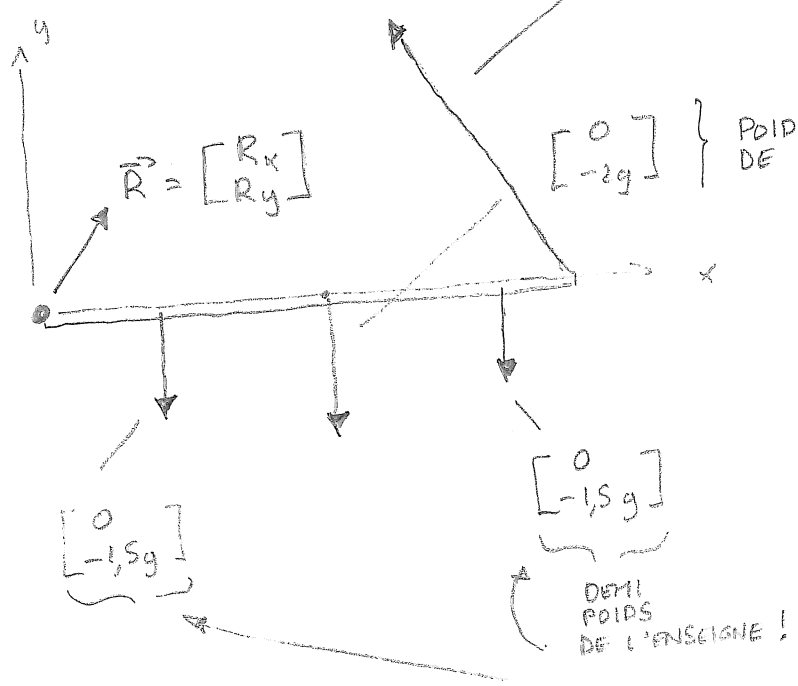
$T_2\ 3,6 = -60g \times 1,3 - 5g \times 1,8 - 8g \times 2,8$

$\boxed{T_2 = 298\ N}$

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

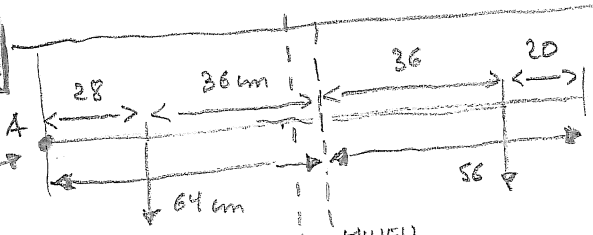
50

$$\begin{bmatrix} -T\sin\theta \\ T\cos\theta \end{bmatrix} = \vec{T}$$



3 INCONNUES
(R_x, R_y, T)
3 EQUATIONS D'EQUILIBRE

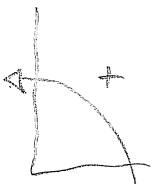
EQUILIBRE ROTATION



$\sum M_A = 0$: SOMME DES MOMENTS PAR RAPPORT A A

$$-0,6 * 2g - 0,28 * 1,5g - 1,00 * 1,5g + 1,2\, T\cos(\theta) = 0$$

$$(-1,2 - 0,42 - 1,5) = -3,12$$



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

EQUILIBRE TRANSLATION

$\sum \vec{F} = 0$

$$R_x = T\sin\theta = 44,2\ N$$

$$R_y = 5g - T\cos\theta = 23,5\ N$$