$(F_{ext}) = 0$

N.L $\begin{cases} \# \ I^{st} \text{ Law} \\ \# \ 3^{rd} \text{ Law} \end{cases}$

$\rightarrow \leftarrow$

Dynamics 1

VMC Vidyamandir Classes SINCE 1986

IIT JEE | MEDICAL | FOUNDATION

Newtons second law of motion:

$\overset{m}{\bullet} \rightarrow v$

momentum of particle = (mv)

$$F = \frac{dp}{dt} = \frac{d}{dt}(mv)$$

$$= m\frac{dv}{dt}$$

$$\boxed{F_{ext} = (ma)}$$

F

F_{int} F_{avg}

$\frac{dp}{dt}$ $\frac{\Delta p}{\Delta t}$

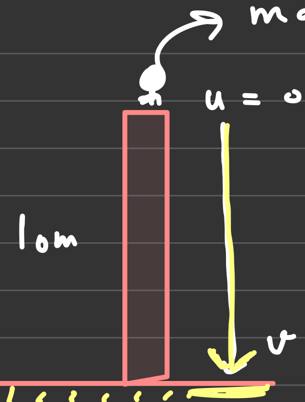
$\frac{(\Delta p)_x}{\Delta t}$ $\frac{(\Delta p)_y}{dt}$ $\frac{(\Delta p)_z}{dt}$

F_x F_y F_z

$$\vec{F} = F_x\hat{i} + F_y\hat{j} + F_z\hat{k}$$

Q)

mass = 50kg



$$v = \sqrt{2gh} = \sqrt{2\times10\times10} = 10\sqrt{2}\ m/s$$

During collision:

$$F_{avg} = \frac{\Delta P}{\Delta t} = \frac{P_f - P_i}{\Delta t}$$

Lets assume $\Delta t = 0.01$

$$= \frac{0 - (-50\times10\sqrt{2})}{\Delta t}$$

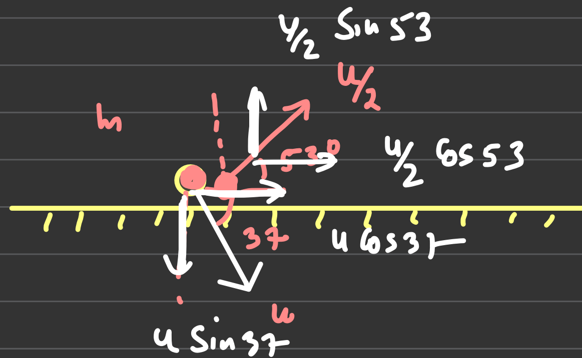
$$= \frac{500\sqrt{2}}{0.01}\ N$$

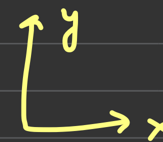
$$= 50000\sqrt{2}\ N$$

$$= 500\,[100\sqrt{2}]$$

θ)

$$\vec{F}_{ext} = \left(\frac{\Delta P}{dt}\right)_x \hat{i} + \left(\frac{\Delta P}{dt}\right)_y \hat{j}$$





$$(\Delta P)_x = m \frac{u}{2} \cos 53 - m u \cos 37$$

$$= m \times \frac{u}{2} \times \left(\frac{3}{5}\right) - m u \left(\frac{4}{5}\right)$$

$$= \frac{3mu}{10} - \frac{4mu}{5} = -\frac{5mu}{10} = -\left(\frac{mu}{2}\right)$$

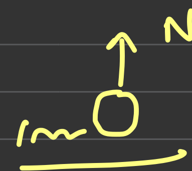
$$(F_x) = \frac{(\Delta P)_x}{\Delta t} = \left(\frac{mu}{2\Delta t}\right)$$

$$(F_y) = \frac{(\Delta P)_y}{\Delta t} = \frac{\left\{+m\frac{u}{2}\sin 53 - (-mu\sin 37)\right\}}{\Delta t}$$

