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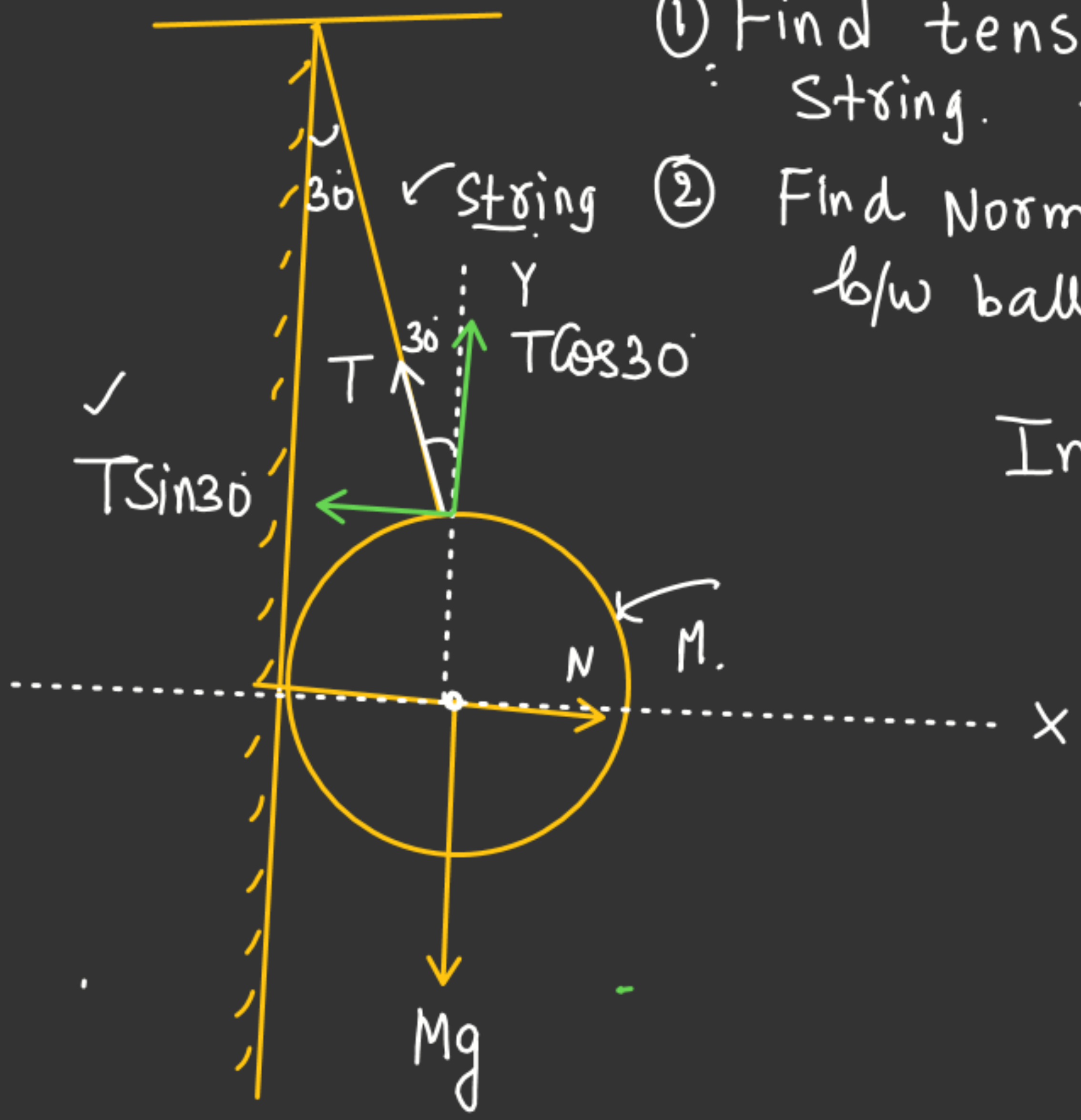

① Find tension in the String.

② Find Normal reaction acting b/w ball and wall.

