YAKEEN NEET 2.0

2026

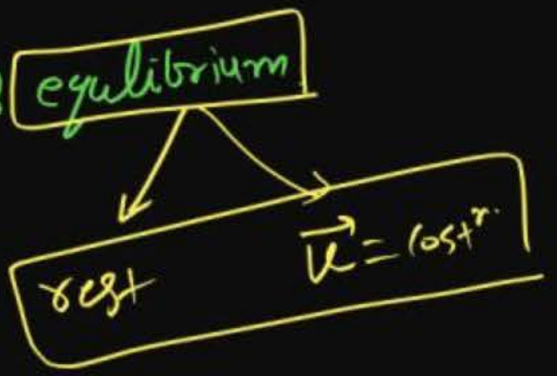
Laws of Motion

Physics | Lecture - 02

By- Manish Raj (MR Sir)

Topics to be covered

1. # PhD on Normal force, Tension force, & equilibrium



2.

3.

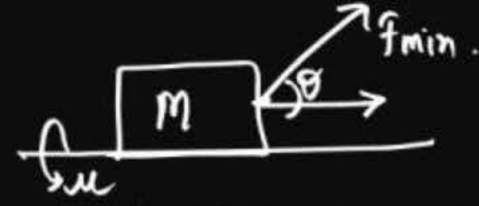
4.

aaj must hai ⟶ Assignment - 3 solve Karna.

assignment → 5 (aaj upload) every

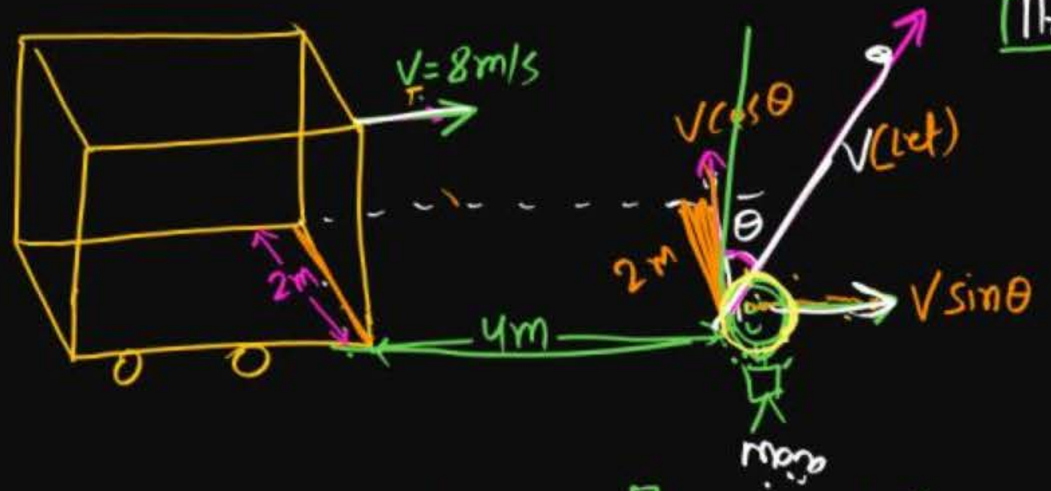
Question

hint $y = a\sin\theta + b\cos\theta$, $y_{max} = \sqrt{a^2+b^2}$



A 2m wide truck is moving with a uniform speed $V_0 = 8\ ms^{-1}$ along a straight horizontal road. A pedestrian starts to cross the road with a uniform speed v, when the truck is 4 m away from him. The minimum value of v so that he can cross the road safely is

1. $2.62\ ms^{-1}$
2. $4.6\ ms^{-1}$ ✗
3. $3.57\ ms^{-1}$ ✓
4. $1.414\ ms^{-1}$



1 to road $t = \frac{2}{V\cos\theta} = \frac{dist^n}{speed}$ — (i)

1 to road $t = \frac{4}{8 - V\sin\theta}$ — (ii)

(i) = (ii)

$\frac{2}{V\cos\theta} = \frac{4}{8 - V\sin\theta}$ 2

$8 - V\sin\theta = 2V\cos\theta$

$V(\sin\theta + 2\cos\theta) = 8$

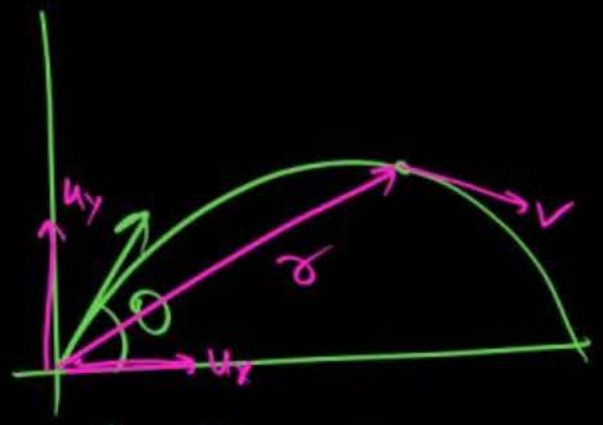
$V_{min} = \frac{8}{(\sin\theta + 2\cos\theta)_{max}}$

$V_{min} = \frac{8}{\sqrt{1+2^2}} = \frac{8}{\sqrt{5}} = 3.57$ m/s.

HOMEWORK.

(Q) object is Project at angle θ such that its Position vector always Increases from Projection then find maxm angle of Projection.

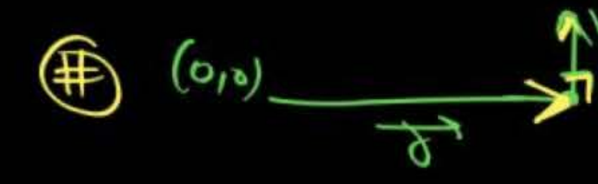
(last Class में दिया था।)



gf Velocity is along Position vector then $\vec{\gamma}$ → Incre.

$\vec{\gamma}\cdot\vec{v}$ = +ve $\gamma v\cos\theta$ ther $\gamma\uparrow$

↑ Angle b/w $\vec{\gamma}$ & $\vec{v}$ is acture $\theta<90°$



length $\vec{\gamma}$ cost^{h}

$\vec{\gamma}\cdot\vec{v}=0$ (circular motion)

$\vec{\gamma}\cdot\vec{v}$ = -ve (obtuse angle) $\vec{\gamma}\downarrow$

$\vec{v}=u_x\hat{i}+(u_y-gt)\hat{j}$ $\quad\vec{v}\cdot\vec{\gamma}\geq0$

$\vec{\gamma}=u_x t\hat{i}+(u_y t-\frac{1}{2}gt^2)\hat{j}$

$\sin^2\theta=\frac{8}{9}$

$\sin\theta=\sqrt{8/9}$

$\theta\leq70°$

Notes में लिखो

(Q) find u so that ball will collide & time of collsion.

IIT Adv 2014

Cond^n of collsion.

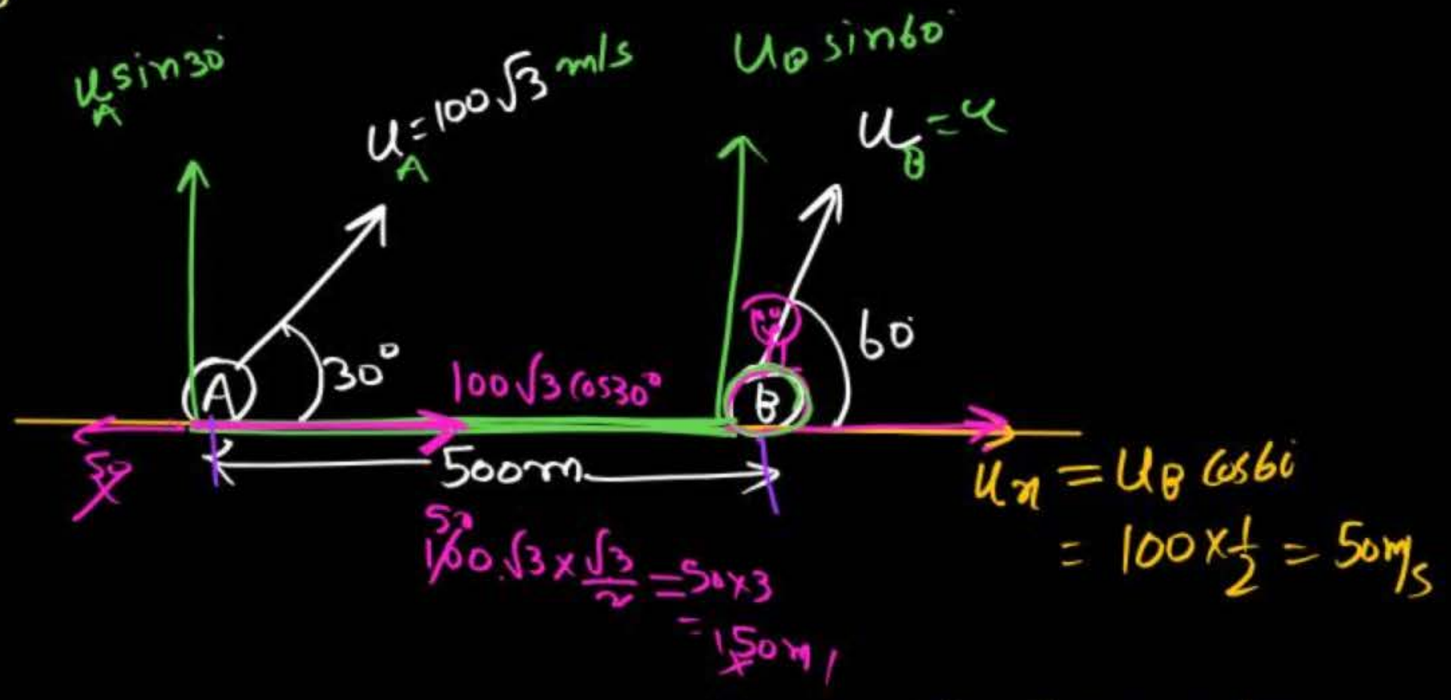
* Comp^n of Velocity $\perp$ to line Joining must be same.

$u_A \sin 30^\circ = u_B \sin 60^\circ$

$\Rightarrow 100\sqrt{3} \sin 30^\circ = u_B \sin 60^\circ$

$100\sqrt{3} \times \frac{1}{2} = u_B \frac{\sqrt{3}}{2}$

$u_B = 100 \text{ m/s}$



Consider motion in x-axis

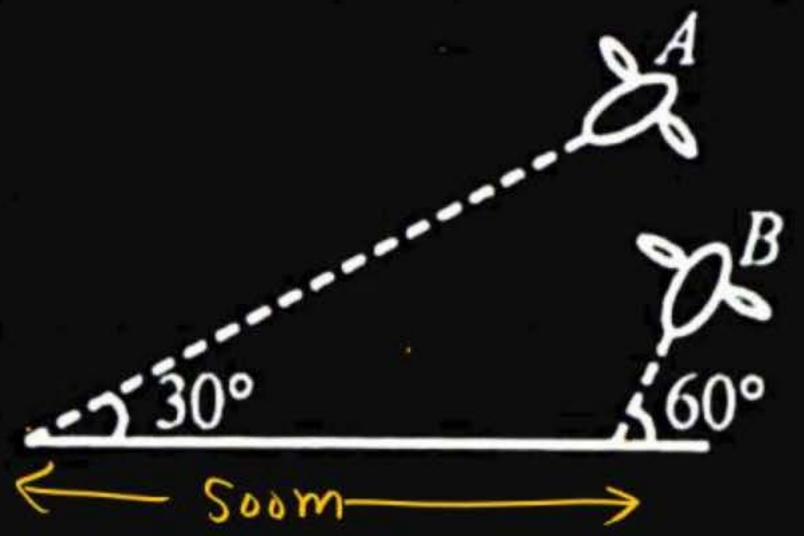
$$t = \frac{\text{length of line Joining}}{\text{Relative velocity along line Joining}}$$

$$t = \frac{500}{150 - 50} = \frac{500}{100} = 5 \text{ sec}$$

Question

Airplanes A and B are flying with constant velocity in the same vertical plane at angles 30° and 60° with respect to the horizontal respectively as shown in the figure. The speed of A is $100\sqrt{3}$ ms^{-1}. At the time $t = 0$s, an observer in A finds B at a distance of 500 m. This observer sees B moving with a constant velocity perpendicular to the line of motion of A. If at $t = t_0$, A just escapes being hit by B, t_0 in seconds is

[JEE ADV, 2014]

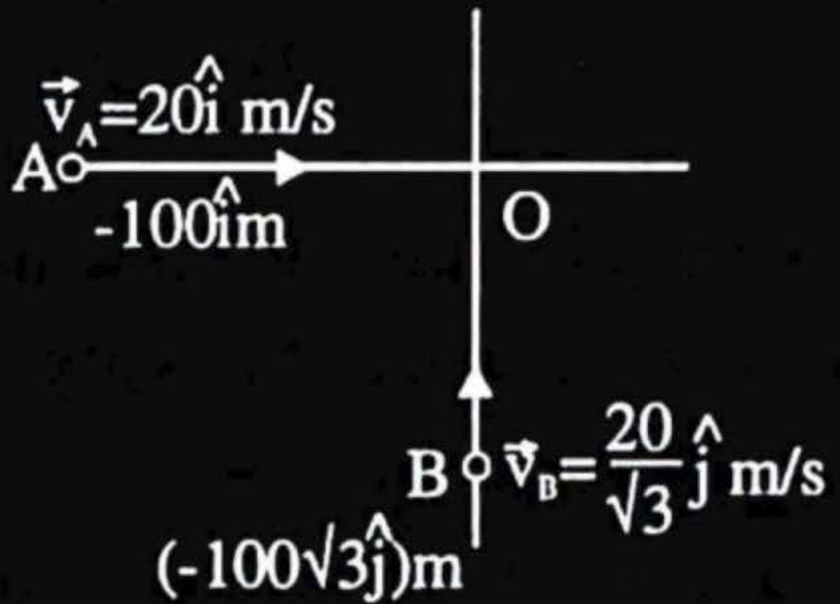


Question

H|W → Ascy → 5

Positions of two vehicles A and B with reference to origin O and their velocities are as shown. Which of the following options is incorrect?

