

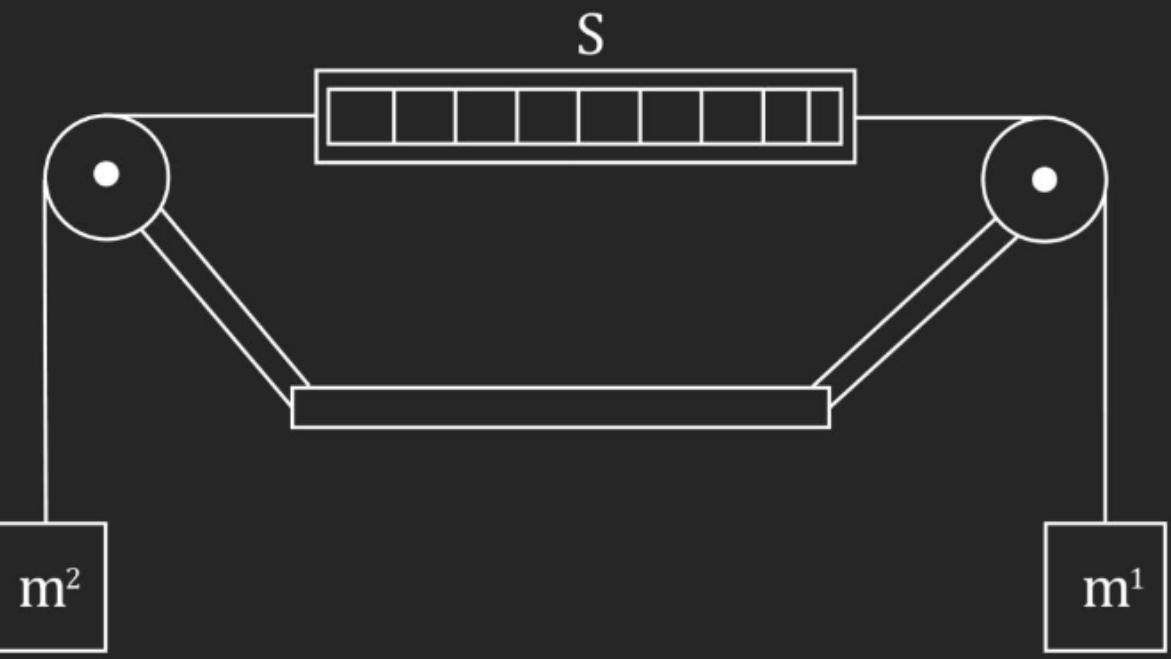
Law of Motion

H-W

Q.2 In the arrangement shown, the pulleys are fixed and ideal, the strings are light. $m_1 > m_2$ and S is a spring balance which is itself massless. The reading of S (in unit of mass) is :

- (A) $(m_1 - m_2)g$
- (B) $\frac{1}{2}(m_1 - m_2)g$
- (C) $\frac{m_1 m_2}{m_1 + m_2} g$
- (D) $\frac{2m_1 m_2}{m_1 + m_2} g$

✓



Law of Motion

Q.3

A bead of mass m is attached to one end of a spring of natural length R and spring constant $K = (\sqrt{3} + 1)mg/R$. The other end of the spring is fixed at a point A on a smooth vertical ring of radius R as shown in the figure. The normal reaction at B just after it is released to move is:

