9

$$\vec{x}(t) = \begin{bmatrix} x(t) \\ y(t) \end{bmatrix} = \begin{bmatrix} 3t^2 - 2t \\ -t^3 \end{bmatrix}$$

$$\vec{v}(t) = \begin{bmatrix} x'(t) \\ y'(t) \end{bmatrix} = \begin{bmatrix} 6t - 2 \\ -3t^2 \end{bmatrix}$$

$$\vec{a}(t) = \begin{bmatrix} x''(t) \\ y''(t) \end{bmatrix} = \begin{bmatrix} 6 \\ -6t \end{bmatrix}$$

- $\vec{v}(2) = \begin{bmatrix} 12-2 \\ -12 \end{bmatrix} = \begin{bmatrix} 10 \\ -12 \end{bmatrix}$
- $\vec{a}(4) = \begin{bmatrix} 6 \\ -24 \end{bmatrix}$

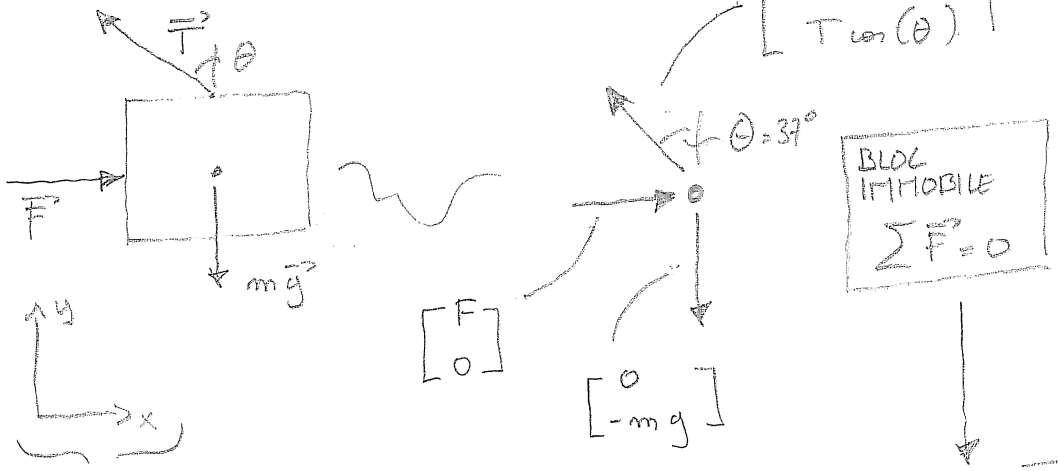
} EN REMPLAÇANT t PAR 2 ET 4 RESPECTIVEMENT

- $\vec{a}_M = \dfrac{\vec{v}(3) - \vec{v}(1)}{3-1} = \dfrac{1}{2}\left(\begin{bmatrix} 18-2 \\ -27 \end{bmatrix} - \begin{bmatrix} 4 \\ -3 \end{bmatrix}\right)$

$$= \frac{1}{2}\begin{bmatrix} 12 \\ -24 \end{bmatrix} = \begin{bmatrix} 6 \\ -12 \end{bmatrix}$$

⚠ NE PAS CONFONDRE ACCELERATION MOYENNE ET ACCELERATION INSTANTANEE

10



REPERE A INDIQUER OBLIGATOIREMENT !

$$\begin{bmatrix} 0 \\ 0 \end{bmatrix} = \begin{bmatrix} F \\ 0 \end{bmatrix} + \begin{bmatrix} 0 \\ -mg \end{bmatrix} + \begin{bmatrix} -T\sin\theta \\ T\cos\theta \end{bmatrix}$$

$$\begin{cases} F = T\sin\theta \\ mg = T\cos\theta \end{cases}$$

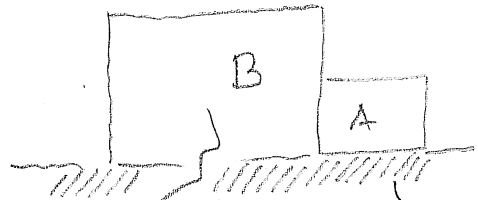
$$T = \frac{mg}{\cos\theta} \qquad F = \frac{mg\sin\theta}{\cos\theta}$$