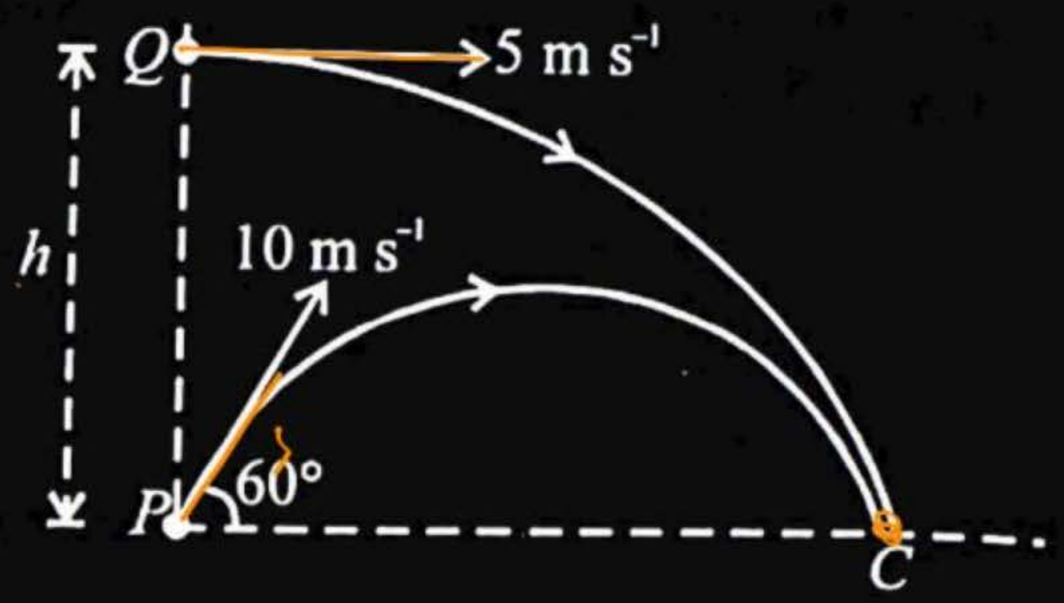
1. They will collide.
2. Distance of closest approach is 100 m.
3. Their relative velocity is $\frac{40}{\sqrt{3}}$ m/s
4. Their relative velocity is $\frac{20}{\sqrt{3}}$ m/s



Question

A particle P is projected from ground with an initial speed of 10 m/s at an angle of 60° with the horizontal. From what height h should an another particle be projected horizontally with velocity 5 m/s so that both the particles collide in ground at point C, if both are projected simultaneously? (g = 10 m/s^2)

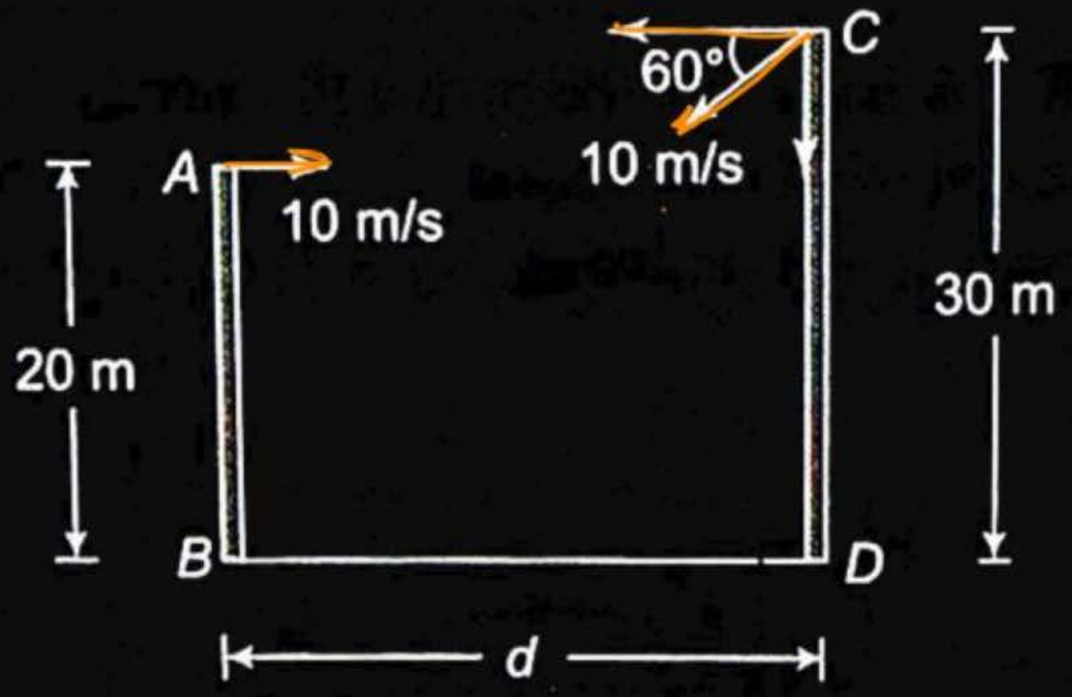
1. 10 m
2. 30 m
3. 15 m
4. 25 m



Question

HW

Consider the situation as shown in the figure. Two balls are thrown simultaneously with same speed 10 m/s, one horizontally and another at angle 60° in downward direction. After sometime balls collide in mid-air, find distance d.



Question

H/w (Class

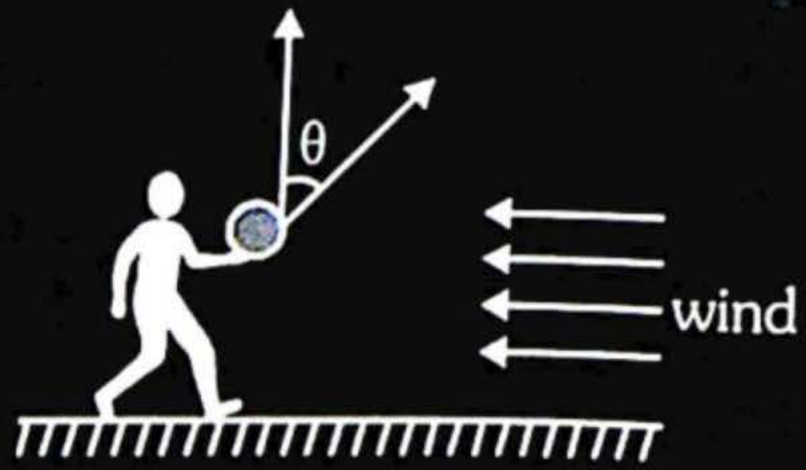
A particle is projected from ground at an angle θ with horizontal with speed u. The ratio of radius of curvature of its trajectory at the point of projection to the radius of curvature at maximum height is

1. $\frac{1}{\sin^2\theta\cos\theta}$
2. $\cos^2\theta$
3. $\frac{1}{\sin^3\theta}$
4. $\frac{1}{\cos^3\theta}$

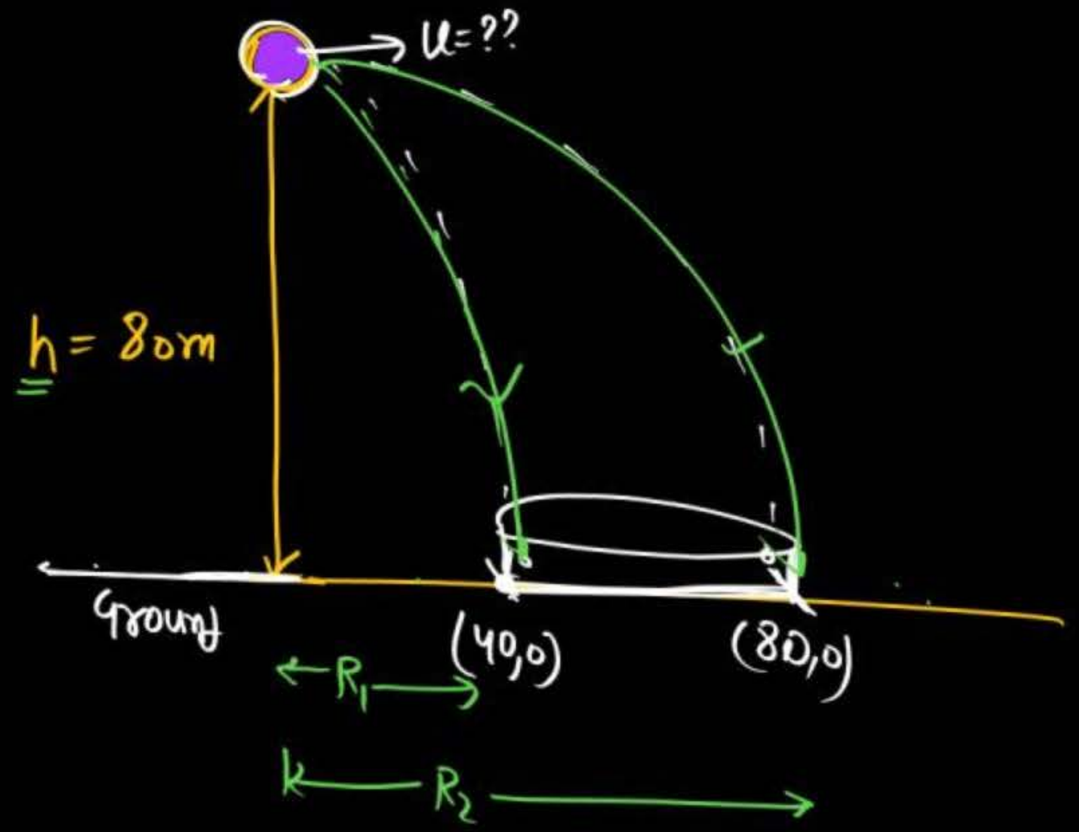
Question

HW

A boy throws a ball upwards with velocity $v_0 = 20$ m/s. The wind imparts a horizontal acceleration of 4 m/s^2 to the ball. The angle θ from vertical at which the ball must be thrown so that the ball returns to the boy's hand is ($g = 10$ m/s^2)



1. $\tan^{-1}(1.2)$
2. $\tan^{-1}(0.2)$
3. $\tan^{-1}(2)$
4. $\tan^{-1}(0.4)$



Find u_{min} & u_{max} so that ball will fall in given containing.

$$T = \sqrt{\frac{2H}{g}} = \sqrt{\frac{2\times 80}{10}} = \sqrt{16} = 4\ \text{sec}$$

for $R_1 = u_x T_f$

$40 = u_x \times 4$

$u_x = 10\ m/s$

$\Rightarrow u_{min}$

$R_2 = u_x T_f$

$20 + 80 = u_{max} \times 4$

$u_{max} = 20\ m/s$


NLM

Normal Reaction (Contact force)

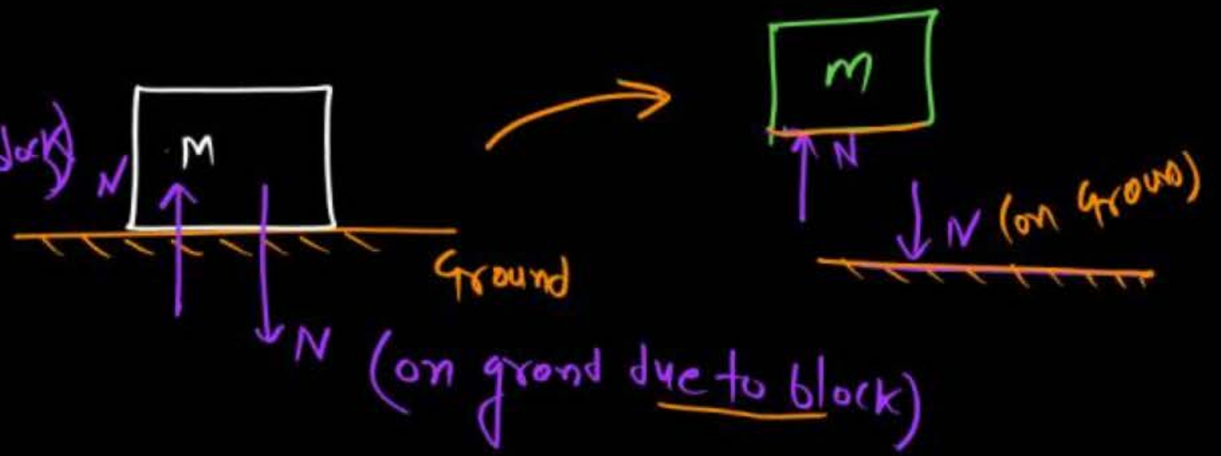
→ when two object in contact

→ Normal (N=0) → No contact

MRT Box :— for Normal

Contact surface ke ⊥r perpendicular do Parallel line draw Karo, Normal force upar wale pe upar, Niche pe Niche, agge pe agge Pichhe pe Pichhe.

