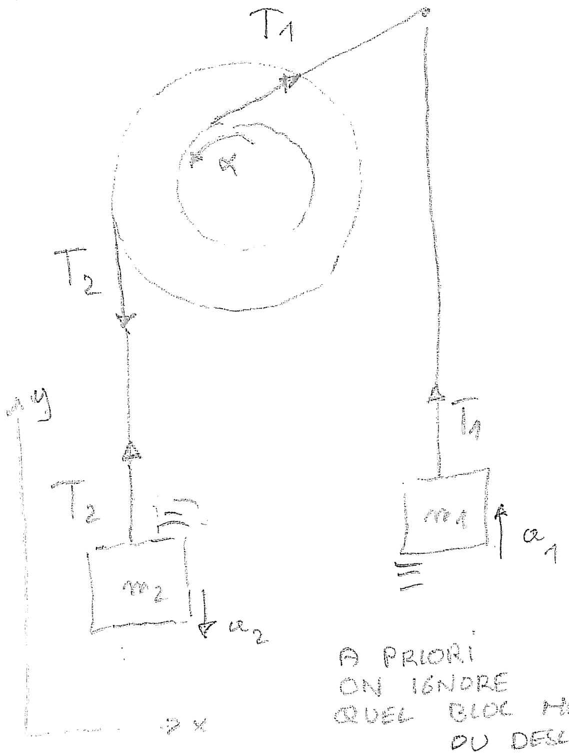
$\boxed{51}$



3 CORPS

$\boxed{I\alpha = \sum M}$

1 POULIE

$$I\alpha = R_2 T_2 - R_1 T_1 \quad (1)$$

2 BLOCS

$$m_2 a_2 = m_2 g - T_2 \quad (2)$$
$$m_1 a_1 = T_1 - m_1 g \quad (3)$$

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

A PRIORI
ON IGNORE
QUEL BLOC MONTE
OU DESCEND !

LE SIGNE FOURNIRA LA SOLUTION

CINEMATIQUE

$$(4) \quad \alpha R_1 = a_1$$
$$(5) \quad \alpha R_2 = a_2$$

5 INCONNUES $\alpha, a_1, a_2, T_1, T_2$

5 EQUATIONS

(5) DS (2) $\quad m_2 R_2 \alpha = m_2 g - T_2$

(4) DS (3) $\quad m_1 R_1 \alpha = T_1 - m_1 g$

$$T_2 = m_2 (g - R_2 \alpha)$$
$$T_1 = m_1 (g + R_1 \alpha)$$

EN INJECTANT
TOUT DANS (1) :

$$I\alpha = R_2 m_2 (g - R_2 \alpha) - R_1 m_1 (g + R_1 \alpha)$$
$$(I + m_1 R_1^2 + m_2 R_2^2)\alpha = (R_2 m_2 - R_1 m_1) g$$

$$\boxed{\alpha = \frac{(R_2 m_2 - R_1 m_1) g}{(I + m_1 R_1^2 + m_2 R_2^2)}}$$

VALEURS
NUMERIQUE

$\alpha = 10{,}548$ rad/sec^2

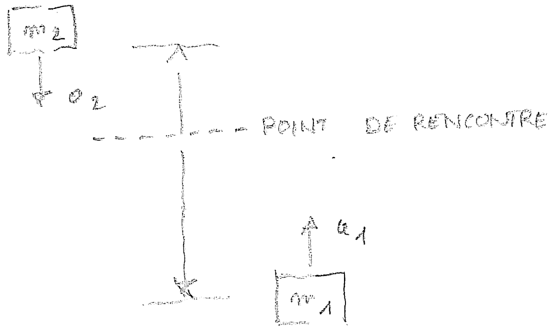
$a_1 = 0{,}52742$ m/s^2

$a_2 = 1{,}0548$ m/s^2

$T_1 = 10{,}3$ N

$T_2 = 26{,}3$ N

INSTANT OU LES 2 BLOCS SONT A LA MEME HAUTEUR



$$h = \underbrace{(a_1 + a_2)\frac{t^2}{2}}$$

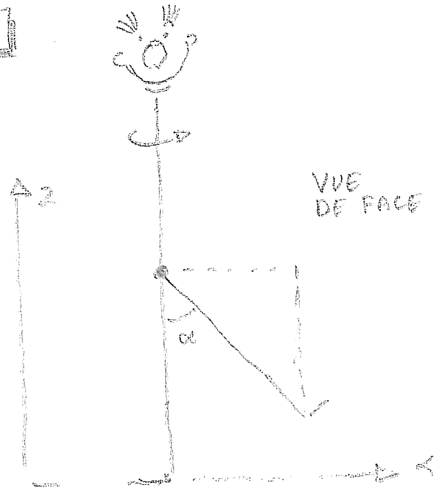
Σ DISTANCES PARCOURUES PAR LES 2 BLOCS !