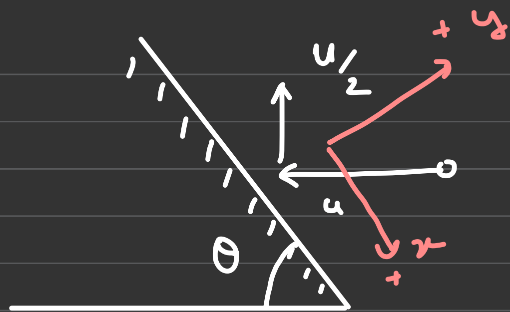
$$= \frac{\frac{mu}{2}\times\frac{4}{5} + mu\times\frac{3}{5}}{\Delta t}$$

$$(F_y) = \frac{\frac{2mu}{5} + \frac{3mu}{5}}{\Delta t} = \frac{(mu)}{\Delta t}$$

$$\vec{F}_x = -\frac{mu}{2\Delta t}\hat{i} + \frac{mu}{\Delta t}\hat{j}\,;$$



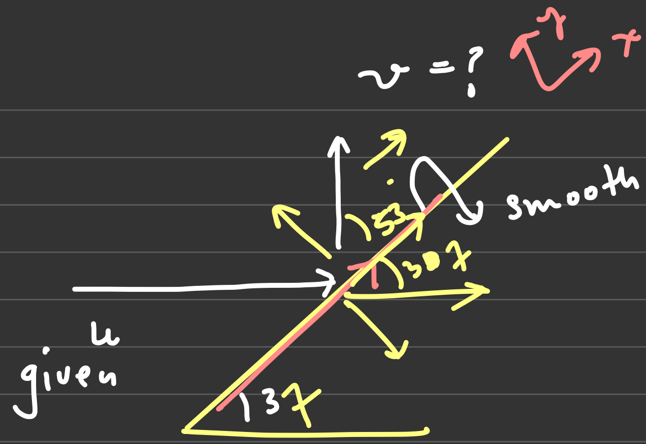
Q) H.W



'Δt' collide

find force experienced by ball during collision

Q)



find $v = ?$

$$F_x = \left(\frac{dP}{dt}\right)_x = 0$$

$P_x = \text{const}$

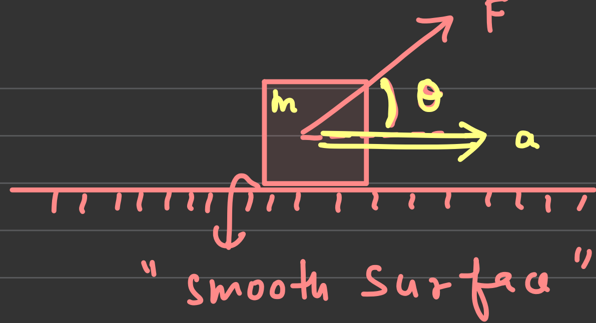
① along surface momentum is going to same as $(F_{ext})_x = 0$

$$v \cos 53 = u \cos 30°$$

$$v \times \frac{3}{5} = u \times \frac{4}{5} \Rightarrow v = \left(\frac{4}{3}\right) \underline{\underline{Ans}}$$

② get force (H.W)

Q)



find acceleration of block?

Steps: ① Draw FBD:

② Statement A1: "if a body is in contact with fixed surface then acceleration of body must be only along surface"

Draw acceleration

(3) Draw Co. axis

assume x- axis along acceleration
then ⊥ to it y- axis

(4) Resolve | take component along axis

(5) Apply $\vec{F} = m\vec{a}$ along x- axis

$$F\cos\theta = m \times a$$

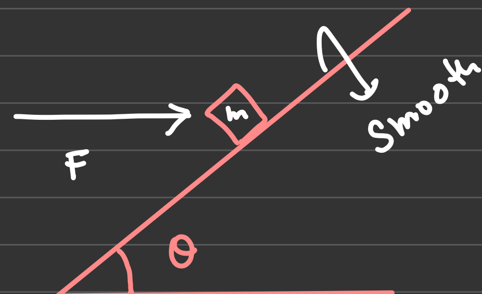
$$a = \left(\frac{F\cos\theta}{m}\right)$$

$F\sin\theta + N = mg$

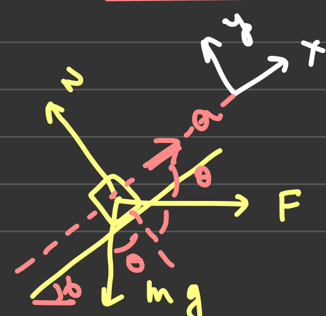
$$\boxed{N = mg - F\sin\theta}$$

Q)

then find acceleration of block?



