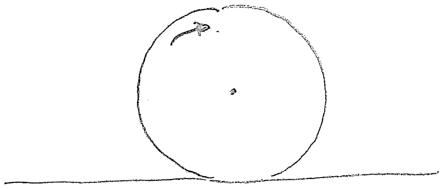


$$\boxed{\begin{aligned}\Theta(t) &= \omega_0 t + \alpha t^2/2 \\ \omega(t) &= \omega_0 + \alpha t\end{aligned}}\qquad \begin{aligned}&(1)\\&(2)\end{aligned}$$

• $\omega_0 = 120 \left[\frac{\text{tours}}{\text{minute}}\right] = \overbrace{120 \ \frac{2\pi}{60}}^{12,6} \left[\frac{\text{rad}}{\text{sec}}\right]$

$$\boxed{\begin{aligned}1 \text{ tour} &= 2\pi \text{ rad} \\ 1 \text{ mn} &= 60 \text{ sec}\end{aligned}}$$

• $t = 60 s$

• $\Theta(t) = 90 \,[\text{tours}] = \underbrace{90 \ 2\pi}_{565,5} \ [\text{rad}]$

$$\boxed{\alpha = 2\frac{\Theta(t)}{t^2} - \frac{2\omega_0}{t}}$$

VALEUR NUMERIQUE

$\alpha = -0,105 \text{ rad}/s^2$

NEGATIF CAR DECELERATION !

ON AURAIT AUSSI PU METTRE LE SIGNE NEGATIF DIRECTEMENT DANS (1) ET ECRIRE : $\Theta(t) = \omega t - \alpha t^2/2$:-)

TEMPS REQUIS POUR S'ARRETER

$$\boxed{t^* = -\frac{\omega_0}{\alpha}}$$

CAR $\underbrace{\omega(t^*)}_{\omega_0 t^* - \alpha} = 0$

VALEUR NUMERIQUE

$t^* = \frac{12,6}{0,105} = 120$ sec

APPROXIMATIVEMENT 2 minutes !

$$\boxed{\Theta(t^*) = \omega_0\left(-\frac{\omega_0}{\alpha}\right) + \frac{\alpha}{2}\left(-\frac{\omega_0}{\alpha}\right)^2 = -\frac{1}{2}\frac{\omega_0^2}{\alpha}}$$

ANGLE PARCOURU

VALEUR NUMERIQUE 756 rad
120 tours

DISTANCE PARCOURUE PAR LA ROUE

$$\boxed{x = \Theta \cdot R}$$

VALEURS NUMERIQUE

$x = 151$ m

58

$$\boxed{\begin{aligned}\Theta(t) &= \omega_0 t + \alpha t^2/2 \\ \omega(t) &= \omega_0 + \alpha t\end{aligned}}$$

RESOUDRE LE PROBLEME EN TOURS/MINUTES !!
EST NETTEMENT PLUS SIMPLE !

$\omega_0 = 20$

$$\begin{cases} 40 = 20t + \alpha t^2/2 \\ 50 = 20 + \alpha t \end{cases}$$

$$\begin{cases} 40 = 20t + \alpha t^2/2 \\ 30/\alpha = t \end{cases}$$

ON DEDUIT QUE

$$40 = \frac{600}{\alpha} + \alpha\left(\frac{900}{\alpha^2}\right)\frac{1}{2}$$

$$4\alpha = 60 + 45$$

$$\alpha = \frac{105}{4} = \underbrace{26{,}25 \left[\frac{\text{tour}}{(\text{minute})^2}\right]}_{0{,}046\ [\text{rad}/s^2]}$$

$\alpha = 26{,}25$

$$\boxed{\begin{aligned}\Theta &= \alpha t^2/2 \\ 20 &= \alpha t\end{aligned}}$$

ON DEDUIT QUE

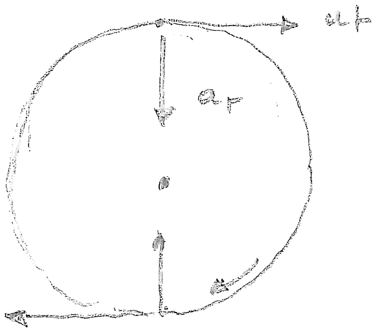
$$t = \frac{20}{\alpha}$$

$$\Theta = \alpha\left(\frac{400}{\alpha^2}\right)\frac{1}{2}$$

$$= \frac{200}{26{,}25} = 7{,}62\ [\text{tour}]$$

C'EST JUSTE COMME DES EXERCICES ELEMENTAIRES DE MRUA !!