- (A) $mg/2$
- (B) $\sqrt{3}mg$ ✓
- (C) $3\sqrt{3}mg$
- (D) $3\sqrt{3}mg/2$

Let, x be elongation in the spring. $x = (l_f - l_0)$

$$N = Kx \cos 30^\circ \quad | \quad x = (\sqrt{3}R - R)$$

$$N = \left(\frac{Kx}{2} \sqrt{3} \right) \quad | \quad x = (\sqrt{3}-1)R$$

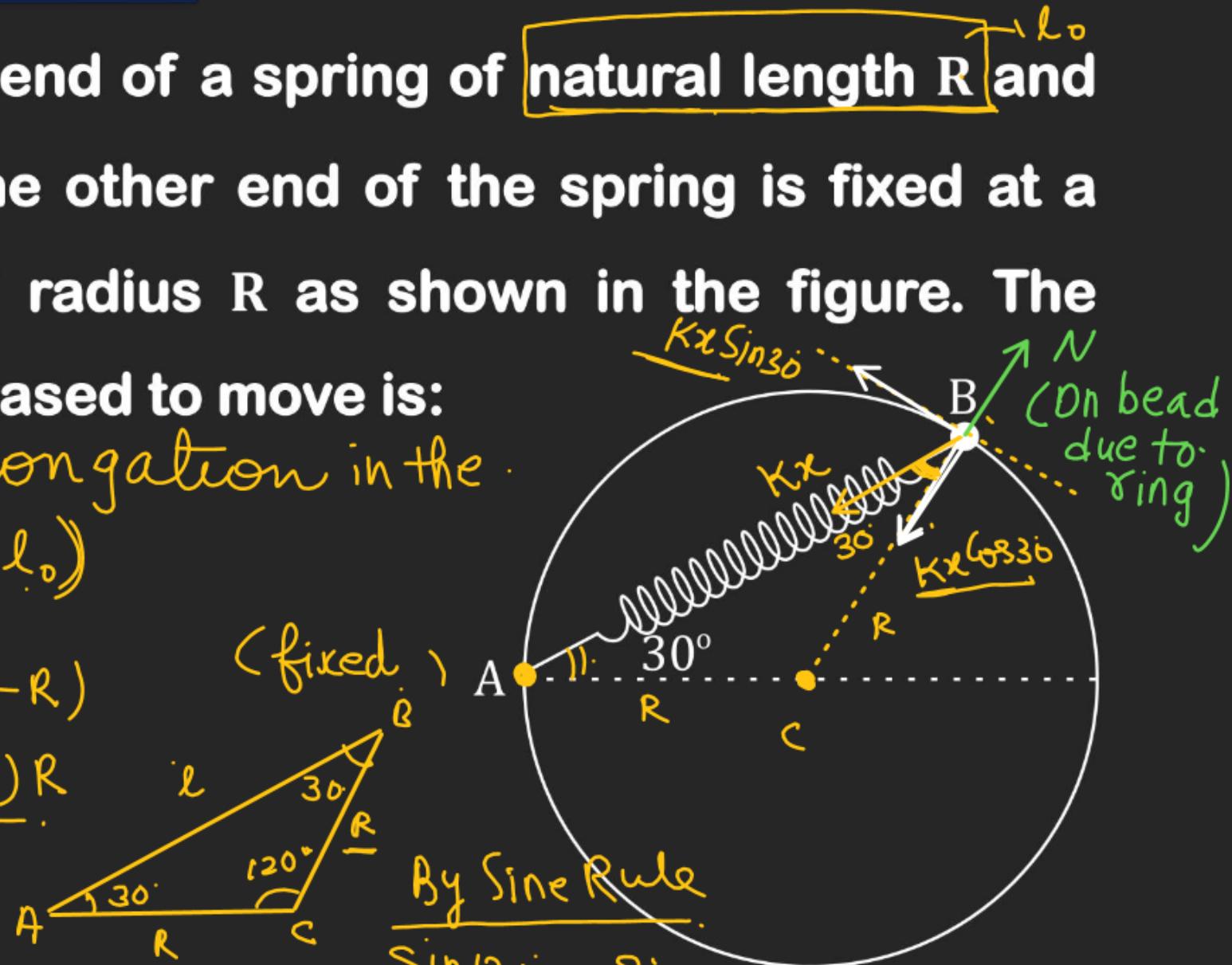
$$N = \left(\frac{\sqrt{3}}{2} \right) (\sqrt{3}-1)R \times (\sqrt{3}+1) \frac{mg}{R}$$

$$N = \frac{\sqrt{3}mg}{2} \left[(\sqrt{3})^2 - (1)^2 \right] = \underline{\underline{\sqrt{3}mg}}$$

By Sine Rule

$$\frac{\sin 120^\circ}{l} = \frac{\sin 30^\circ}{R}$$

$$l = \frac{R \sin 120^\circ}{\sin 30^\circ} = \frac{R(\sqrt{3}/2)}{1/2} = \underline{\underline{\sqrt{3}R}}$$



Law of Motion

H.W

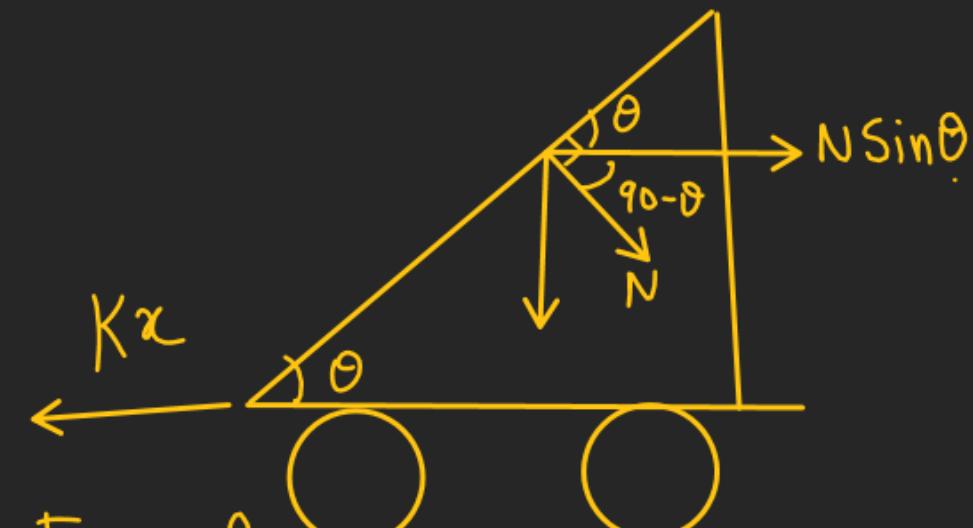
Q.4 Block B has a mass m and is released from rest when it is on top of wedge A, which has a mass $3m$. Determine the extension of the spring of force constant k while B is sliding down on A. Neglect friction :