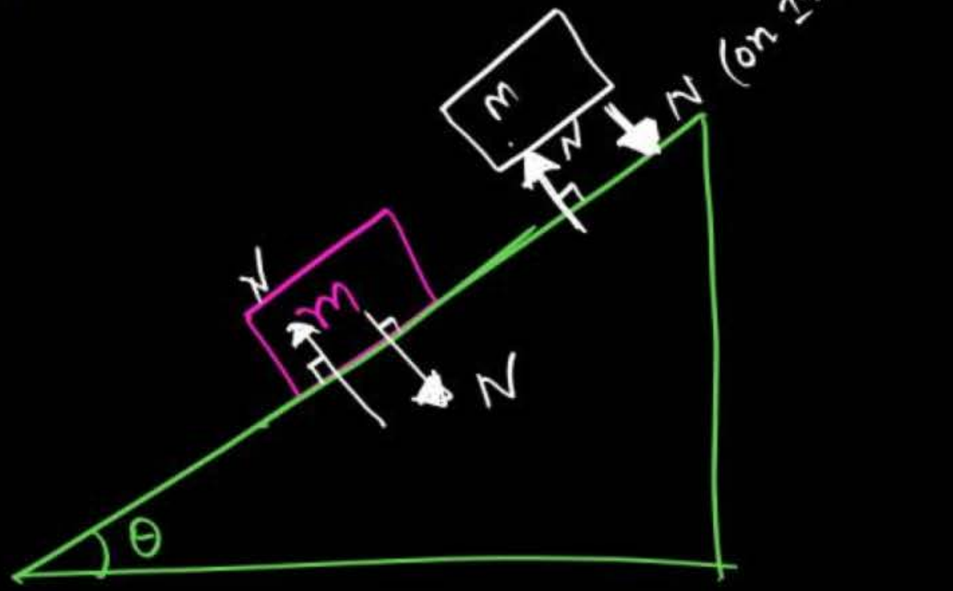
ek contact → 2 line.

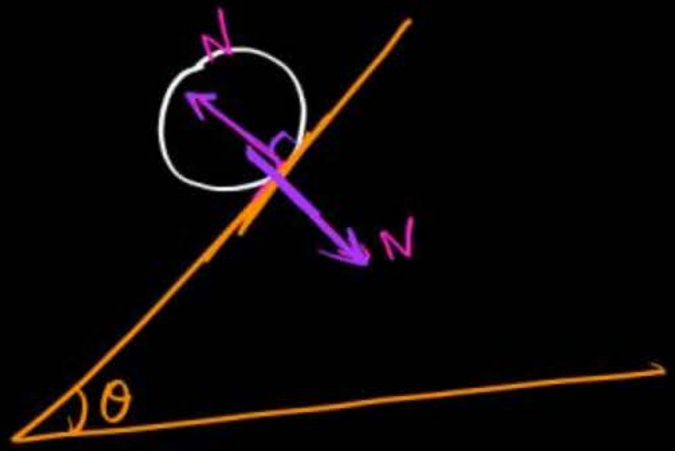


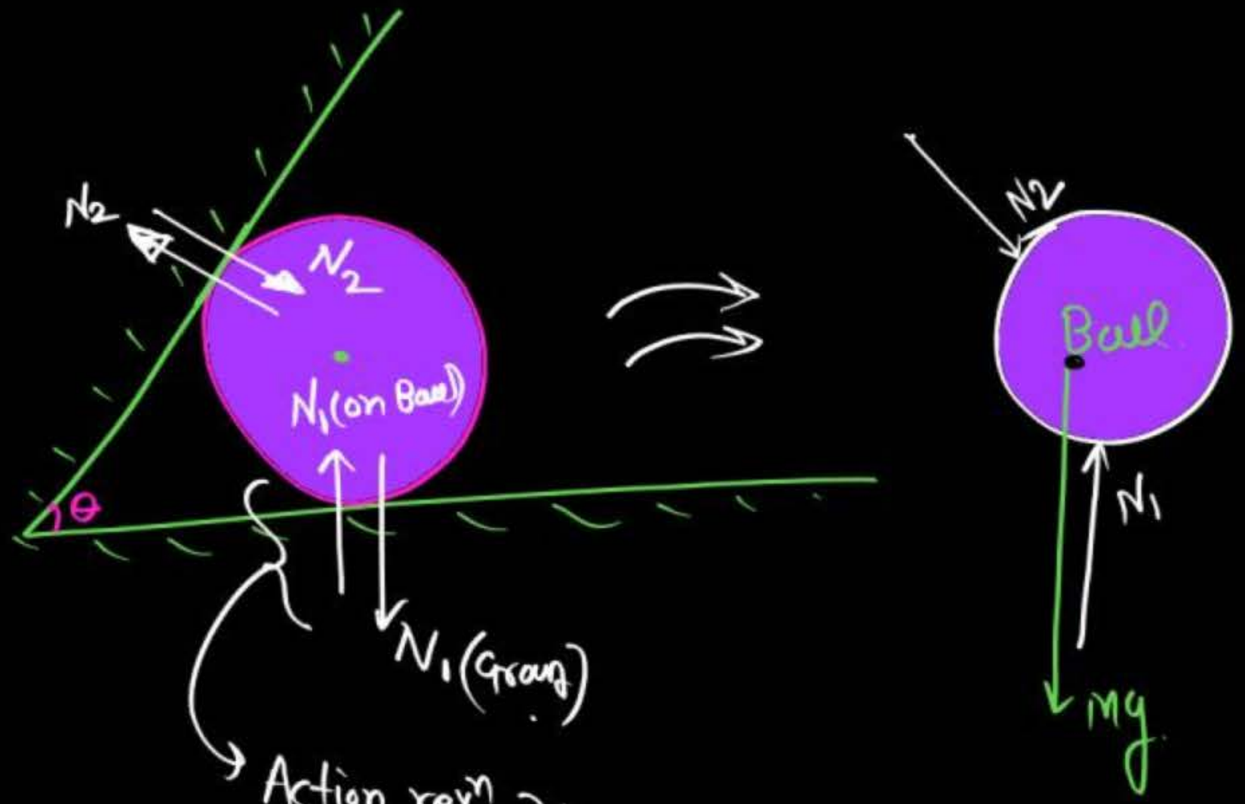
mRK Bey.

Normal ka ek hi naam
1 contact पर 2 line ho
hamara.