59



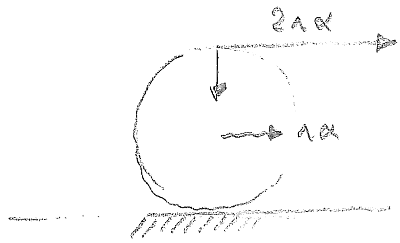
PAR RAPPORT AU CENTRE

$$a_t = \overbrace{R\alpha}^{3\ m/s^2}$$

$$a_c = \underbrace{\frac{v^2}{R}}_{\frac{2^2}{0,25}} = 16\ m/s^2$$

$$a = \sqrt{a_t^2 + a_c^2} = 16,3\ m/s^2$$

PAR RAPPORT AU SOL



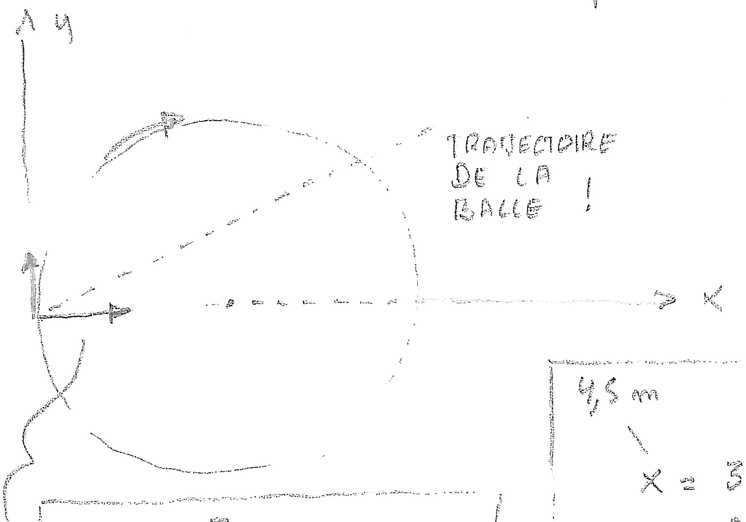
⚠

$$a_t = 2R\alpha = 6\ m/s^2$$

$$a_c = \frac{v^2}{r} = 16\ m/s^2$$

$$a = \sqrt{a_t + a_c} = 17,1\ m/s^2$$

60



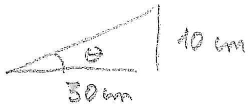
$$\vec{v} = \begin{bmatrix} 30 \\ \underbrace{R\omega}_{3,6} \end{bmatrix}\ m/s$$

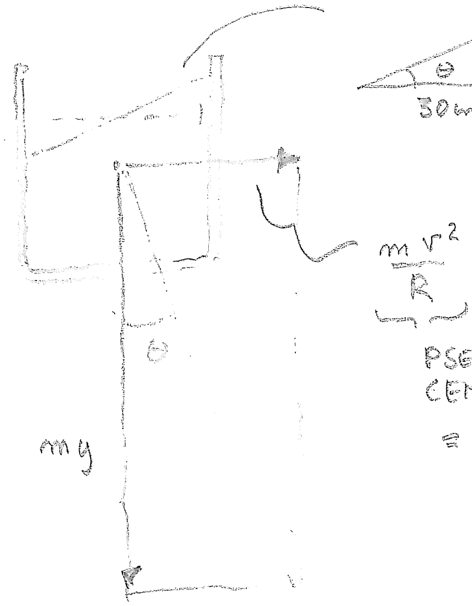
$$\overbrace{x}^{4,5\ m} = 30\ t$$

$$y = 3,6\ t$$

$$y = 3,6\ \frac{4,5}{30} = 0,54\ m$$

G1





$$\underbrace{\frac{mv^2}{R}}_{\text{PSEUDO-FORCE CENTRIFUGE}}$$

PSEUDO - FORCE
CENTRIFUGE
= - ACCELERATION
CENTRIPETE

LA SURFACE DE L'EAU EST PERPENDICULAIRE A LA RESULTANTE DES 2 FORCES !