(A) $2mg\cos\theta/k$

(B) $\frac{mg}{2k} \cos\theta$

(C) $\frac{mg}{2k} \sin 2\theta$

(D) $mgsin 2\theta/k$

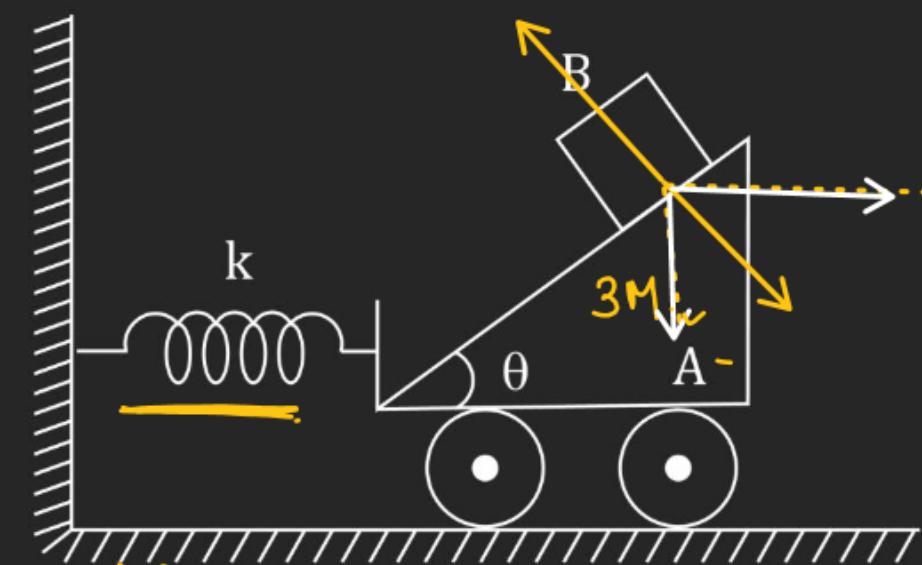


Equilibrium of trolley in

$$0 = \frac{mg}{2k} (2\sin\theta\cos\theta)x - \text{direction}$$

$$Ns\sin\theta = Kx \quad \text{(1)}$$

$$Mg\cos\theta \cdot \sin\theta = Kx$$



$N = mg\cos\theta$ \downarrow
 only true.
 When trolley
 at rest.
 Possible for
 maximum
 elongation.

Law of Motion

H.W.

Q.6

The block shown in the figure is in equilibrium. Find the acceleration of the block just after the string burns :