#

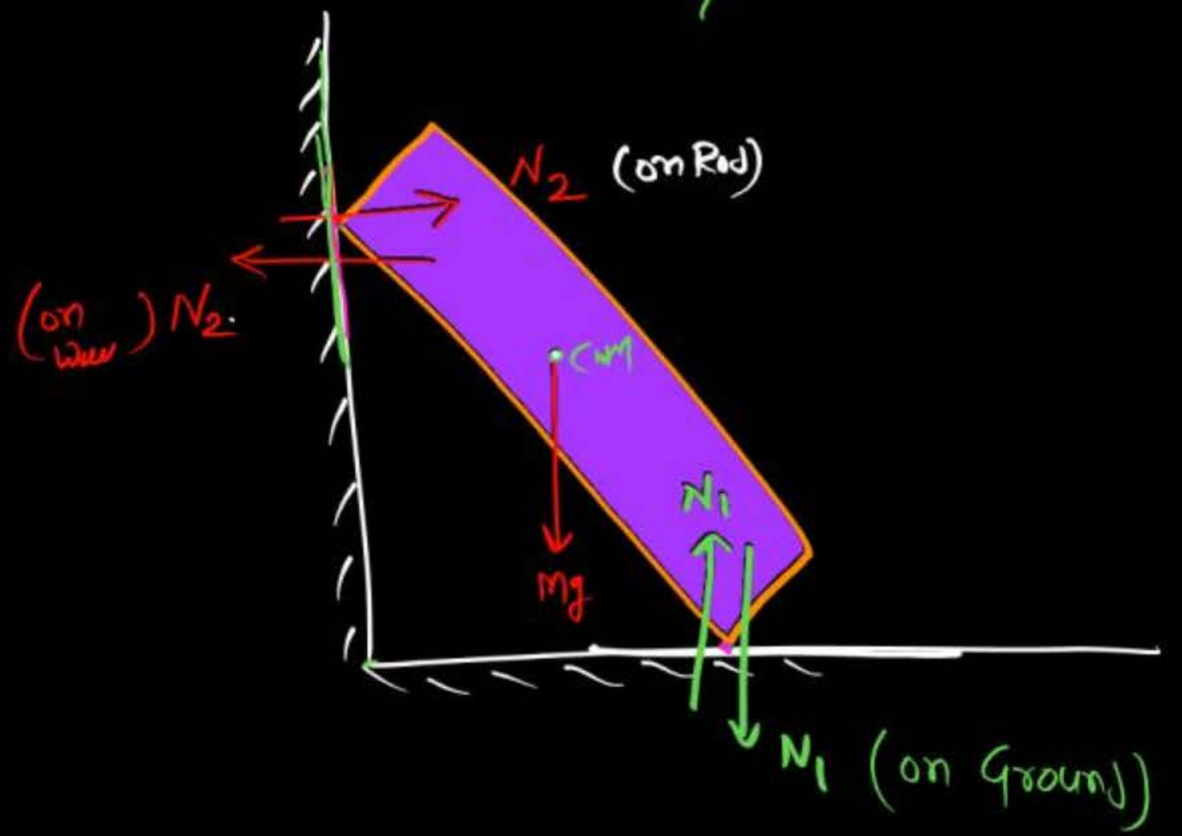


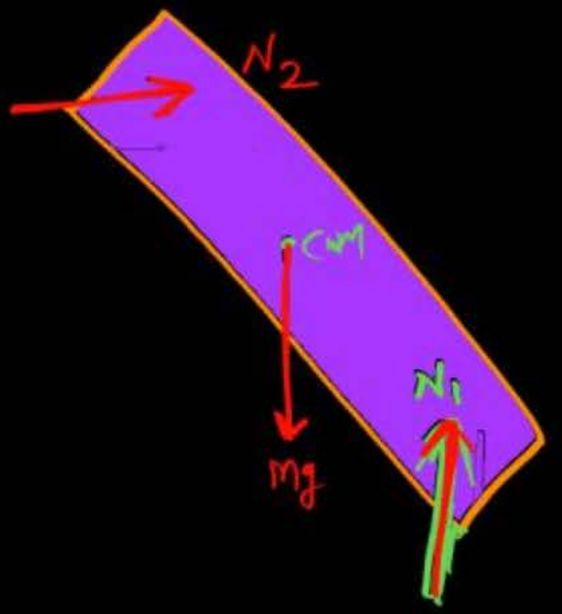



N_2
N_2
N_1(on Ball)
θ
N_1(Ground)
Action rexn Pair
hai

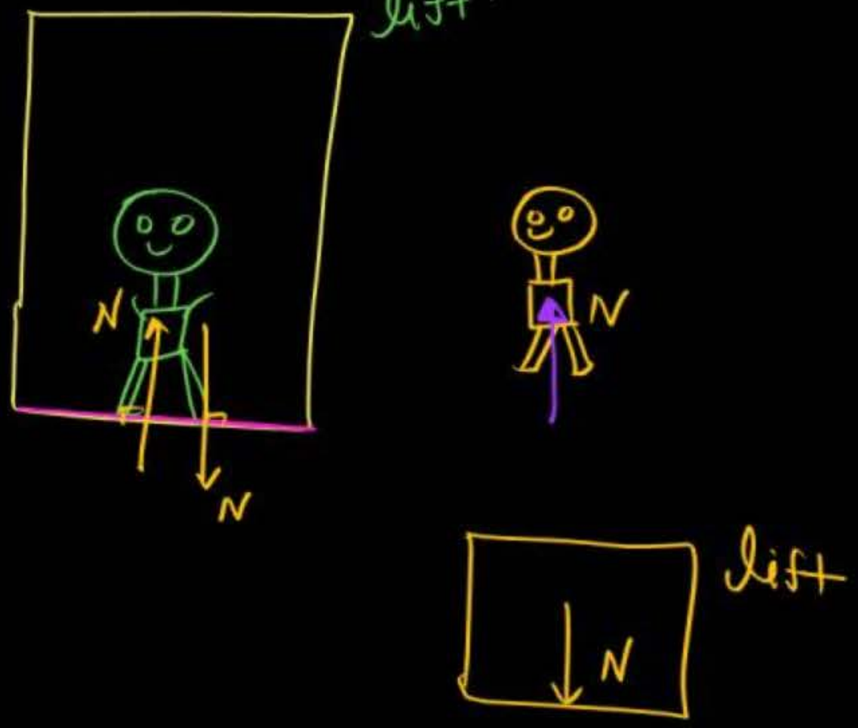
N_2
Ball
N_1
mg

FBD



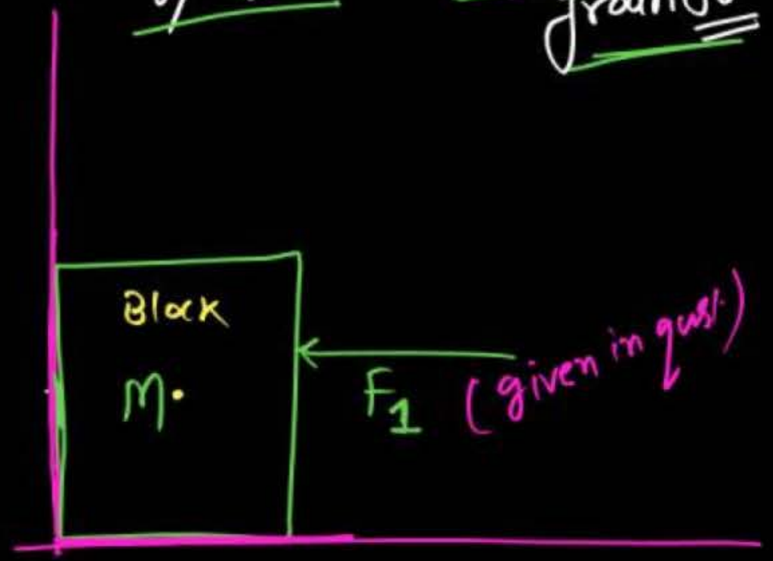


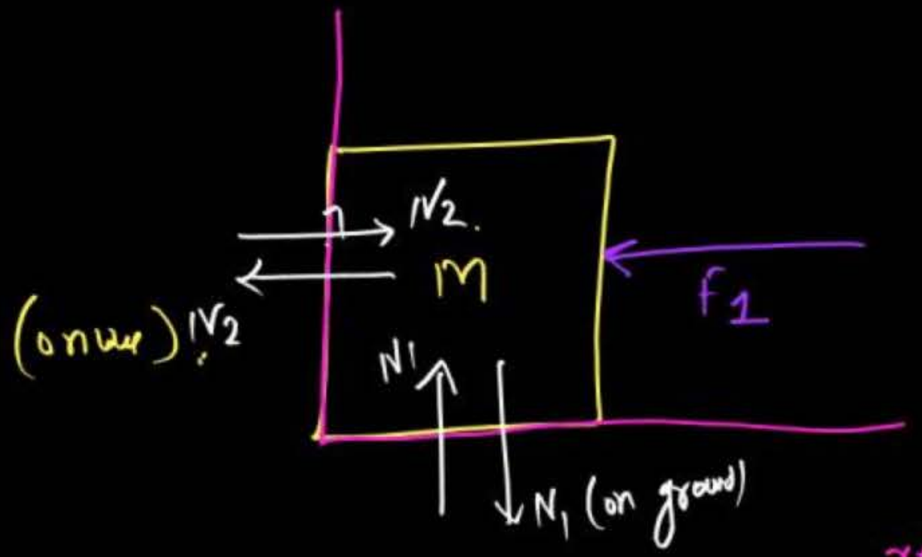
Dirn of Normal on man & lift



Dono foot ko ek man liya

Find Normal rex^n applied by Block on wall & ground.



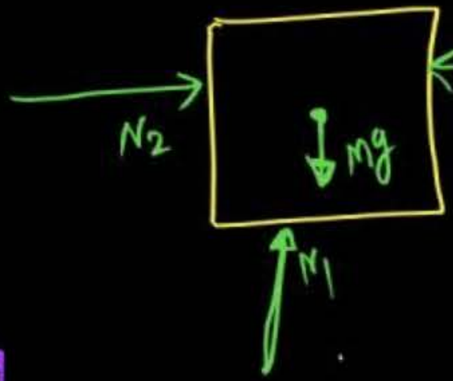


rest → $(F_{net})_x = 0$

$F_1 = N_2$

$(F_{net})_y = 0$

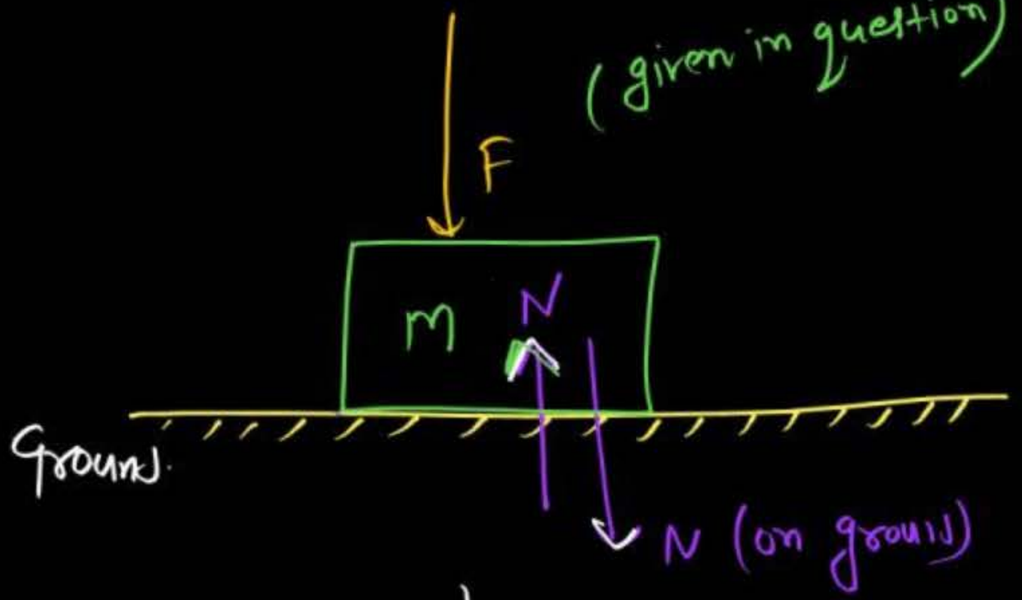
$my = N_1$

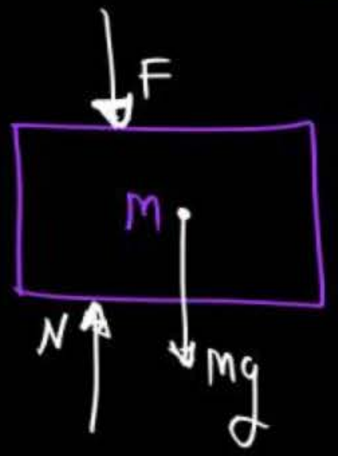


force on ground due to block $N_1 = mg$

force on Wall $= N_2 = F_1$

(2) Find Normal force b/w Block & ground



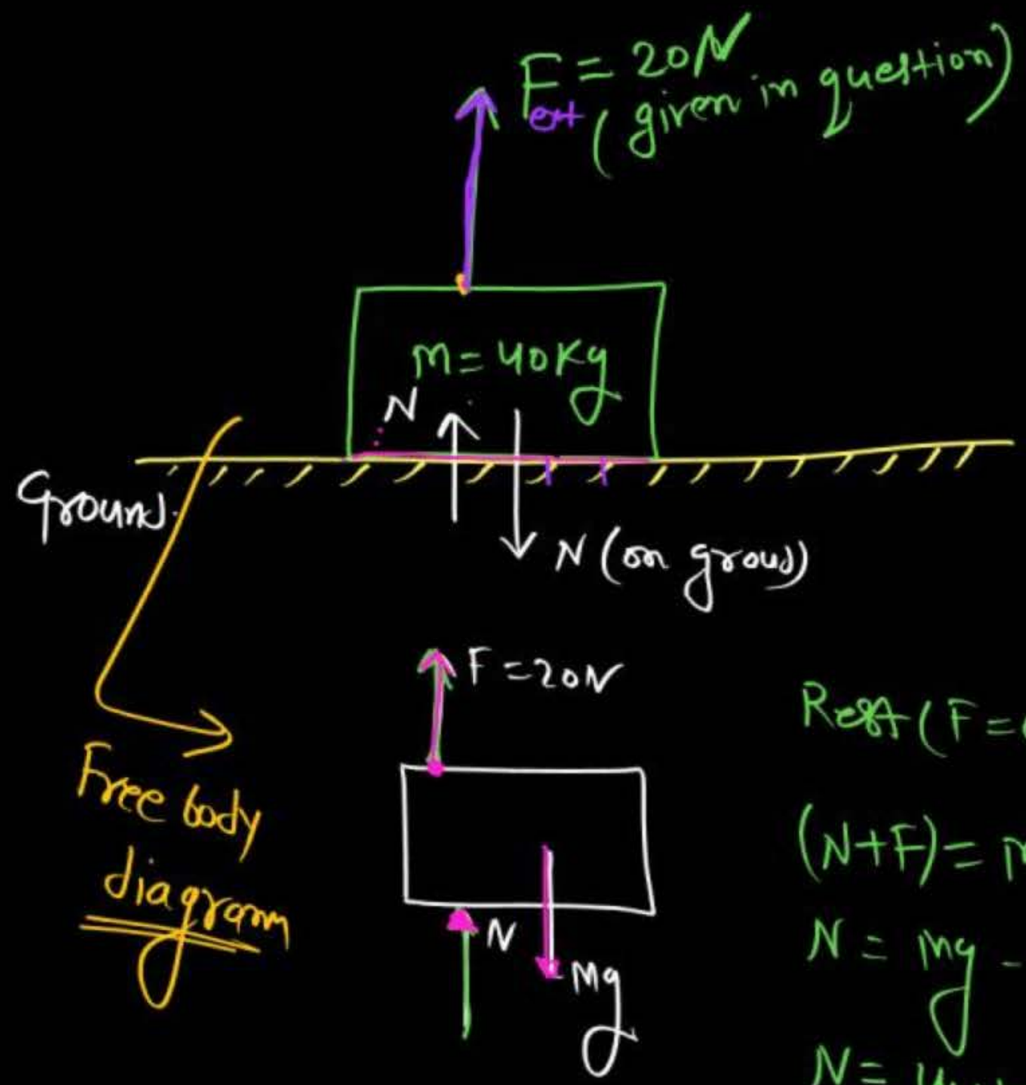


Rest → equilibrium ($F_{net} = 0$)

$F + mg = N$ (on block due to ground)

force applied by Block on ground = $N_{on\ ground} = F + mg$ (downward)

(Q) Find Normal force b/w Block & ground



Rest ($F = 0$)

$(N + F) = mg$

$N = mg - F$

$N = 40 \times 10 - 20 = 400 - 20 = 380\,N$

free body diagram (F.B.D)

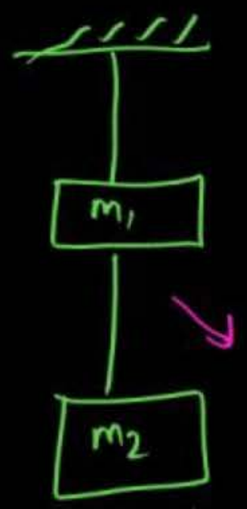
MR* Box:- for F.B.D

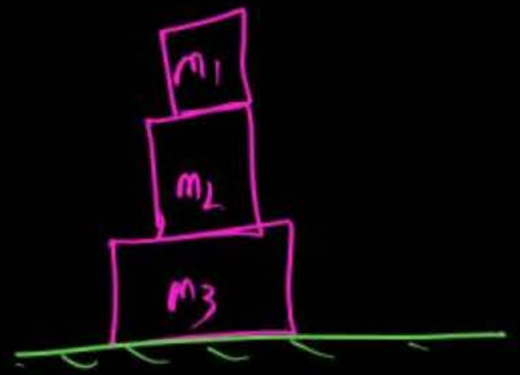
(1) Body ko system se separate kar lo.

(2) object (body) par kitne (no.) force kidhar (dirn) ke sath dekh lo

(3) sare force ko vector form me object par draw karo.