$$\boxed{t = \sqrt{\frac{2h}{a_1 + a_2}}}$$

VALEUR NUMERIQUE

$t = 1,59\ s$

52



$$\boxed{I_h = I + m h^2}$$

INERTIE BARRE CM

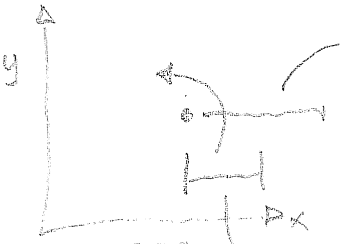
THEOREME DES AXES //

$$I_h = \underbrace{\frac{1}{12} m (L \sin\alpha)^2} + \underbrace{m \left(\frac{L \sin\alpha}{2}\right)^2}$$

$$I_h = \left(\frac{1}{12} + \frac{1}{4}\right) m L^2 \sin^2\alpha$$

$$I_h = \frac{1+3}{12} m L^2 \sin^2\alpha$$

$$\boxed{I_h = \frac{1}{3} m L^2 \sin^2\alpha}$$

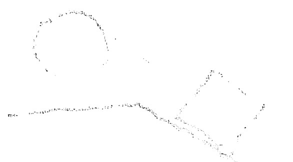


ROTATION D'UNE BARRE DE LONGUEUR $L \sin\alpha$

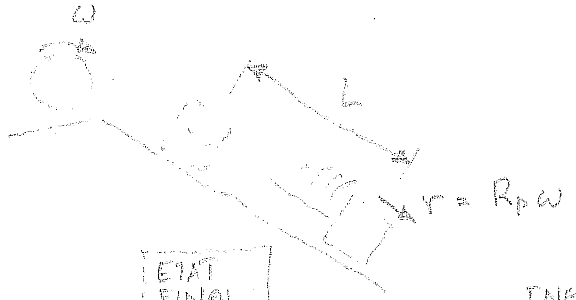
UN RARE EXERCICE EN 3D !

$$h = \frac{L \sin\alpha}{2}$$

53



ETAT INITIAL



ETAT FINAL

$$\boxed{\begin{array}{l} K = 0 \\ U = 0 \end{array}}$$

PAS DE FROTTEMENT !

→ CONSERVATION ENERGIE MECANIQUE

$$K = \frac{1}{2}\overbrace{\left(\frac{1}{2} m_p R_p^2\right)}^{\text{INERTIE POULIE}} \omega^2 + \frac{1}{2} m_b \underbrace{R_p^2 \omega^2}_{(\text{VITESSE BLOC})^2}$$

$$U = -m_b g L \sin\theta$$

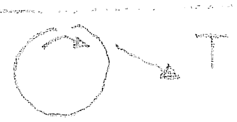
LE BLOC EST DESCENDU

$$\overbrace{R_p^2 \omega^2}^{v^2} = \frac{m_b g L \sin\theta}{\left[\frac{1}{4} m_p + \frac{1}{2} m_b\right]}$$

$$\boxed{v = \sqrt{\frac{4 m_b g L \sin\theta}{m_p + 2 m_b}}}$$

VALEUR NUMERIQUE
$v = 2{,}8$ m/s

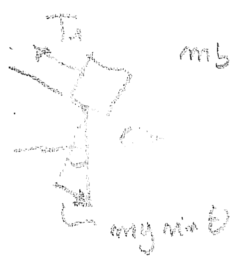
ACCELERATION ?



$$\underbrace{\left(\frac{1}{2} m_p R_p^2\right)}_{I} \alpha = R_p T$$

POULIE

BLOC



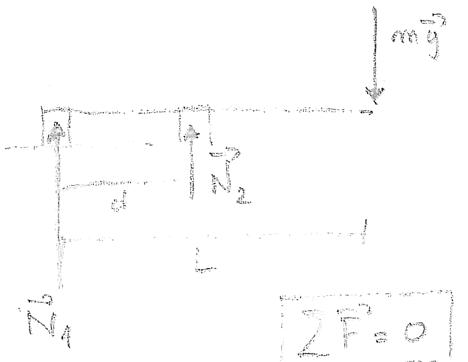
$$m_b R_p \alpha = m_b g \sin\theta - T$$

2 EQUATIONS
2 INCONNUES α, T

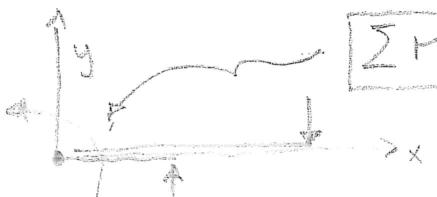
$$\boxed{\alpha = \frac{\sin\theta \, m_b g}{\frac{1}{2} m_p R_p + m_b R_p}}$$