(A) $\frac{3g}{5}$

(B) $\frac{4g}{5}$

(C) $\frac{4g}{3}$ ✓

(D) $\frac{3g}{4}$

$$Kx = \left(\frac{Mg}{\cos 53^\circ} \right)$$



For block to be in equilibrium

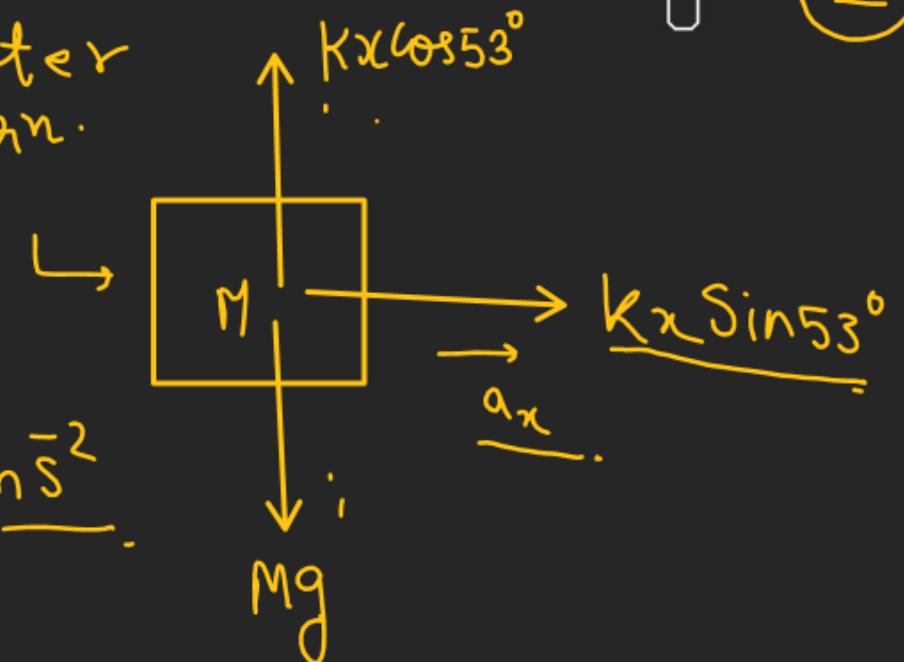
$$T = Kx \sin 53^\circ$$

$$Kx \cos 53^\circ = Mg$$

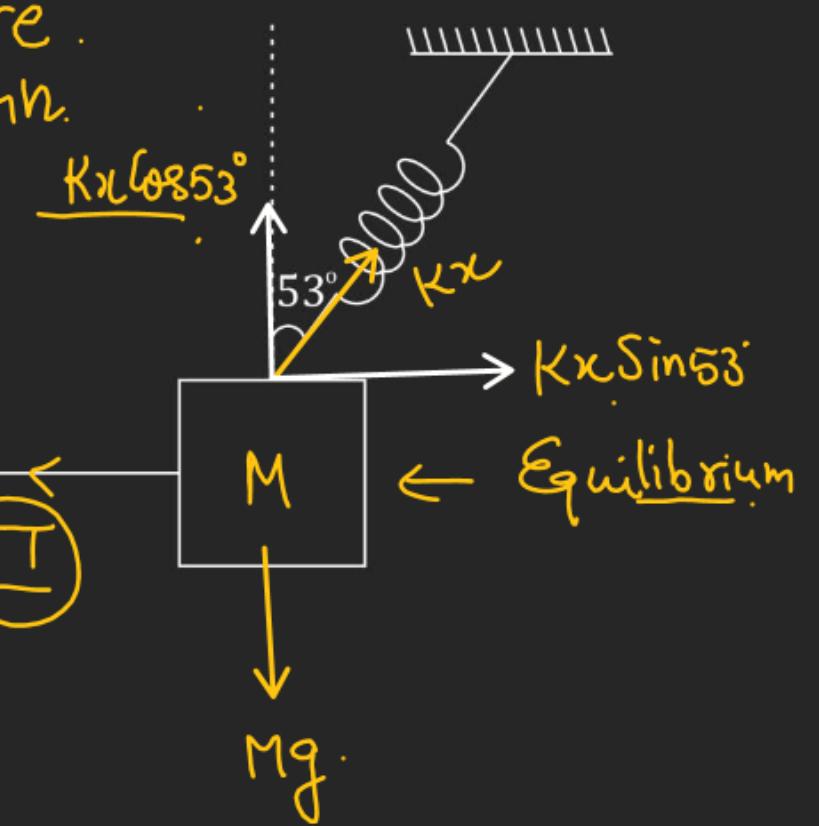
Just after string is burn.

$$a_x = \left(\frac{Kx \sin 53^\circ}{M} \right)$$

$$a_x = g \tan 53^\circ = \frac{4g}{3} m s^{-2}$$



Just before string is burn.



Law of Motion

H-W

Q.5

All surfaces shown in figure are smooth. System is released with the spring unstretched. In equilibrium, (compression) in the spring will be :