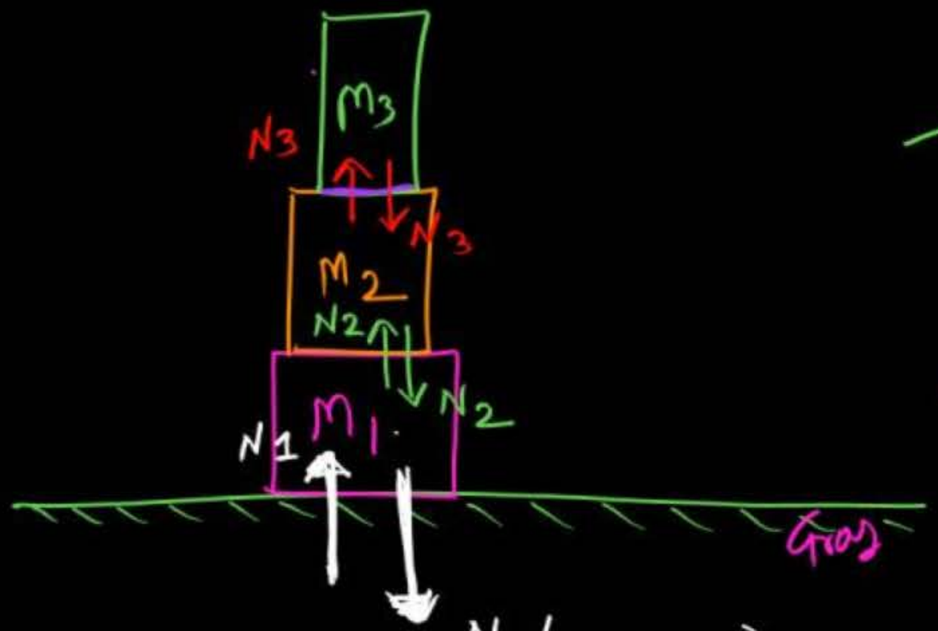
(4) Now apply laws of motion



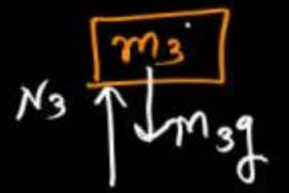


likho

#Likho

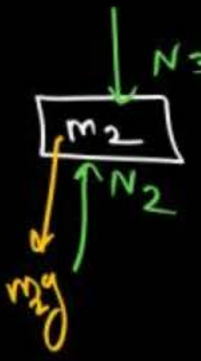


FBD of m_3



rest
$N_3 = m_3g$ — ①

FBD of m_2

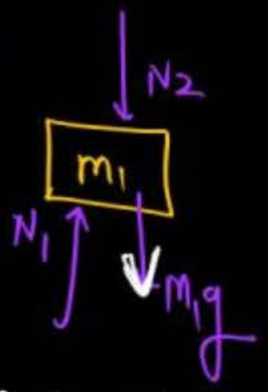


rest
$N_3 + m_2g = N_2$

$N_2 = N_3 + m_2g$

$N_2 = m_3g + m_2g$

$N_2 = (m_3 + m_2)g$



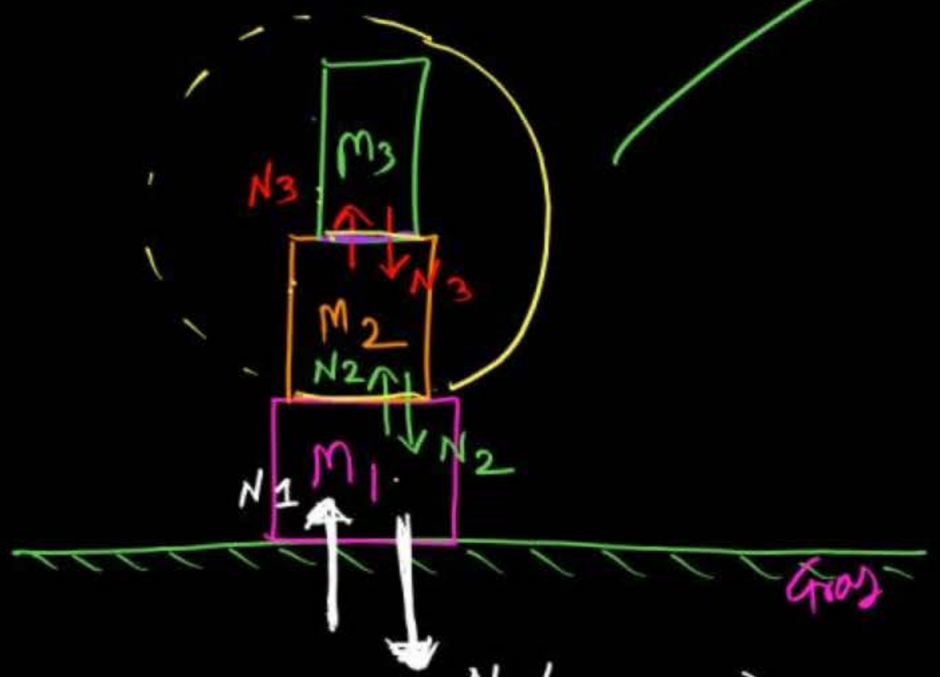
$F_y = 0$

$N_2 + m_1g = N_1$

$N_1 = (m_3 + m_2)g + m_1g$

on ground by m_1 $\Rightarrow N_1 = (m_1 + m_2 + m_3)g$

#Likho

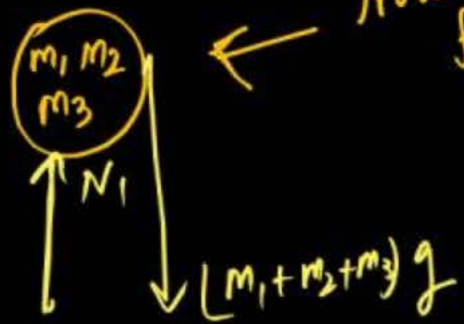


N_1 (on ground)

(MR Box)

Jab bhi 2 ya 3 object ko ek sath system assume karenge to unke bich ka Normal cancel hoga

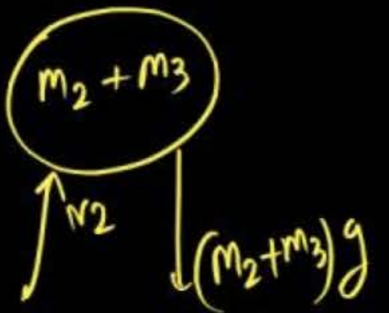
Combined F.B.D of m_1, m_2 & m_3.



Now contact force B/W m_1 & m_2 & m_3 will cancel

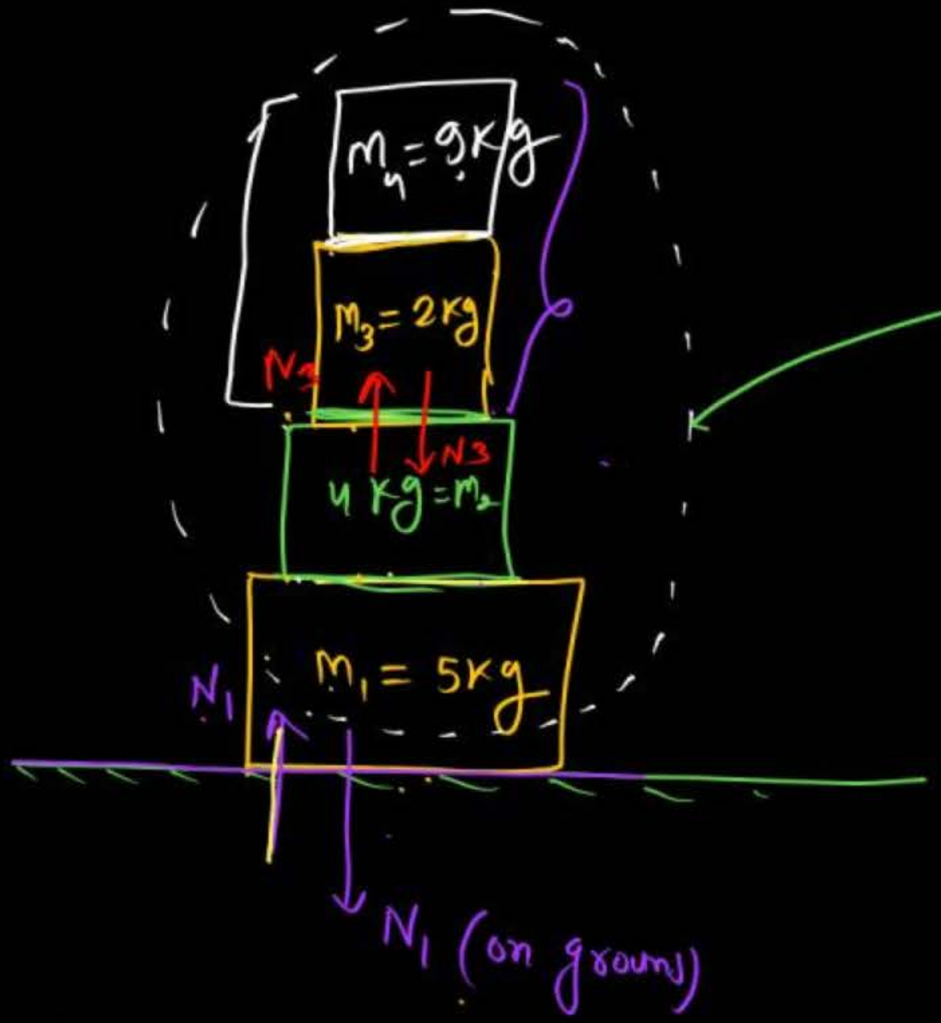
$N_1 = (m_1+m_2+m_3)g$ Ans

FBD of m_2 & m_3



$N_2 = (m_2+m_3)g$

(Q)



(I) find force on Ground by m_1.

$(m_1 + m_2 + m_3 + m_4)$

$N_1 = m_{net} g$
$= 20 \times 10$
$= 200\ N$

on ground $N_1 =$ **200 (downward)**

(II) force on m_2 & m_3

Combined F.B.D (m_3 & m_4)

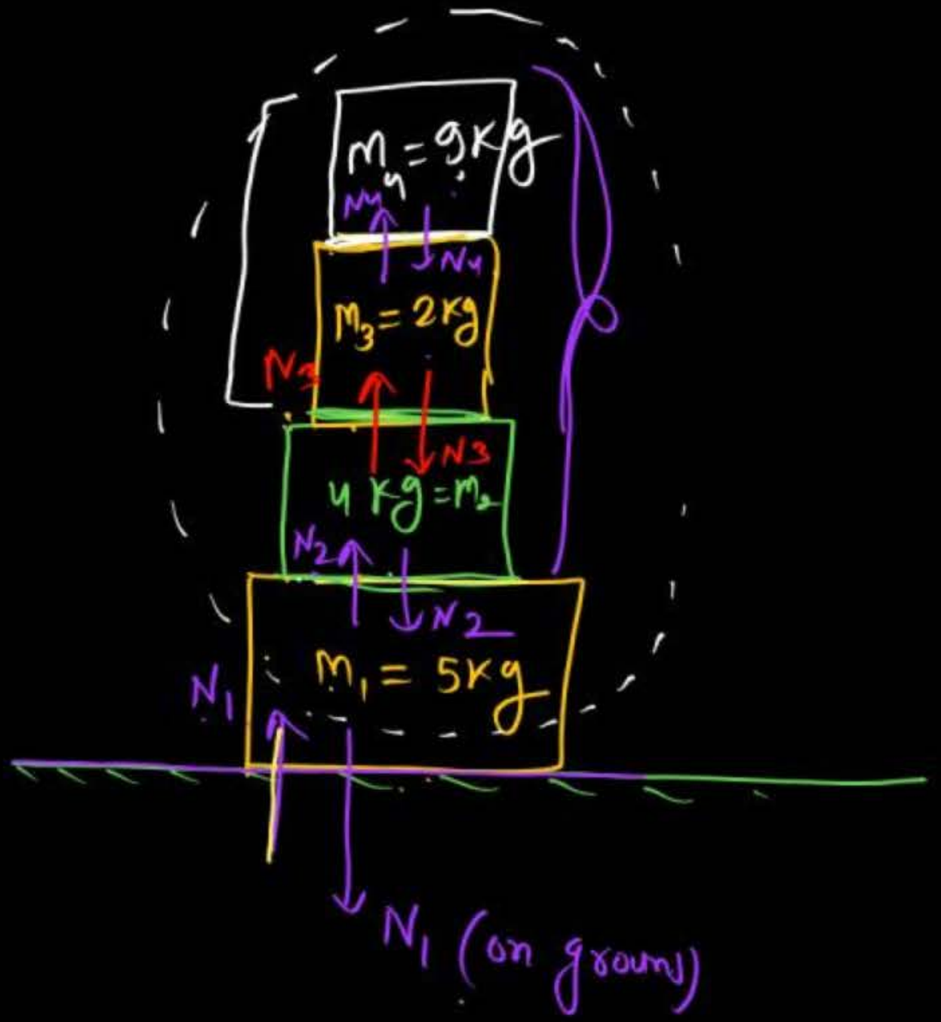
$N_3 = 110N$

(III) Normal B/W m_4 & m_3

$N_4 = 90N$

(IV) Normal B/W m_2 & m_1 ⇒ 150N

(2)