In x-direction

$T\sin 30° = N$

$T\cos 30° = Mg$

$T\frac{\sqrt{3}}{2} = Mg$

$T = \left(\frac{2Mg}{\sqrt{3}}\right)$

$N = \frac{T}{2}$

$\left[N = \frac{Mg}{\sqrt{3}}\right]$

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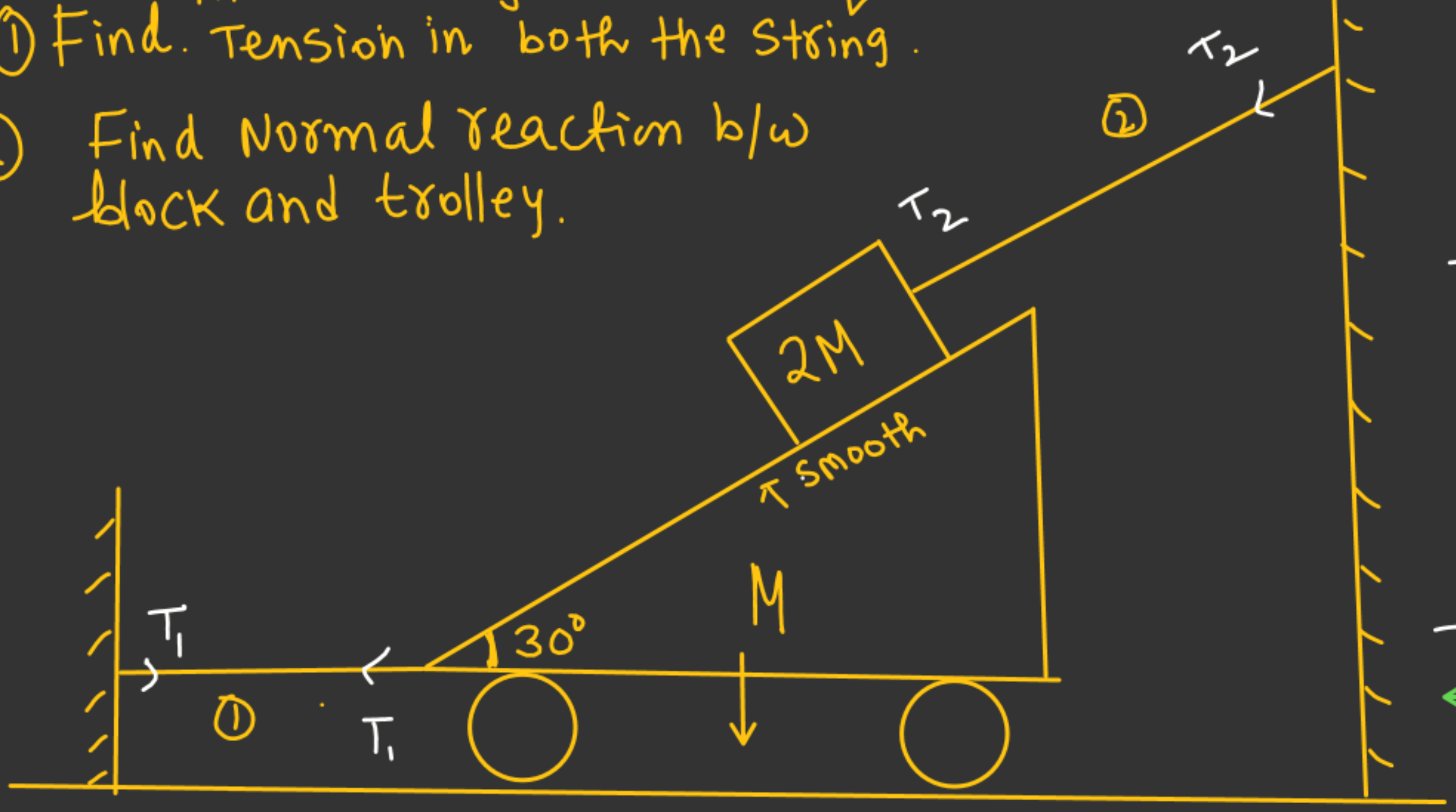
The whole System is in equilibrium.

(1) Find. Tension in both the String.

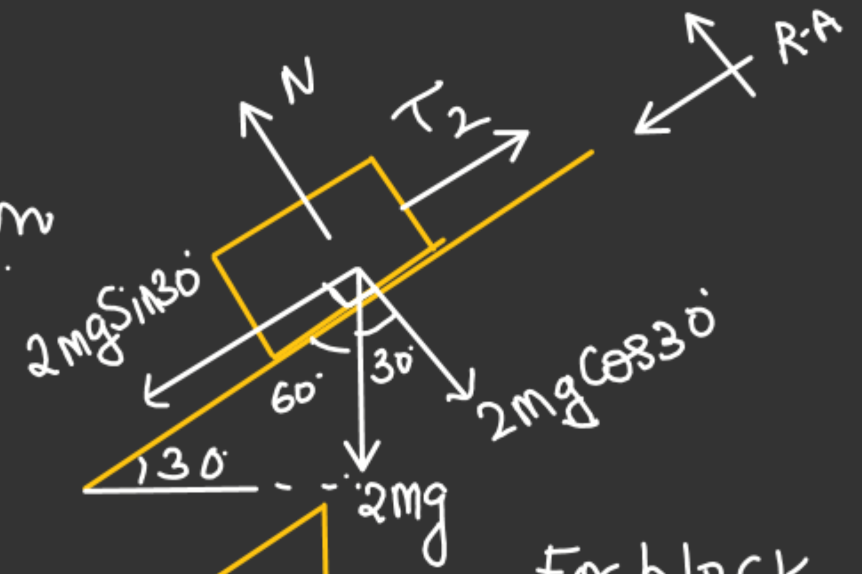
(2) Find Normal reaction b/w block and trolley.