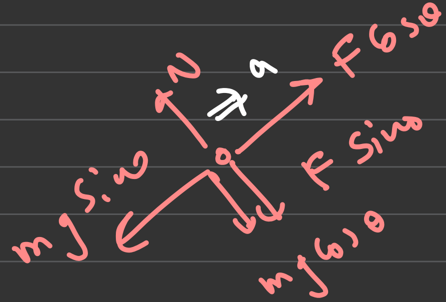
1. FBD



2. acceleration ($\vec{a}$) →

3. axis

(iv)



(v) Apply $(F = ma)_x$

$(\text{net force})_y = 0$

$$F\cos\theta - mg\sin\theta = ma$$

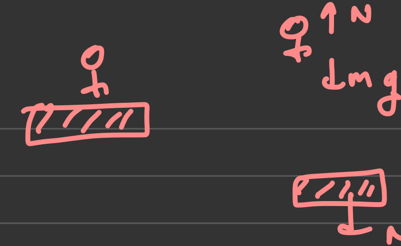
$$a = \frac{F\cos\theta - mg\sin\theta}{m}$$

Q)

a)

rest = 0

$$N = mg$$



- Reading -
in this is going to Normal

b)

$\Uparrow a$

$\rightsquigarrow$ w.m

$\Uparrow a$

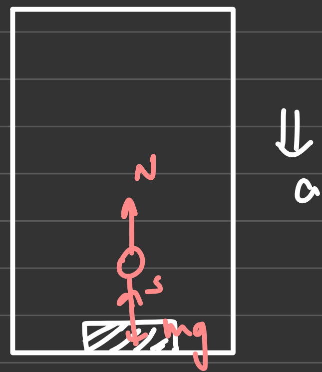
$$N - mg = ma$$

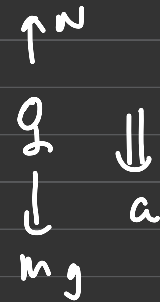
$$N = mg + ma$$

Reading (more Reading)

than mg

c)





$$mg - N = ma$$

$$N = mg - ma$$

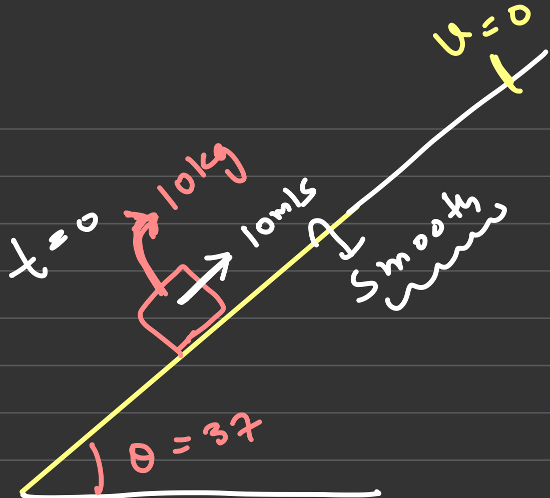
Reading

Less Reading than 'mg'

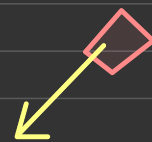
zero weight $= 0 = mg - ma$

$$a = g \quad \Downarrow g$$

Q)



find time after which it comes back to same position?