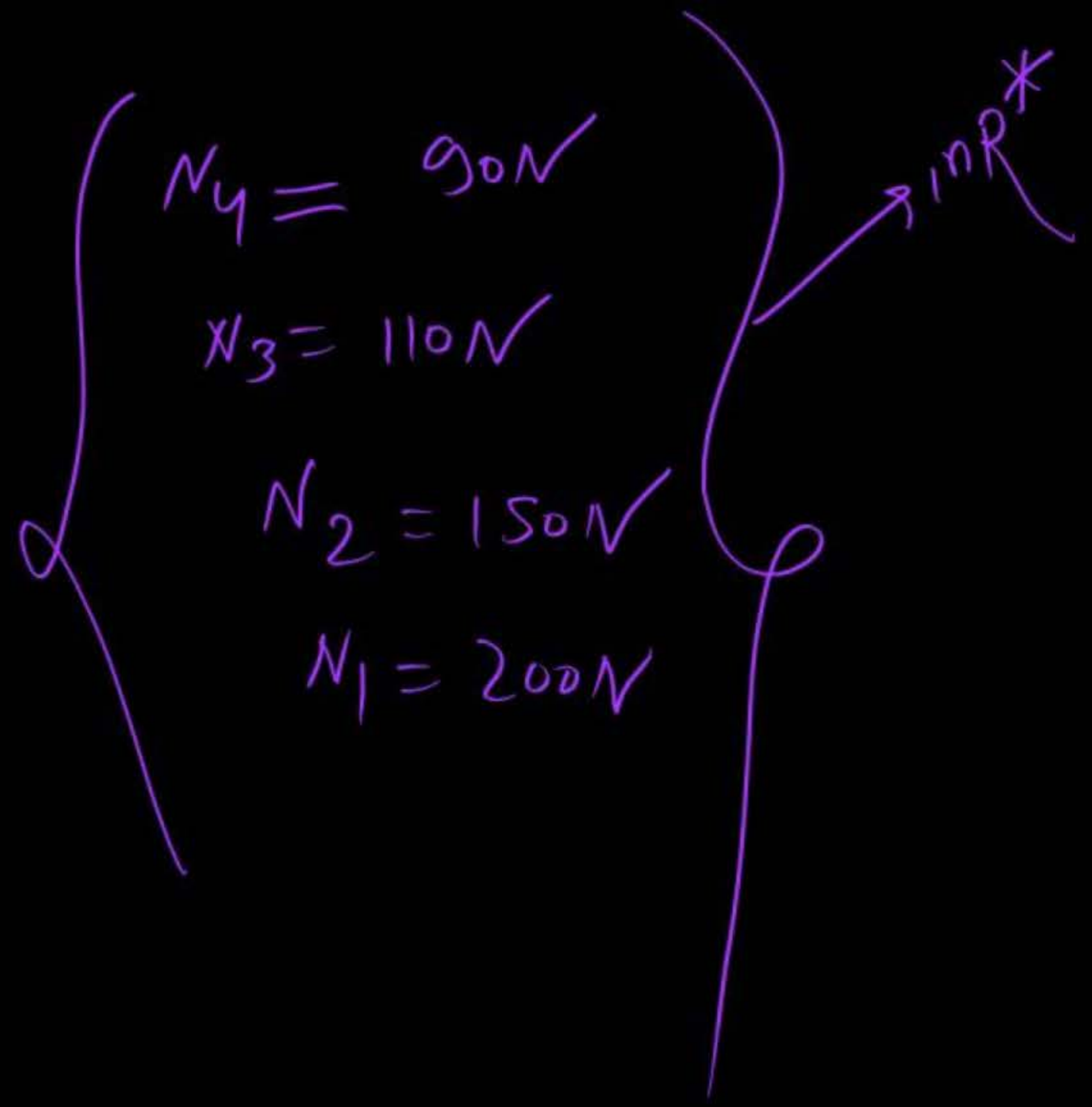
① find force on Ground by

$N_4 = 90N$

$N_3 = 110N$

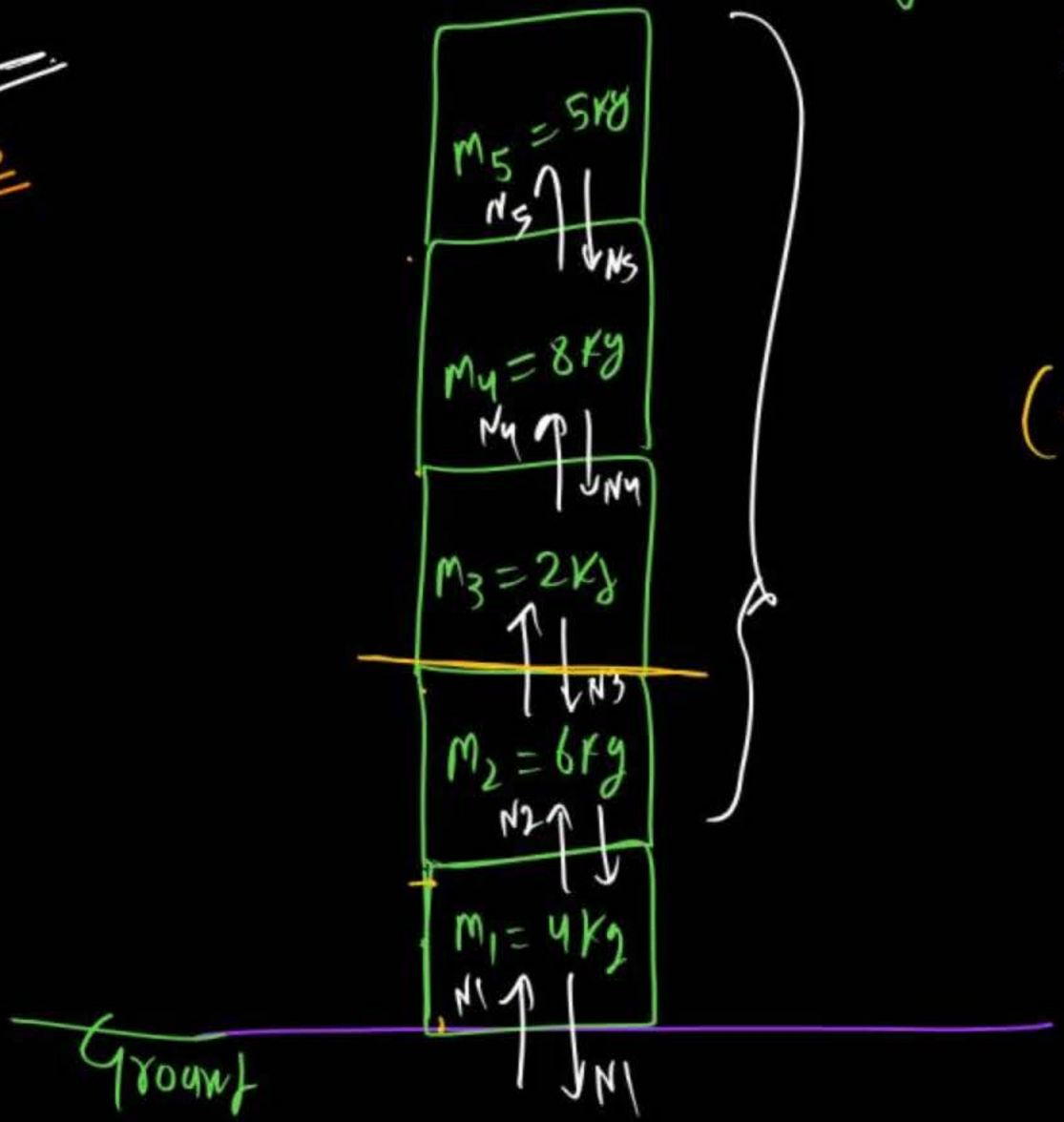
$N_2 = 150N$

$N_1 = 200N$



Q

likho



find N_1, N_2, N_3
N_4, N_5.

(force B/W m_3 & m_2)

$N_5 = 50N$

$N_4 = 130N$

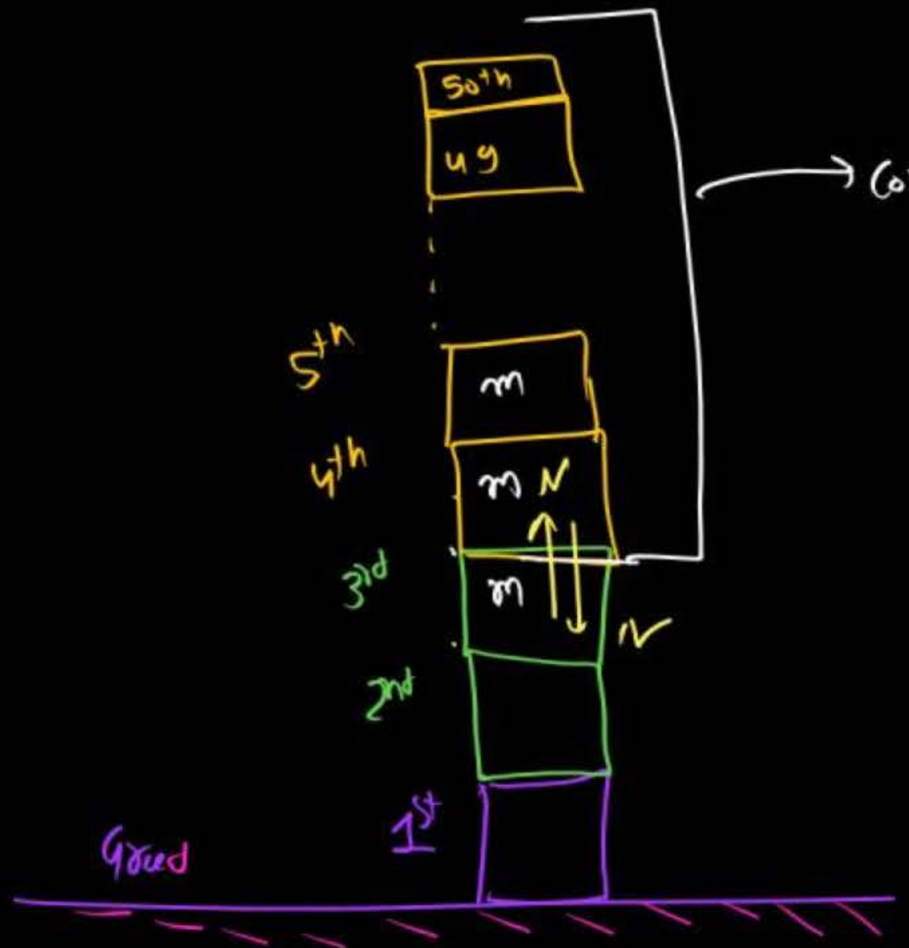
$N_3 = 150N$

$N_2 = 210N$

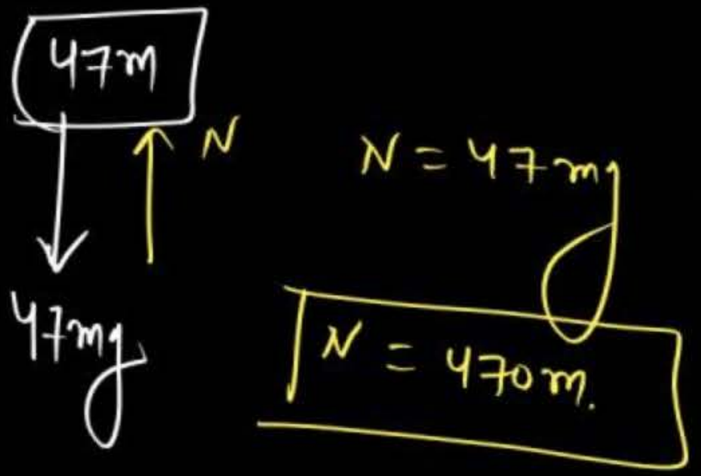
$N_1 = 250N$

@ JEE

50 Identical Box of mass m placed one over other then find contact force b/w 3rd & 4th Box.



→ Combiw F.B.D

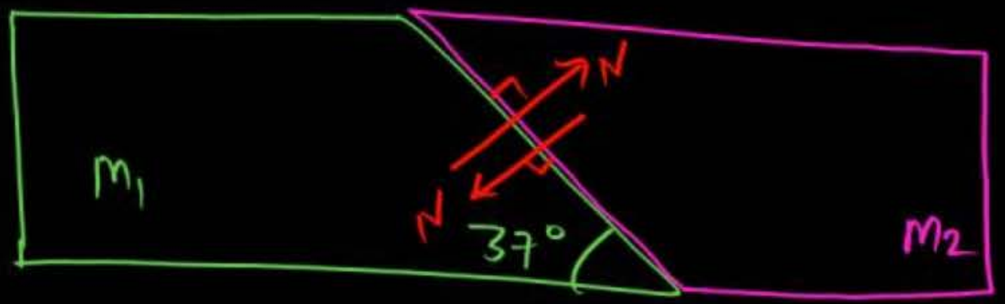


$N = 47mg$

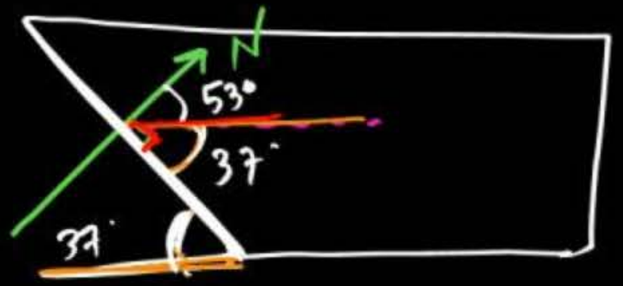
$N = 470m.$

Answer

dirⁿ of Contact force B/W m_1 & m_2 from Horizontal ??