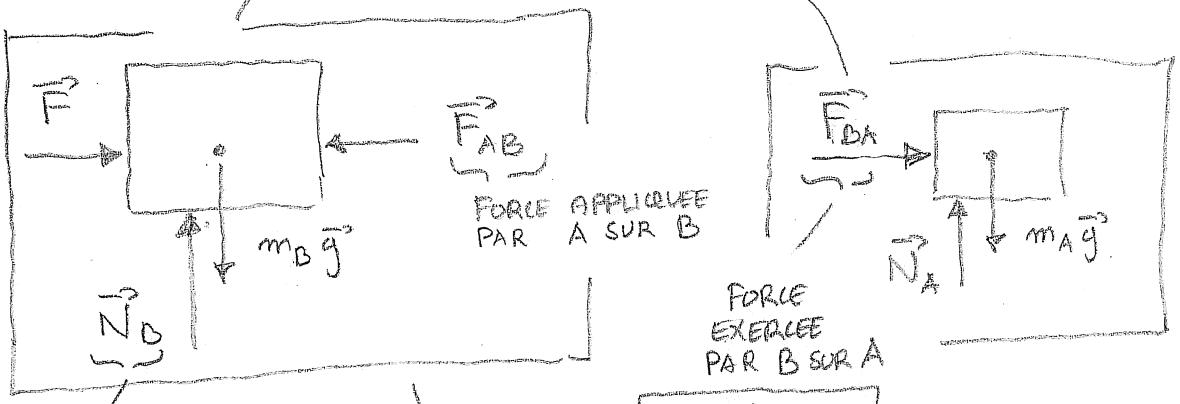
⚠ IL FAUT SUBSTITUER LES VALEURS NUMERIQUES UNIQUEMENT À LA FIN DU CALCUL !

VALEURS NUMERIQUES

$$T = \frac{20}{\cos(37°)} = 25\ [N] \qquad F = 25\sin(37°) = 15\ N$$

11



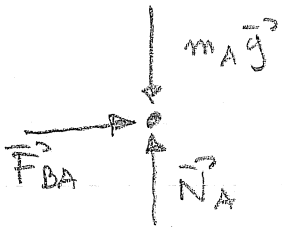


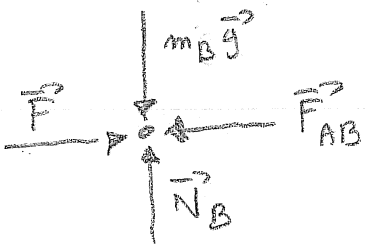
FORCE APPLIQUEE PAR A SUR B

FORCE EXERCEE PAR B SUR A

ACTION REACTION :-)

FORCE EXERCEE PAR LE SOL SUR B





1 $\sum \vec{F} = m\vec{a}$

POUR LES 2 BLOCS

COMPOSANTE HORIZONTALE

$F = (m_A + m_B)\, a_x$

$a_x = 20/5 = 4\ m/s^2$

2 $\sum \vec{F} = m\vec{a}$

POUR LE BLOC B

$F - F_{AB} = m_B a_x$

$a_x = \dfrac{F}{(m_B + m_A)}$

$F\left(1 - \dfrac{m_B}{(m_B+m_A)}\right) = F_{AB}$

$\dfrac{3}{5}$

$F_{AB} = \dfrac{2}{5}\, 20 = 8\ N$

3 $\sum \vec{F} = m_B\vec{a}$

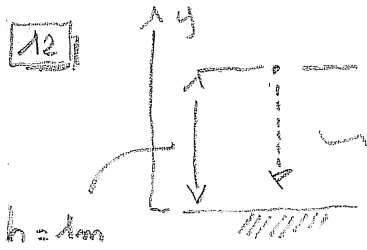
RESULTANTE DES FORCES

$= 3\begin{bmatrix}4\\0\end{bmatrix} = \begin{bmatrix}12\\0\end{bmatrix}$

1' $F\left(1 - \dfrac{m_A}{m_B+m_A}\right) = F_{AB}$

$F_{AB} = \dfrac{3}{5}\, 20 = 12\ N$:-)