$$\frac{1}{3} = \operatorname{tg} \theta = \frac{\frac{mv^2}{R}}{mg}$$

$$\downarrow$$

$$v^2 = \frac{Rg}{3}$$

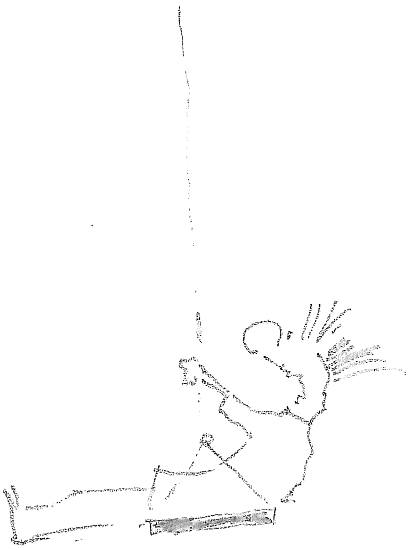
$$\downarrow$$

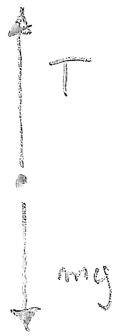
$$\boxed{v = \sqrt{\frac{Rg}{3}}}$$

VALEUR NUMERIQUE

$v = 11,5$ m/s

G2



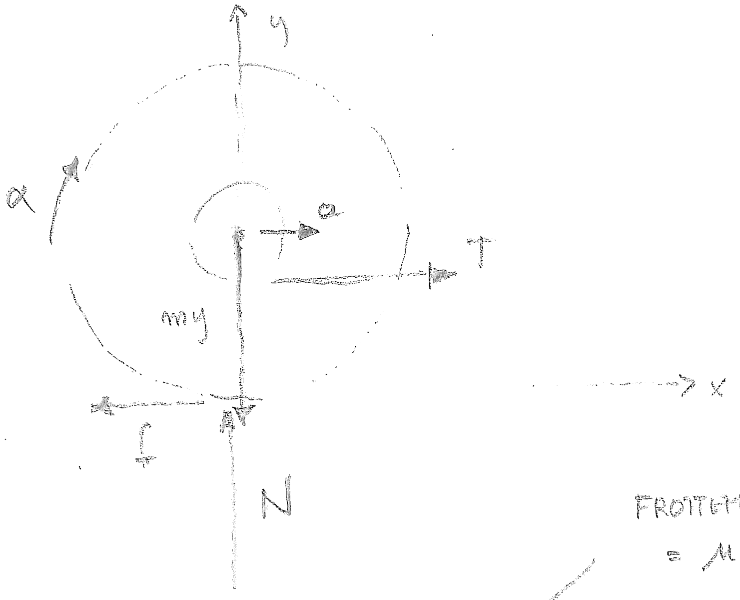


$$\overbrace{\frac{mv^2}{R}}^{\text{ACCELERATION CENTRIPETE}} = T - mg$$

$$\boxed{T = m\left(g + \underbrace{\frac{v^2}{R}}\right)}$$

453,75 N

$\boxed{63}$



car N = mg :-)

FROTTEMENT
$= \mu . N = \mu \, mg$

$\boxed{\sum F_x = ma}$ $\quad ma = T - \overbrace{\mu mg}$ (1)

$\boxed{\sum M = I\alpha}$ $\quad -\frac{mR^2}{2}\alpha = rT - R\mu mg$ (2)

$\boxed{\text{CONDITION DE ROULEMENT SANS GLISSEMENT} \quad +\alpha R = a}$

LA ROUE PROGRESSE DANS LE SENS DU FROTTEMENT !

ATTENTION !!

$$\begin{cases} ma = T - \mu mg \\ -\frac{mRa}{2} = rT - R\mu mg \end{cases}$$

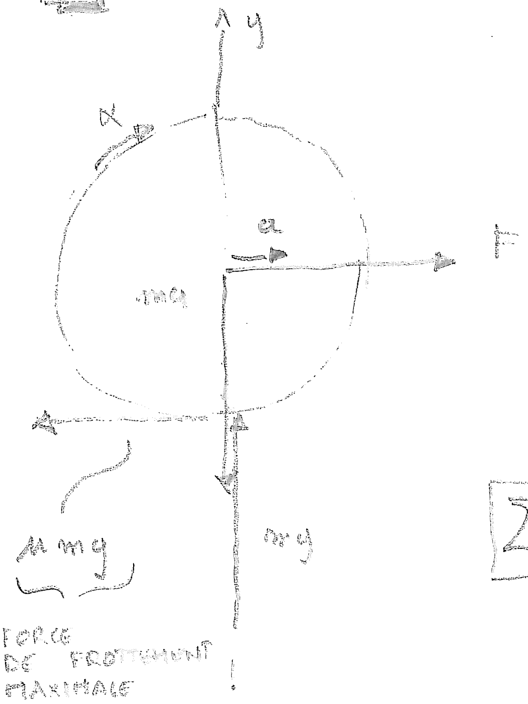
$$\downarrow$$

$$\begin{cases} \frac{1}{2} mRa = \frac{R}{2} T - \mu \frac{R}{2} mg \\ -\frac{1}{2} mRa = rT - R\mu mg \end{cases}$$

EN ADDITIONNANT LES 2 EQUATIONS

$$\left(\tfrac{1}{2}R + r\right) T = mg\mu \left(\frac{3R}{2}\right)$$

$$\boxed{T = \frac{3\mu mg R}{(R + 2r)}}$$



ROULEMENT SANS GLISSEMENT

$$\boxed{\alpha R = a}$$

x

$$\boxed{\sum F_x = ma}$$

$$ma = F - \mu mg$$

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

$$\underbrace{-\frac{1}{2} m R^2 \alpha}_{-\frac{1}{2} m R a} = - R \mu m g$$

$$\mu = \frac{a}{2g}$$

3 EQUATIONS
3 INCONNUES
μ, α, a

$$F = ma + \frac{a}{2g} mg$$

$$F = \frac{3}{2} ma$$

$$\boxed{a = \frac{2F}{3m}}$$

$$\boxed{f = \underbrace{\frac{2F}{3\cancel{m}} \frac{1}{2\cancel{g}} \cancel{m}\cancel{g}}_{= F/3}}$$

IL FAUT

$$\boxed{\mu_s > \frac{F}{3mg}}$$

COEFFICIENT MINIMAL DE FROTTEMENT POUR ROULEMENT SANS GLISSEMENT