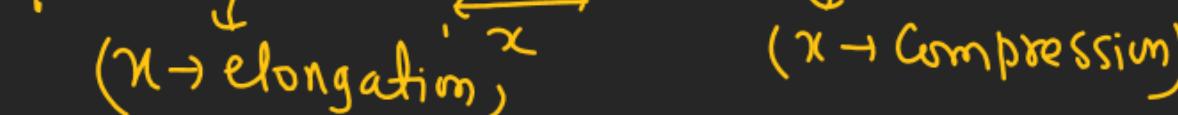
(A) $\frac{2mg}{k}$



(B) $\frac{(M+m)g}{\sqrt{2}k}$



(C) $\frac{mg}{\sqrt{2}k}$

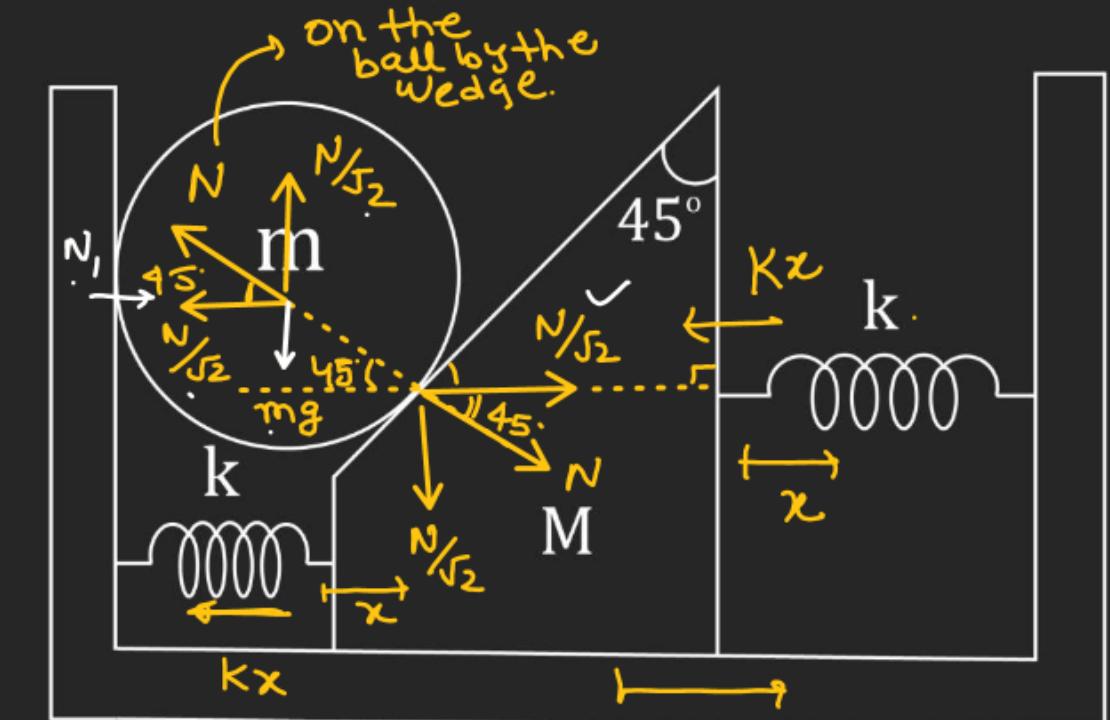


(D) $\frac{mg}{2k}$ ✓

F.B.D of Sphere

$$\frac{N}{\sqrt{2}} = mg$$

$$x = \frac{mg}{2K} \quad N = \frac{\sqrt{2}mg}{\sqrt{2}} \quad \text{--- (1)}$$



In x-direction x

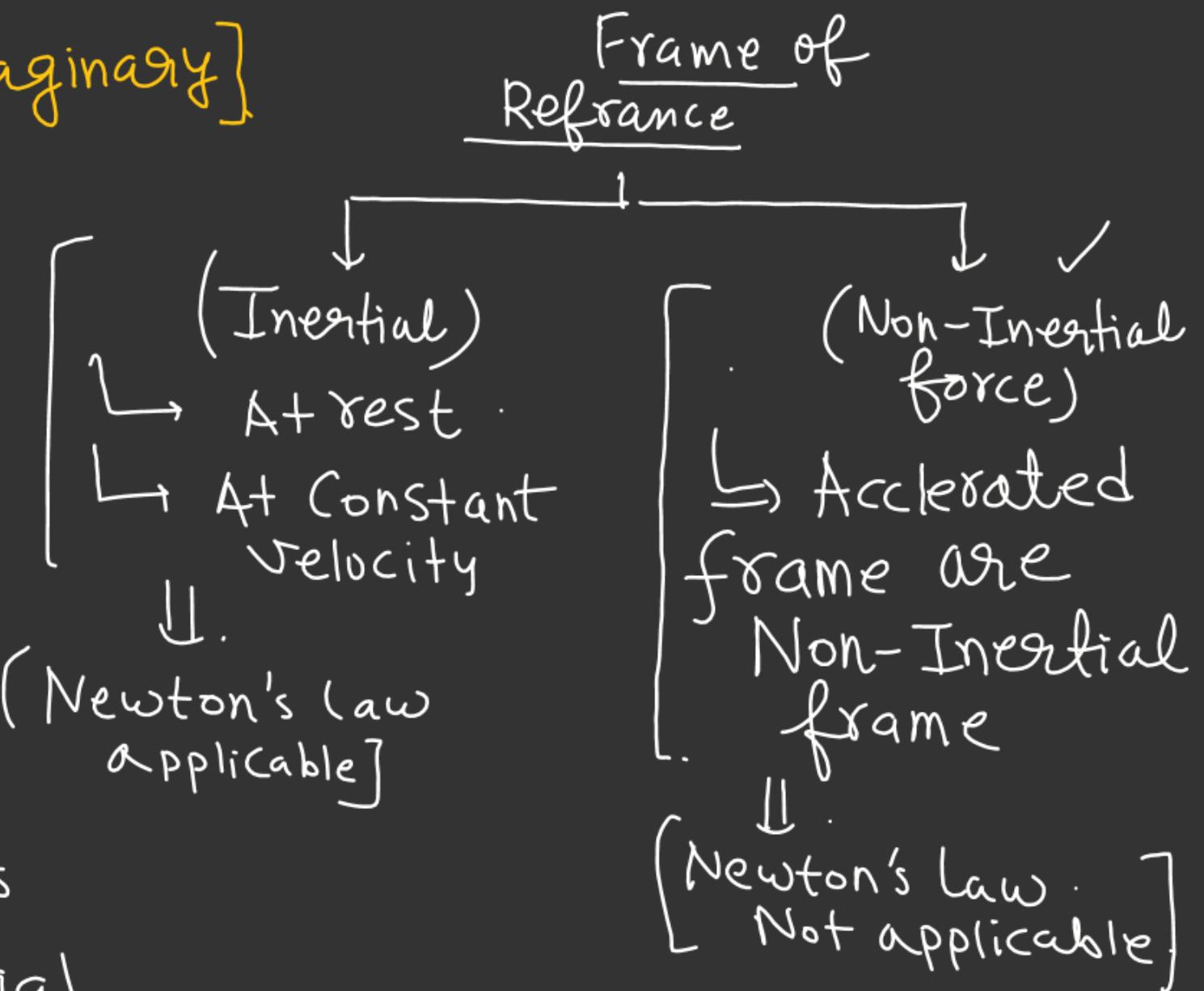
For Wedge

