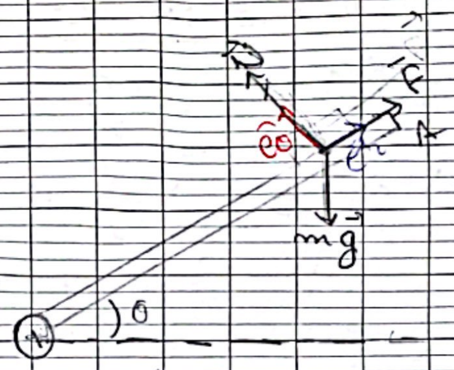
محاولة حل مع سؤال واحد لينحل الكلنسيرو

Ex 11:



$\theta = 50°$ block is slipping

$\mu_s = ?$

Newton's 2^{nd} law (FBD)

on the block

$0 < \theta < 50°$: $m\vec{g} + \vec{N} + \vec{f}_s = m\vec{a}$

proj on $\hat{e}_\theta$: $-mg\cos\theta + N + 0 = ma_\theta$
$= m[r\ddot{\theta} + 2\dot{r}\dot{\theta}]$
$= 0$

$N = mg\cos\theta$

proj on $\hat{e}_r$: $-mg\sin\theta + f = ma$
$= m(\ddot{r} - r\dot{\theta}^2)$

$\dot{\theta} = \omega$

θ : angular pos
$\dot{\theta}$: angular speed $= \omega$
$\ddot{\theta}$: angular accel $= 0$

For $0 < \theta < 50°$: $r = 50cm$
$\dot{r} = 0$, $\ddot{r} = 0$

$-mg\sin\theta + f_s = -mr\dot{\theta}^2$

static | kinetic
friction 50°

$-mg\sin 50 + \mu_s mg\cos 50 = -mr\dot{\theta}^2$

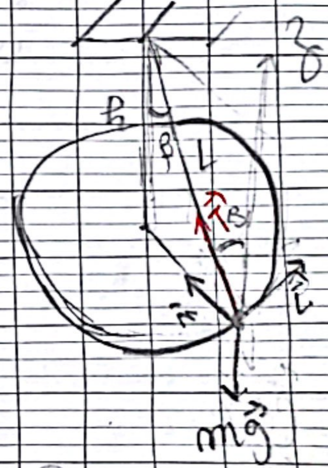
$\mu_s g\cos 50 = -r\dot{\theta}^2 + g\sin 50$

$$\mu_s = \frac{-r\dot{\theta}^2 + g\sin 50}{g\cos 50} = 0,55.$$

Ex 12:

(circular mot: a_n, a_t)

FBD on m:



$m\vec{g} + \vec{T} = m\vec{a}$

proj on $\vec{n}$: $0 + T\sin\beta = ma$

$$\boxed{T\sin\beta = m\frac{v^2}{r}} \quad (1)$$

proj on $\vec{t}$: $0 + 0 = ma_t$; $a_t = 0$

proj on $\vec{k}$: $-mg + T\cos\beta = ma_z = 0$

$$\boxed{T\cos\beta = mg} \quad (2)$$

$\frac{(1)}{(2)}$ $\tan\beta = \frac{v^2}{rg}$

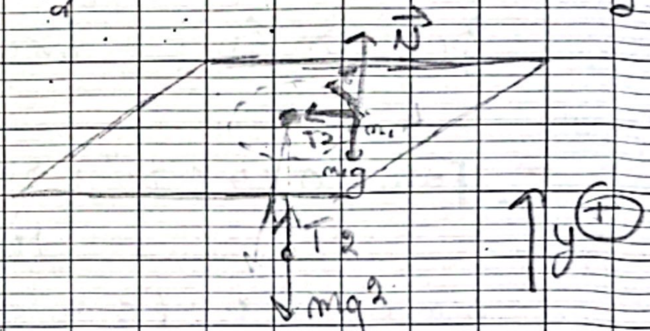
$\frac{r}{R} = \frac{v^2}{rg} = \frac{\omega^2 r}{g}$

$$\frac{v^2}{xg} = \frac{\omega^2 r^2}{xg} \Rightarrow R = \frac{g}{\omega^2}$$

Proj : $\boxed{T = \frac{mg}{\cos\beta}} = \frac{mg\,L}{R} = \frac{mgL}{\frac{g}{\omega^2}} = \frac{gL}{\omega^2}$

<u>Ex 13°:</u>

$\omega = ?$ so that m_2 remains stationary



FRD on m_2:

$m_2\vec g + \vec T_2 = m\vec a = 0$

Proj on y : $-m_2 g + T_2 = 0$

$T_2 = m_2 g$

كي نقولو connected by Tension $T_1 = T_2$

FRD on m_1 : $m_1\vec g + \vec T_1 + \vec N = m\vec a$

Proj on $\hat n$: $0 + T_1 + 0 = m a_n = m_1\frac{v^2}{R} = m_1\omega^2 R$

$T_2 = T_1$

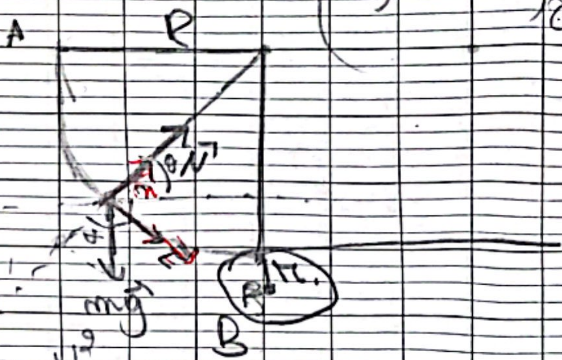
$m_2 g = m_1\omega^2 R$

$\omega^2 = \frac{m_2 g}{m_1 R}$

$\omega = \sqrt{\frac{m_2 g}{m_1 R}}$

غلط !!
$\left(g\cos\theta = \int \frac{dv}{dt} \right)$

Ex 14:



a) FRD on m:

$m\vec{g} + \vec{N} = m\vec{a}$

Proj on $\vec{n}$: $-mg\cos\alpha + N = m\frac{v^2}{R}$

$N = m\left[\frac{v^2}{R} + g\sin\theta\right]$

proj on $\vec{t}$: $+mg\sin\alpha + 0 = ma_t$

$g\cos\theta = a_t$ $\quad$ a_t is a fct of θ

$a_t = a_t(\theta) \Rightarrow a_t ds = v dv$

$ds = R d\theta$

$g\cos\theta . R . d\theta = v dv$

$gR \int_0^\theta \cos\theta d\theta = \int_0^v v dv$

$2gR . \sin\theta = v^2$

$N = m[2g\sin\theta + g\sin\theta]$

$N = 3mg\sin\theta$

b) $\omega = ?$ to prevent any sliding on the Conveyor belt

$V_{Block} = V_{Belt}$ $\left(\theta = \frac{\pi}{2}\right)$

$\sqrt{2gR\sin\theta} = \omega r$

$\omega = \frac{\sqrt{2gR}}{r}$