53° from Horizontal



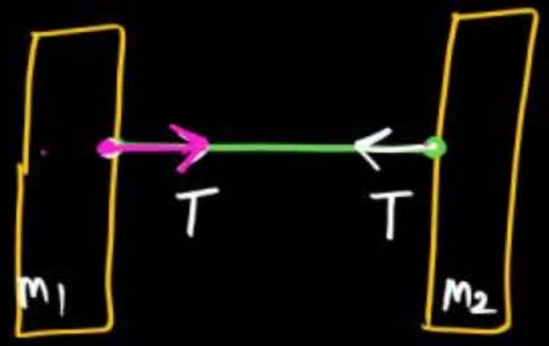
Tension force

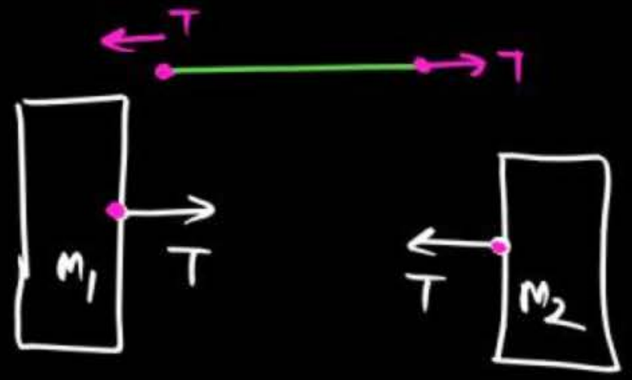
↳ It act away from contact Point along length of string.

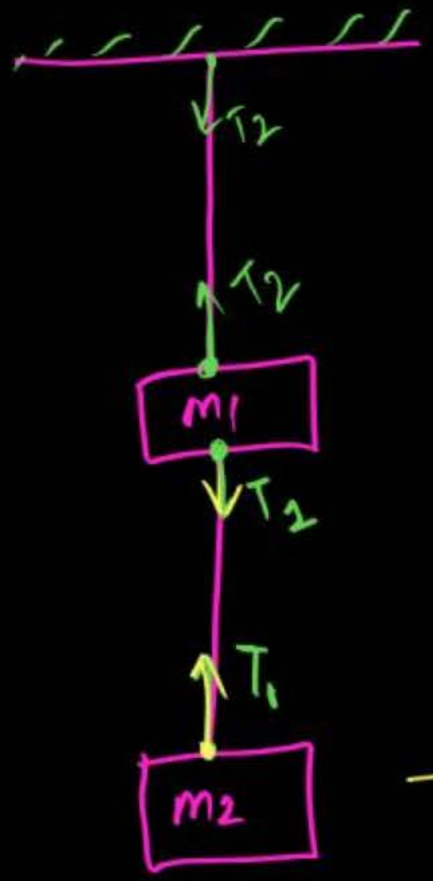
↳ In massless string Tension same b/w two contact Point → Mass wale string me har Point pe tension same ya diff^{n} ho skta hai.

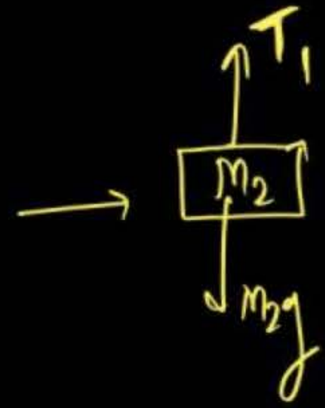
MRX Box

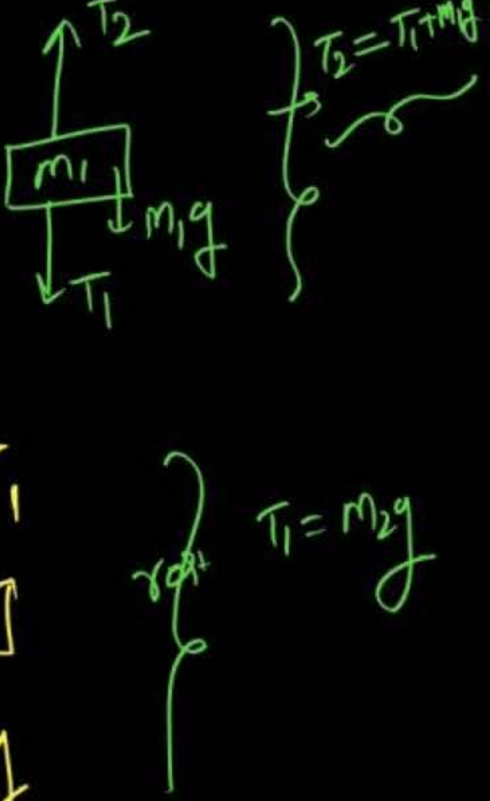
⇒ Contact Point par baith ke string ke along chhaata (लाता) khol lo.

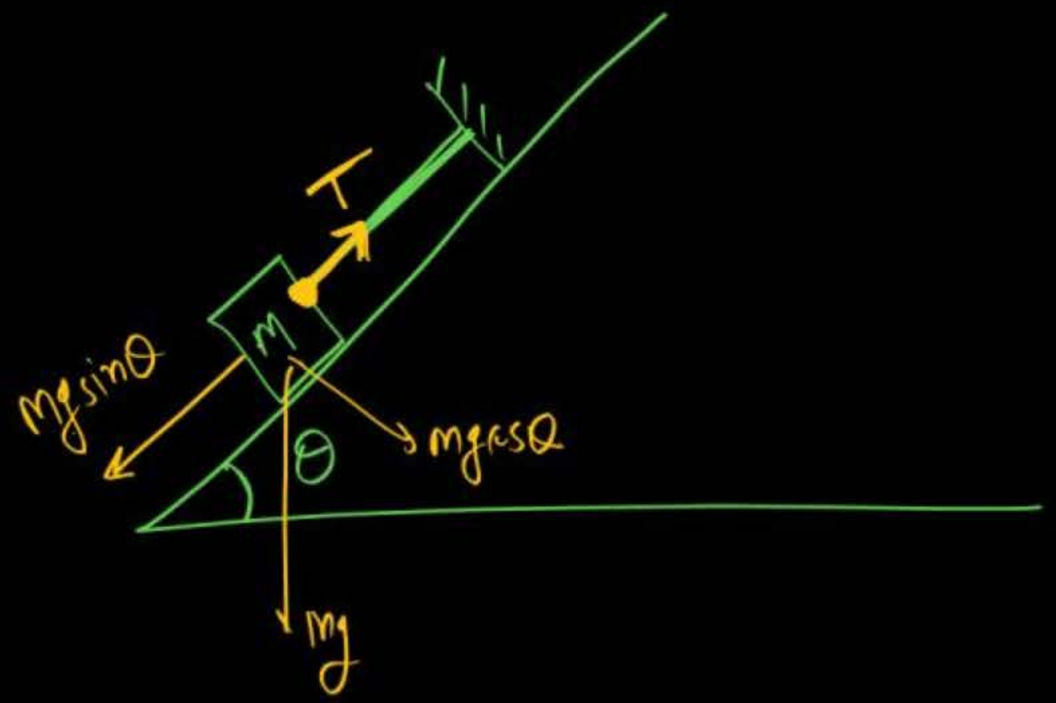

T
T
m_1
m_2


T
T
m_1
T
T
m_2


T_2
T_2
m_1
T_2
T_1
m_2

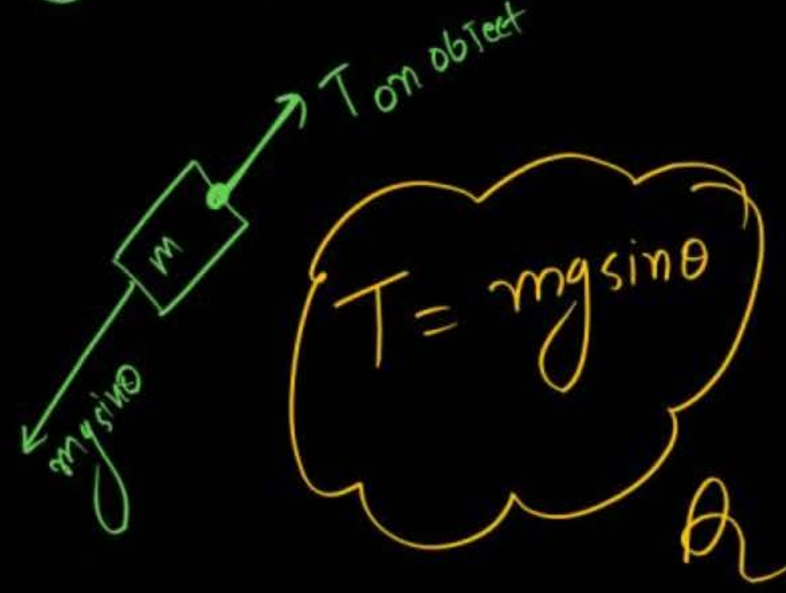

T_1
m_2
m_2g

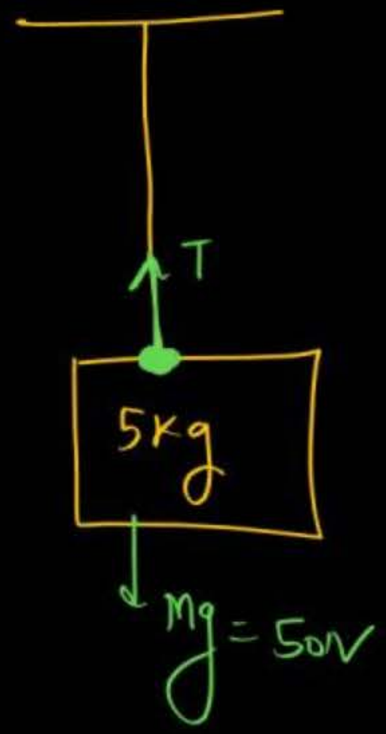

T_2
m_1
m_1g
T_1
$T_2 = T_1 + m_1g$
$T_1 = m_2g$



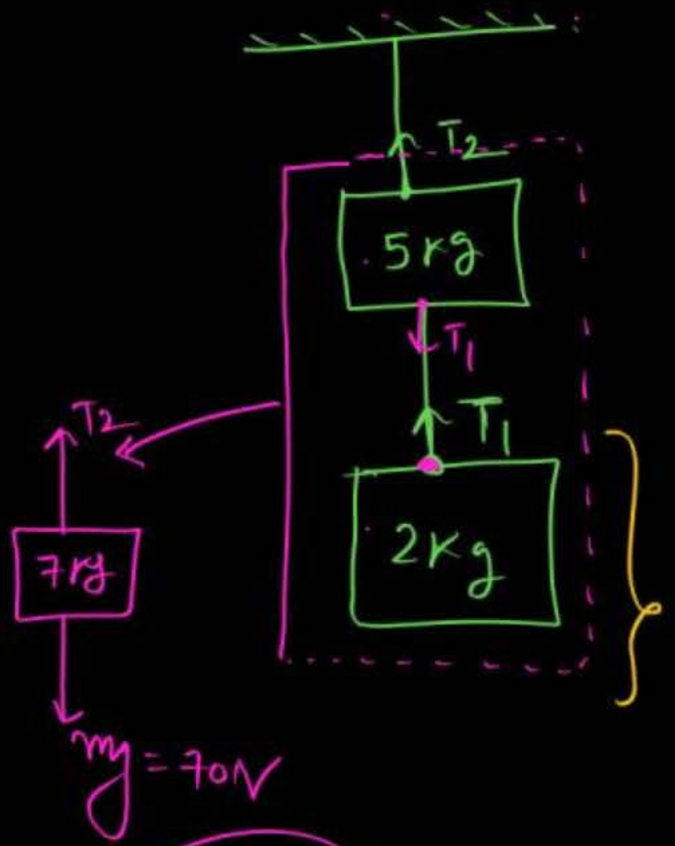
Find Tension in string.