12

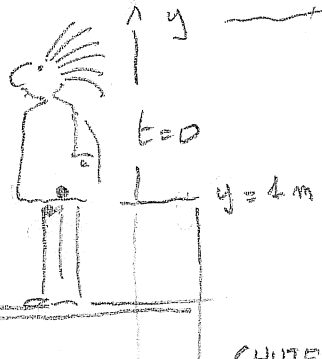


PARTIE 1

CINEMATIQUE

$y(t) = h - gt^2/2$

MOUVEMENT #1

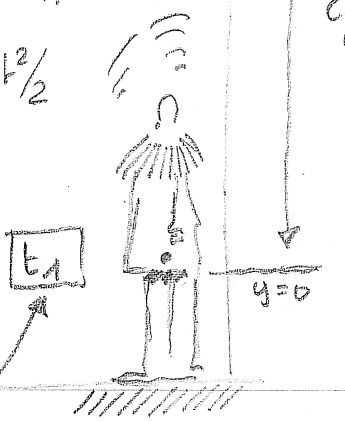


TEMPS CHUTE COMPLET $= t_1 + t_2$

CHUTE LIBRE DE $h = 1\,m$

$y(t) = h - gt^2/2$

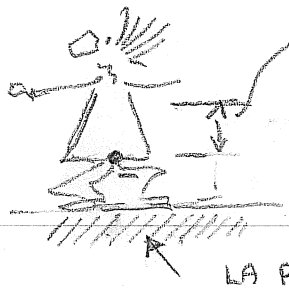
$t \in [0\ t_1]$



LES PIEDS TOUCHENT LE SOL

$$t_1 = \sqrt{\frac{2h}{g}}$$

$$v(t_1) = -g\sqrt{\frac{2h}{g}} = -\sqrt{2hg}$$



ON RALENTIT EN PLIANT LES GENOUX

LA PETITE FILLE EST IMMOBILE APRES AVOIR PLIE LES GENOUX

t_2

ELLE EFFECTUE UNE DECELERATION EN EFFECTUANT CE MOUVEMENT

ON SUPPOSE L'ACCELERATION CONSTANTE ICI : C'EST UN PEU ABUSIF !

IMMOBILE EN t_2

$$y'(t_2) = 0$$

$$-\sqrt{2hg} + a t_2 = 0$$

$$t_2 = \frac{\sqrt{2hg}}{a}$$

$t \in [0, t_2]$

$$y(t) = \underbrace{-\sqrt{2hg}}_{\text{VITESSE INITIALE = CELLE FIN CHUTE LIBRE}} t + a\,t^2/2$$

MOUVEMENT #2

$d = 0.3$ EN t_2

LORSQU'ON EST IMMOBILE

$$\underbrace{y(t_2)}_{-d} = -\frac{2hg}{a} + \frac{2hg}{2a} = -\frac{hg}{a}$$

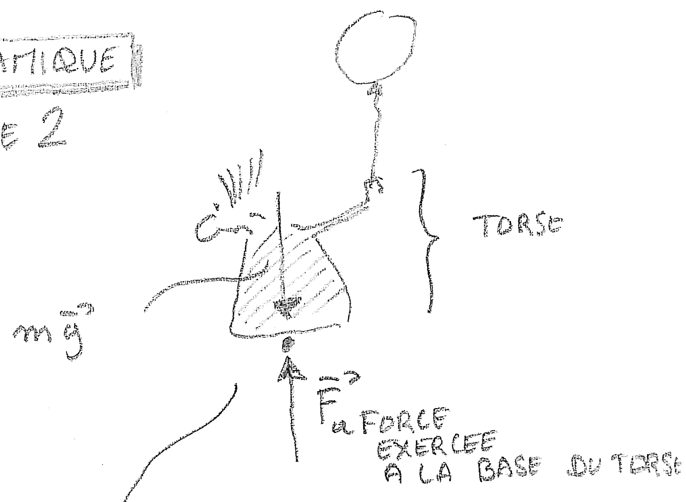
$$a = \frac{hg}{d}$$

[m] [m/s²] [m]

d PETIT ! a GRAND !! LOGIQUE IL FAUT PLIER LES GENOUX !

DYNAMIQUE

PARTIE 2



$$\sum \vec{F} = m\vec{a}$$

COMPOSANTE VERTICALE

$$-mg + F_a = m\,\frac{hg}{d}$$

$$F_a = m\left(\frac{d+h}{d}\right)g$$

(m = 40, g = 10)

$d = 0{,}3 \quad \frac{d+h}{d} = \frac{1{,}3}{0{,}3} = 4{,}33$

$d = 0{,}04 \quad \frac{d+h}{d} = \frac{1{,}04}{0{,}04} = 26$

$F_a = 1733$ [N] si $d = 30$ cm

$F_a = 10400$ [N] si $d = 4$ cm

CONCLUSION : IL FAUT PLIER LES GENOUX !!