$= mg\sin 37$

$= \cancel{10} \times 10 \times \frac{3}{5} = \cancel{m}a$

$a = 6\,m/s^2$

$\Rightarrow v = u + at$

$\Rightarrow 0 = 10 - 6 \times t$

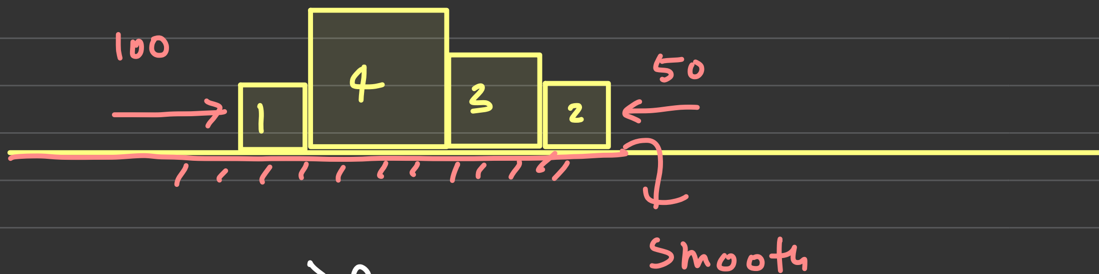
$t = \frac{5}{3}$ sec

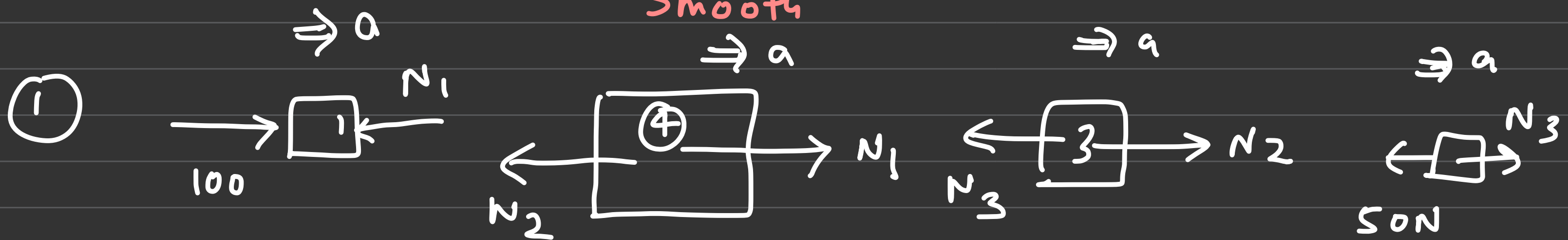
total time to come back to same position

$= 10/3$ sec Ans

Q)

find acceleration of each block and Normal force between them?





$100 - \cancel{N_1} = 1 \times a \Rightarrow N_1 = 100 - 1\times 5 = 95\,N$

$\cancel{N_1} - \cancel{N_2} = 4 \times a$

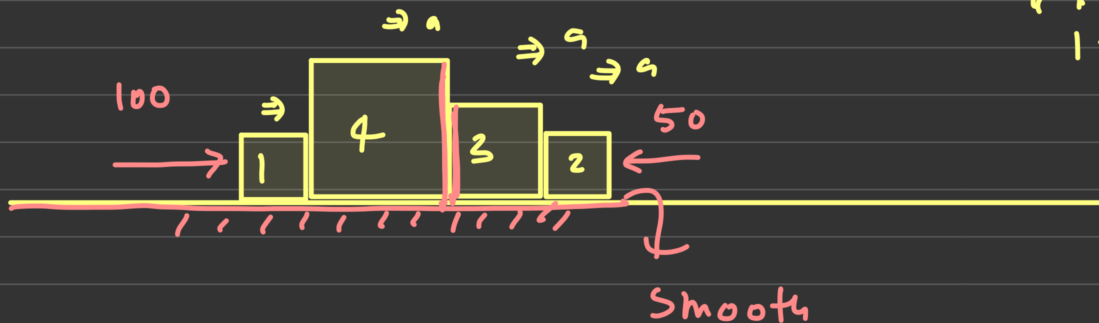
$\cancel{N_2} - \cancel{N_3} = 3 \times a$

$$N_3 - 50 = 2 \times a$$

$$100 - 50 = 10a$$

$$\boxed{a = \frac{50}{10} = 5 m/s^2}$$

Q)

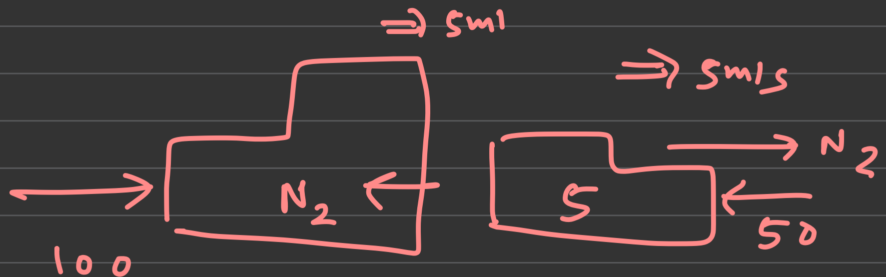


|a| and mag

"if acceleration some rigid body are same then we can assume them a system"