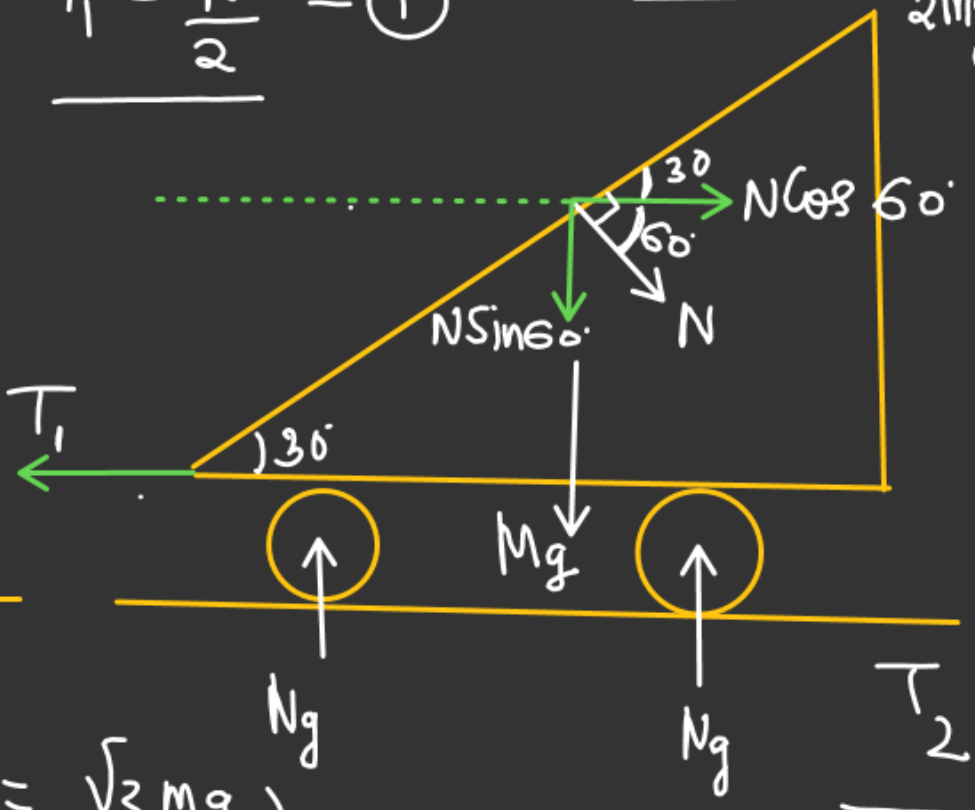


In x-direction

$T_1 = N\cos 60^\circ$

$T_1 = \frac{N}{2}$ —(1)





$\left(T_1 = \frac{\sqrt{3}\,mg}{2}\right)$

For block

$N = 2mg\cos 30^\circ$ —(2)