VALEUR NUMERIQUE
$\alpha = 7{,}83$ rad/s²

54



$\boxed{\sum \vec{F} = 0}$ $N_1 + N_2 = mg$

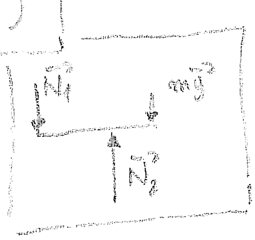


$\boxed{\sum M = 0}$ $N_2 d - mgL = 0$

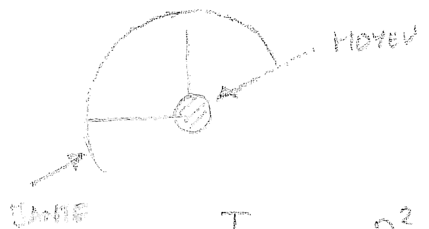
EQUILIBRE DE ROTATION A L'ORIGINE (PAR EXEMPLE !)

$$\boxed{\begin{aligned} N_2 &= mgL/d \\ N_1 &= mg(1 - L/d) \end{aligned}}$$

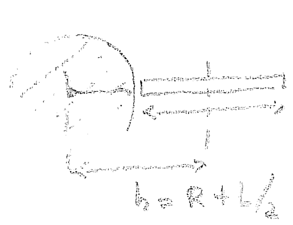
$N_2 = 3652$ N
$N_1 = -2943$ N



55



$$I = \underbrace{\frac{m_1 R_1^2}{2}}_{\text{CYLINDRE PLEIN}} + \underbrace{m_3 R_3^2}_{\text{CYLINDRE CREUX}} + 4\left(\underbrace{m_2 \frac{L^2}{12}}_{\text{BARRE}} + \underbrace{m_2 \left(R_1 + L/2\right)^2}_{\text{THEOREME DES AXES //}}\right)$$

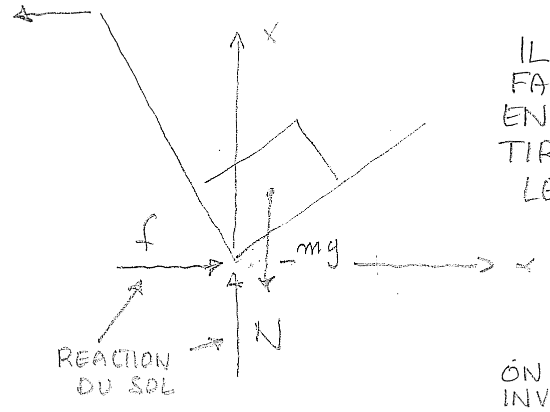


$$= 4 + 72 + 4\left[\frac{16}{12} + \underbrace{(2+2)^2}_{16}\right]$$

$$I = 4 + 72 + 4\left(\frac{4}{3} + 16\right) = 145{,}3$$

$\boxed{I = 145{,}3 \text{ kg m}^2}$ $\boxed{m = 8 \text{ kg}}$ $\boxed{k = \sqrt{\frac{I}{m}} = 4{,}26 \text{ m}}$

56

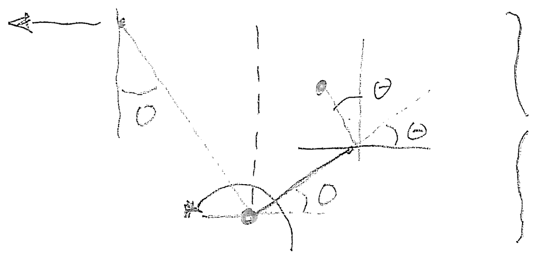


IL FAUT EN FAIT TIRER SUR LE DIABLE

LE DESSIN DE L'ENONCE EST TROMPEUR !

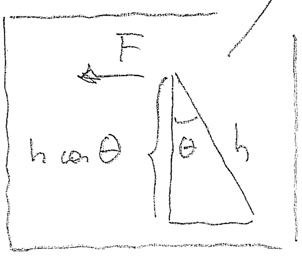
ON PEUT INVERSER LE DESSIN ET OBTENIR UN RESULTAT NEGATIF

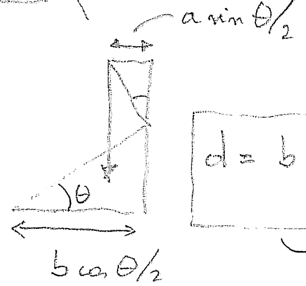
$$\boxed{\sum M = 0} \quad !$$



TRIGONOMETRIE ! TRICKY !

$$\boxed{F \underbrace{h\cos\theta} - mg\,d = 0}$$





$$\boxed{d = \frac{\underbrace{b\cos\theta - a\sin\theta}_{0{,}333\ \text{m}}}{2}}$$

$$\boxed{F = \frac{mgd}{h\cos\theta}}$$

VALEUR NUMERIQUE

$F = 68{,}6$ N