$$100 - 50 = 10 \times a$$

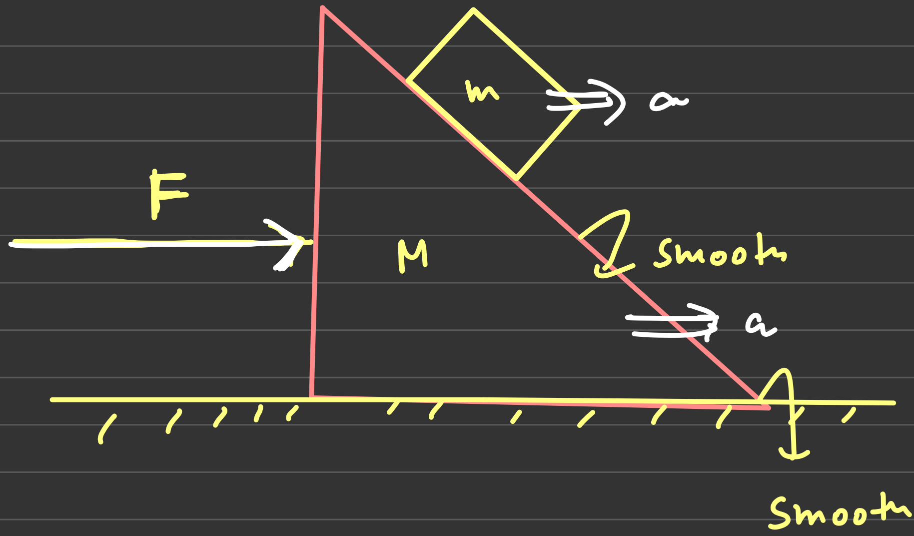
$$\boxed{a = 5 m/s^2}$$



$$N_2 - 50 = 5 \times 5$$

$$N_2 = 75 N$$

Q)



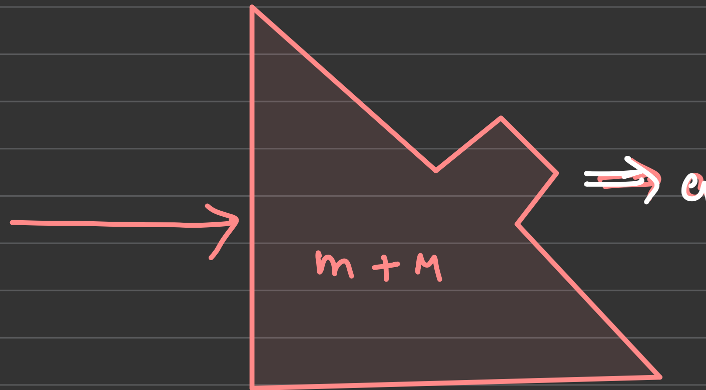
find F for which m does not slip over M ?

if m is not slipping over M then acceleration of m and M must be same

$|\vec{a}|$ and direction

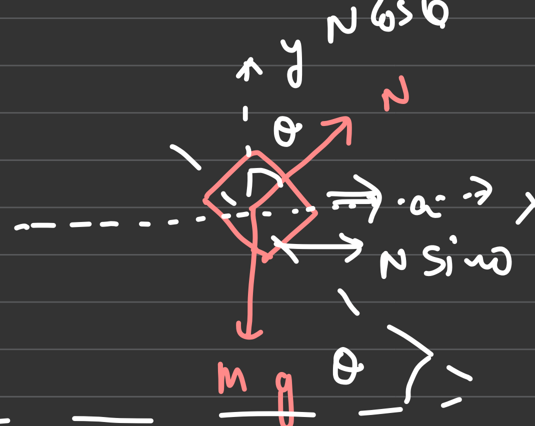
$$F = (m+M)\,a$$

$$\boxed{F = (m+M)\,g\tan\theta}$$



FBD:

① , ② , ③



$$N\sin\theta = ma$$

$$N\cos\theta = mg$$

$$\tan\theta = \frac{a}{g}$$

$$a = g\tan\theta$$

Pre-class: "frictional force"

- INE 4 — 1 DTS
- covd 1 — DTS 4