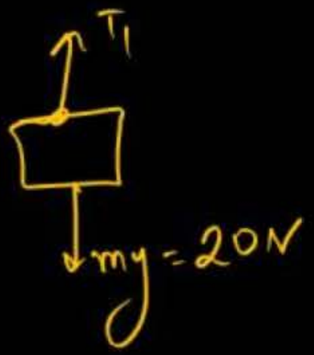
along Inclined Plane
Net force = zero



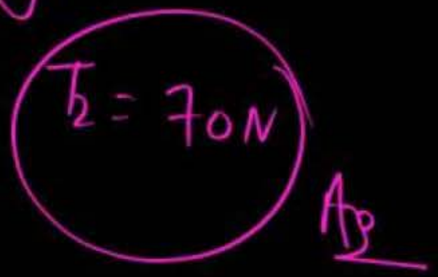


T = 50N

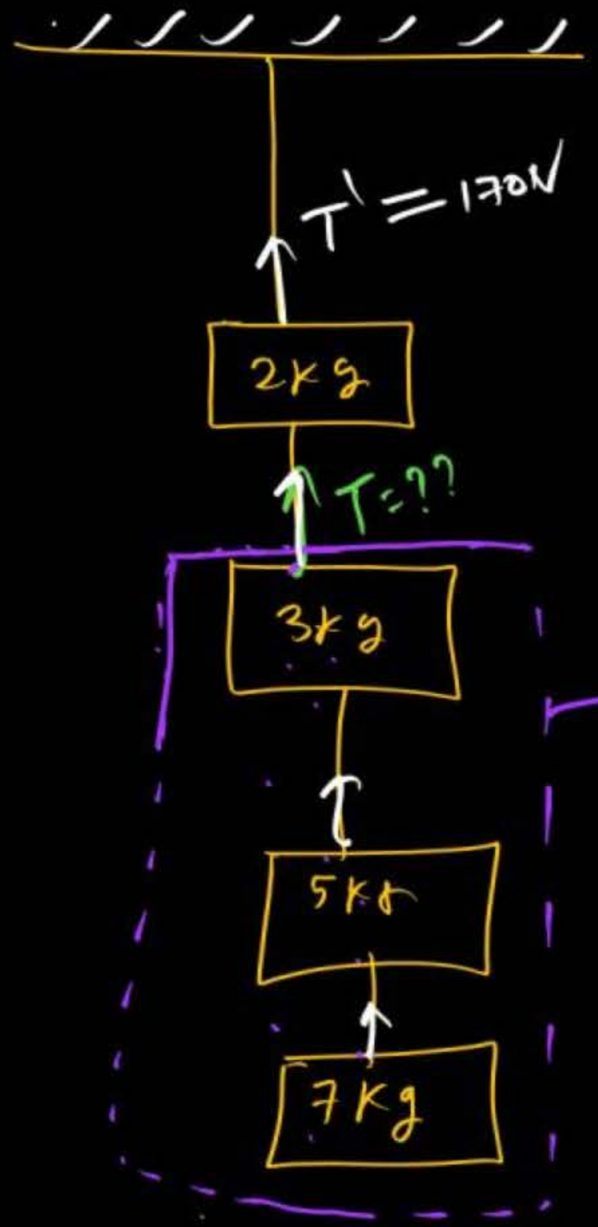


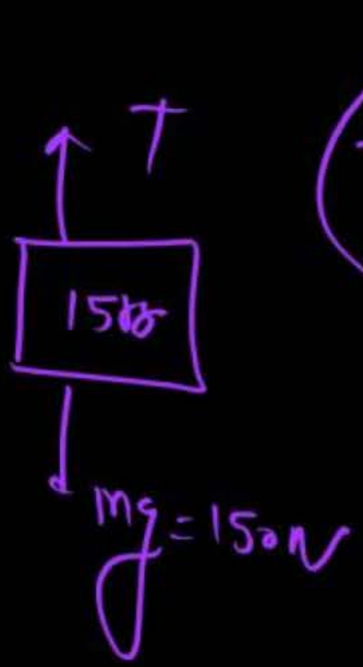


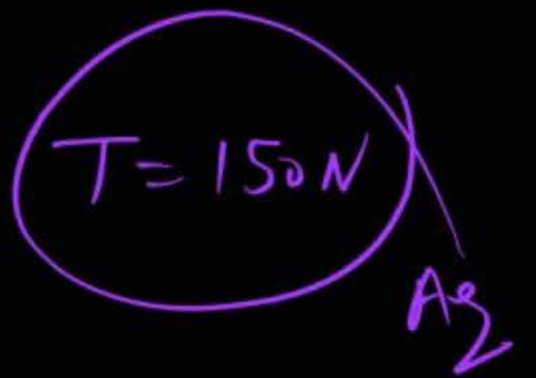
$T_1 = 20N$



A_2







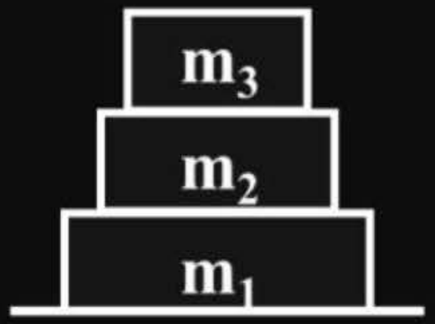
Mr. Box

Jitne object ko ek sath F.B.D (system) maneya

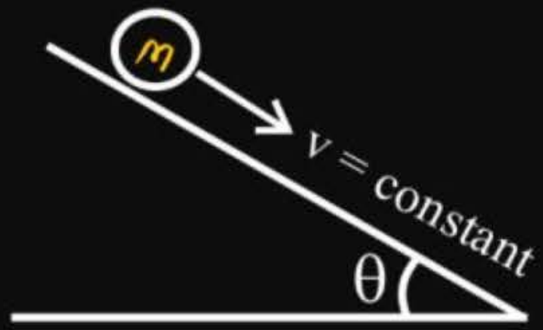
Unke bich ke sirf Tension Cancel hoga

H/W

(1) find net force on m_2



(2) find net force on m.

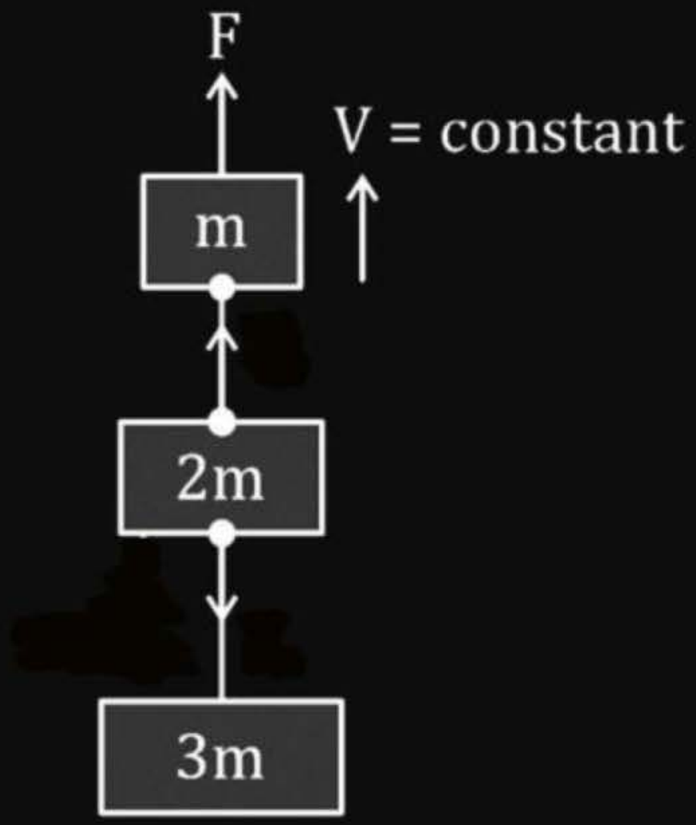


Question

Find net force on 2m.

[NEET-2013]

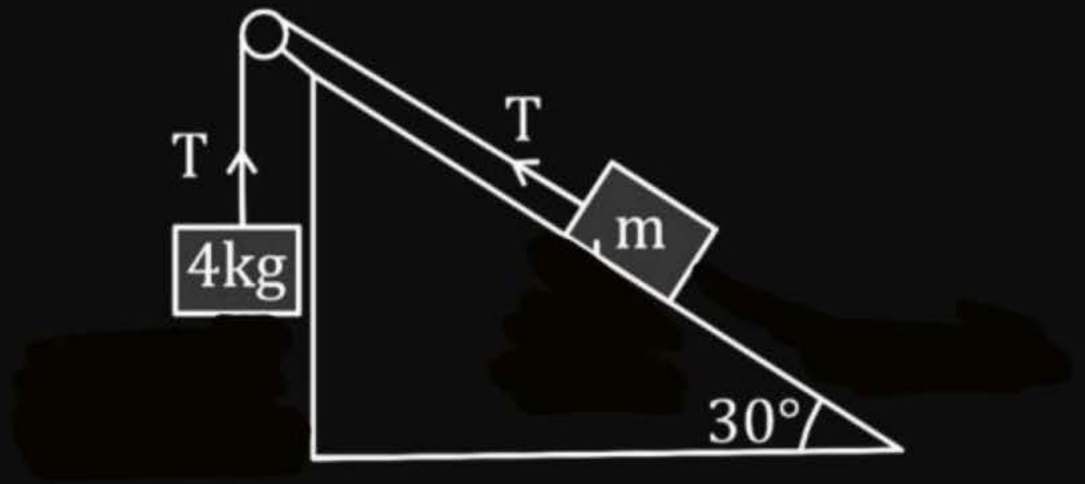
(3)



Question

If system is in equilibrium then find value of m.

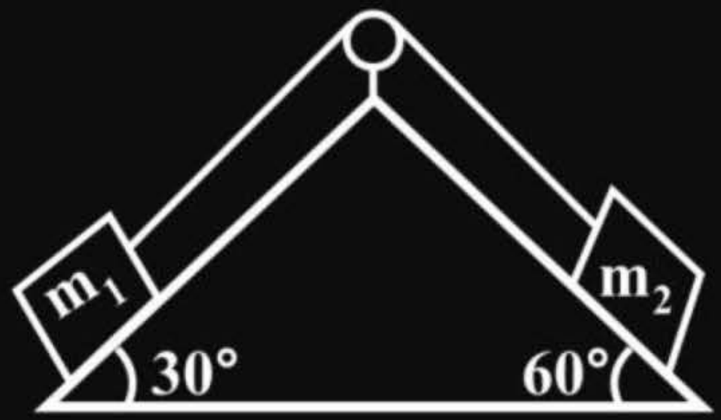
(4)



Question

Find relation between m_1 and m_2 so that system is in equilibrium.

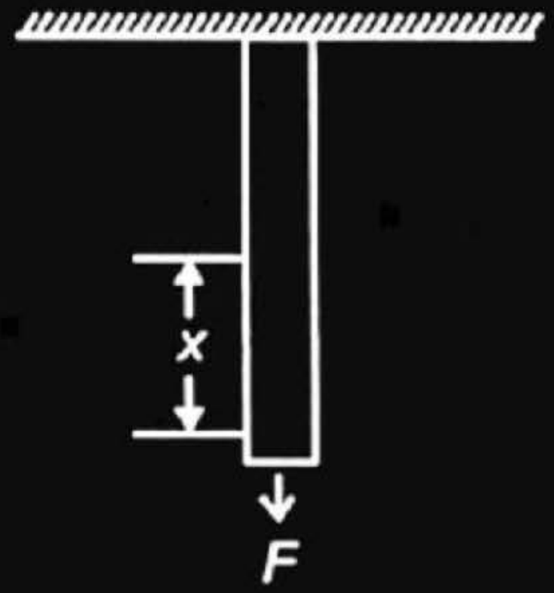
(5)



Question

6 A vertical force F is applied at one end of a uniform rope of mass M and length L. Find out tension in the rope as a function of x.

1. $F + Mg$
2. $F + \frac{MgL}{x}$
3. $\frac{FL + Mgx}{L}$
4. $\frac{Fx + MgL}{L}$

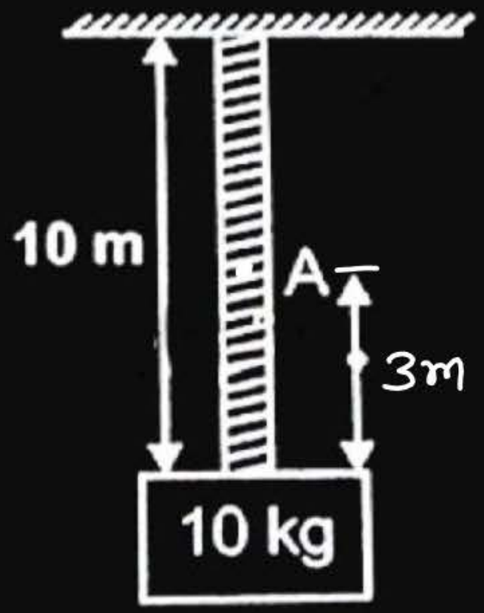


Question

7

The adjoining figure shows a block of mass 10 kg connected to free end of a rope of mass 10 kg and length 10 m. The tension of the rope at point A is: (g = 10 m/s^2)

1. 170 N
2. 30 N
3. 130 N
4. 70 N



7 → question of HOME-WORK

Must Try.

THANK YOU

maha-manthan of Motion in Plane