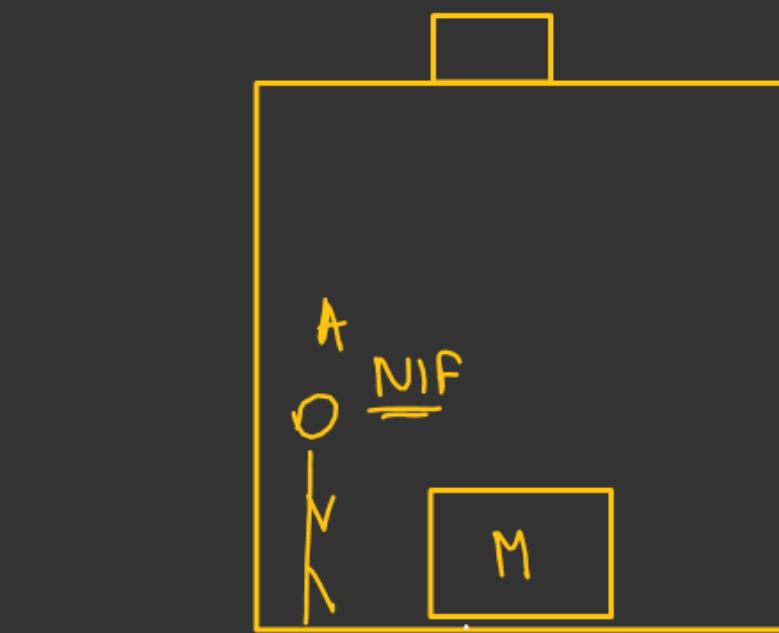
$$\frac{N}{\sqrt{2}} = 2Kx \quad \text{--- (2)}$$

(*) Concept of Pseudo force → ↳ सूझी → [Imaginary].

↳ Need of Pseudo force.

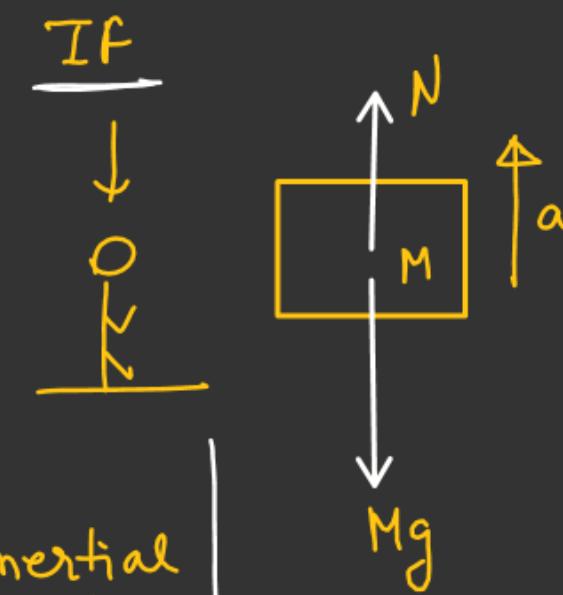
↳ In Non-Inertial frame Newton's law is not applicable. to make Newton's law applicable in Non-Inertial frame, we have to apply an imaginary force to the body, to make Newton's Law applicable in Non-Inertial frame.



Earth

$\text{NIF} \Rightarrow (\text{NonInertial frame})$

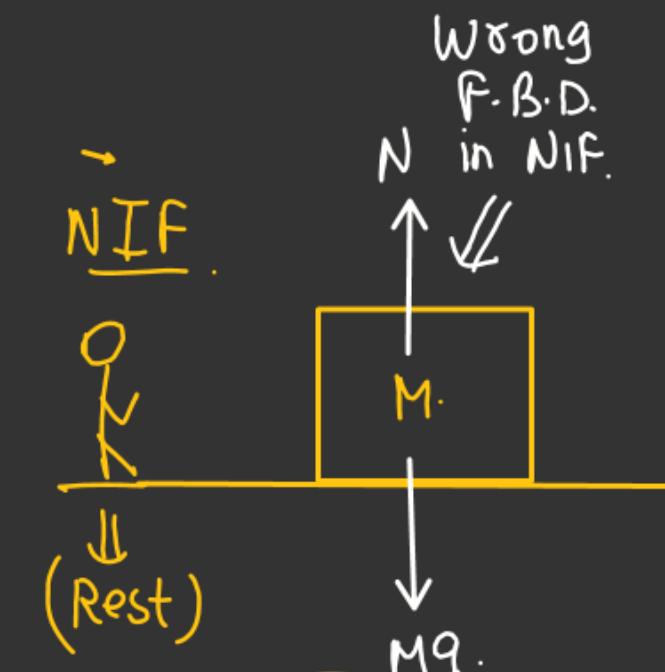
F.B.D w.r.t
earth



Newton's 2nd Law

$$N - Mg = Ma$$

$$\boxed{N = M(g + a)}$$

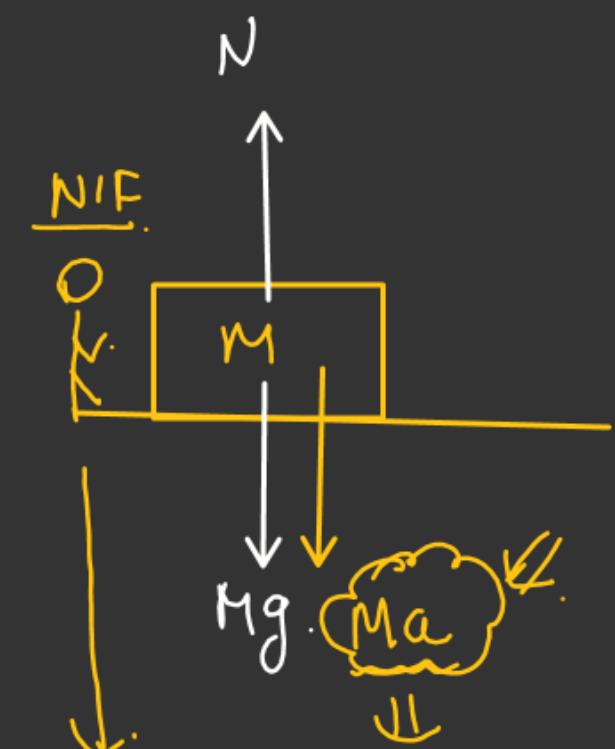


1st Law

$$\boxed{N = Mg}$$

Wrong

Matched



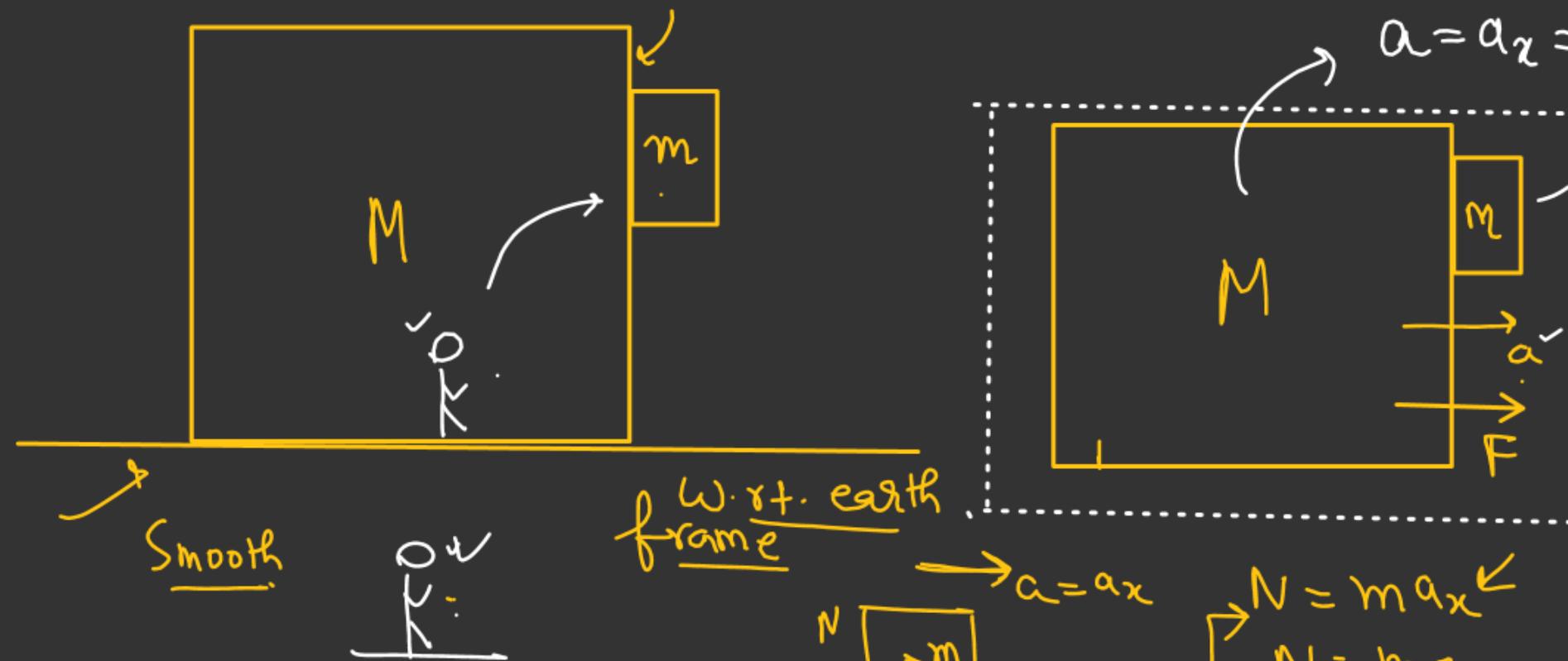
For Equilibrium
of block (Newton's
1st Law)

$$N = Mg + Ma$$

$$\boxed{N = M(g + a)}$$

and multiply it with mass of the body.

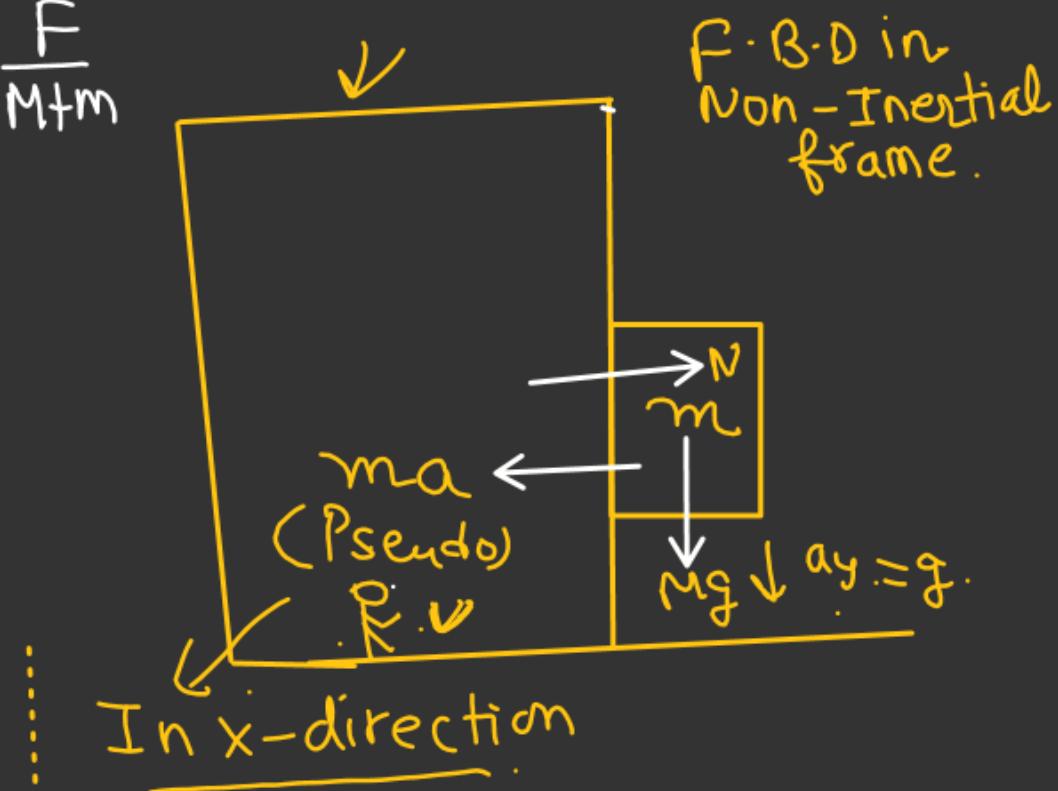
Smooth. # Find Normal reaction and acceleration of smaller block w.r.t earth.



$$\begin{aligned} \vec{a}_{\text{block/bigger block}} &= \left(-g \hat{j} \right) \\ (\text{Relative}) \quad \downarrow & \end{aligned}$$

$$\vec{a}_{\text{block/E}} = ??$$

$$\vec{a}_x \Rightarrow |\vec{a}_{\text{block/E}}| = \sqrt{g^2 + a_x^2}$$



In x-direction

$$N - ma = 0$$

$$N = ma = \left(\frac{mF}{M+m} \right) =$$

$$\sqrt{g^2 + \left(\frac{mF}{M+m} \right)^2}$$