$N = \cancel{2}mg\frac{\sqrt{3}}{\cancel{2}}$

$N = \sqrt{3}\,mg$ ✓

$T_2 = 2mg\sin 30^\circ$

$\boxed{T_2 = mg}$ ✓

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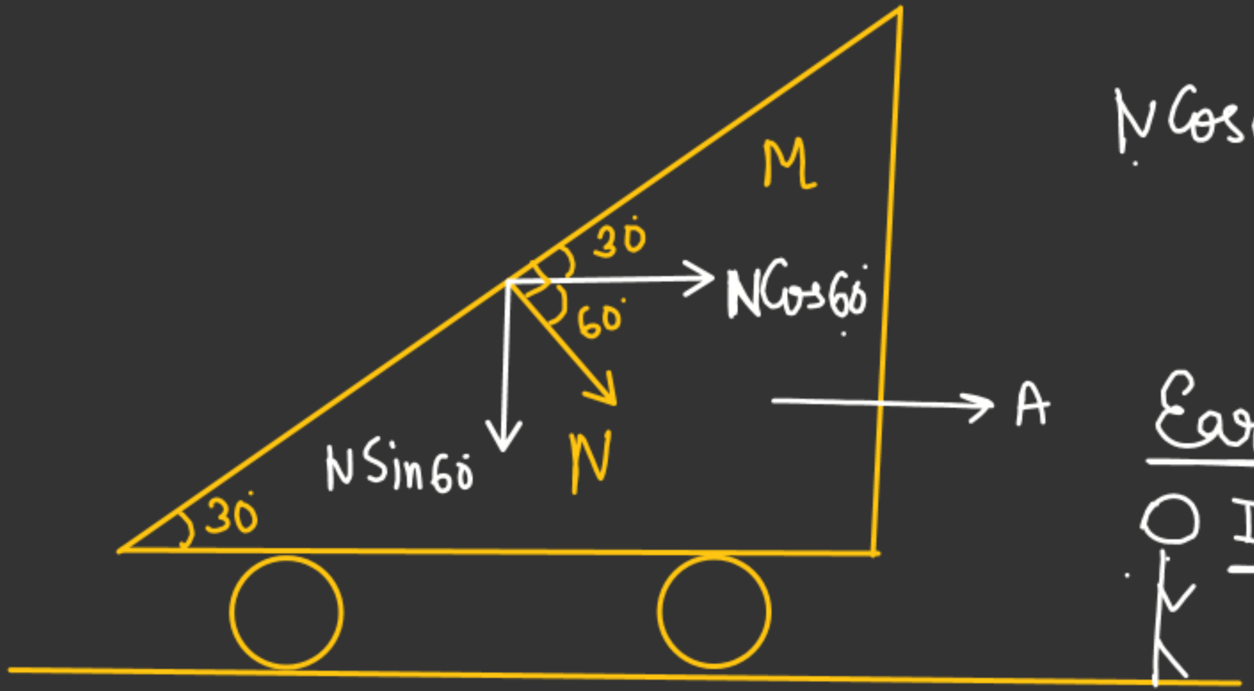
Case-2 :- If both the String Cut Simultaneously find accleration of trolley and block.

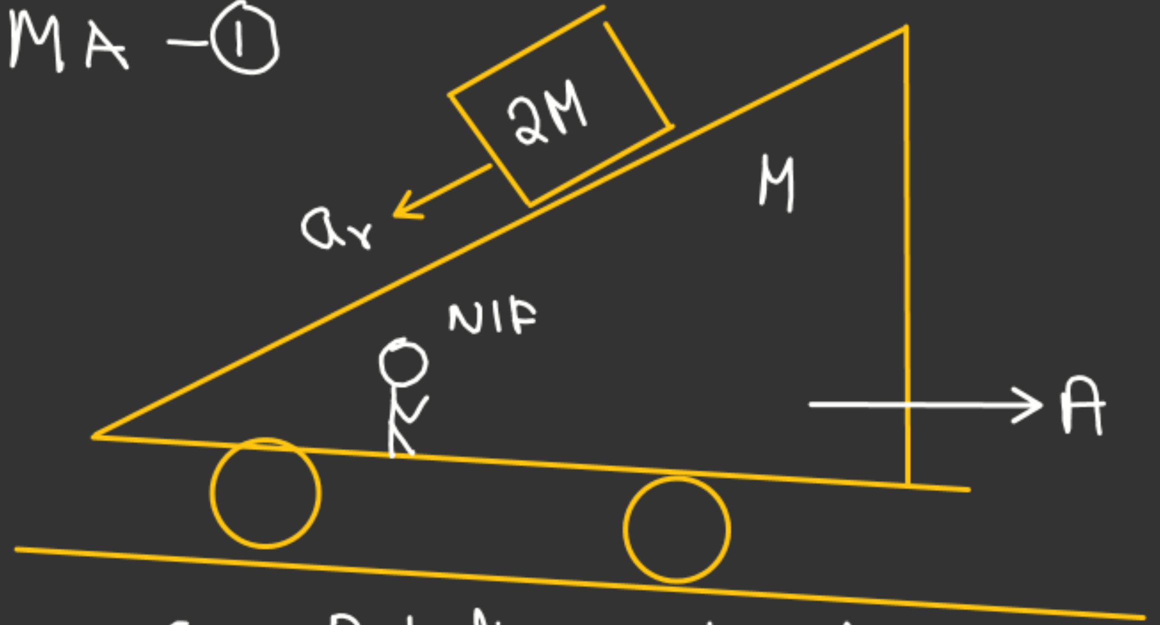


Newton's 2nd Law

$$N\cos 60° = MA \quad -(1)$$

Earth
IF

NIF → Non-Inertial frame Observer



a_r = Relative accleration (w.r.t trolley)

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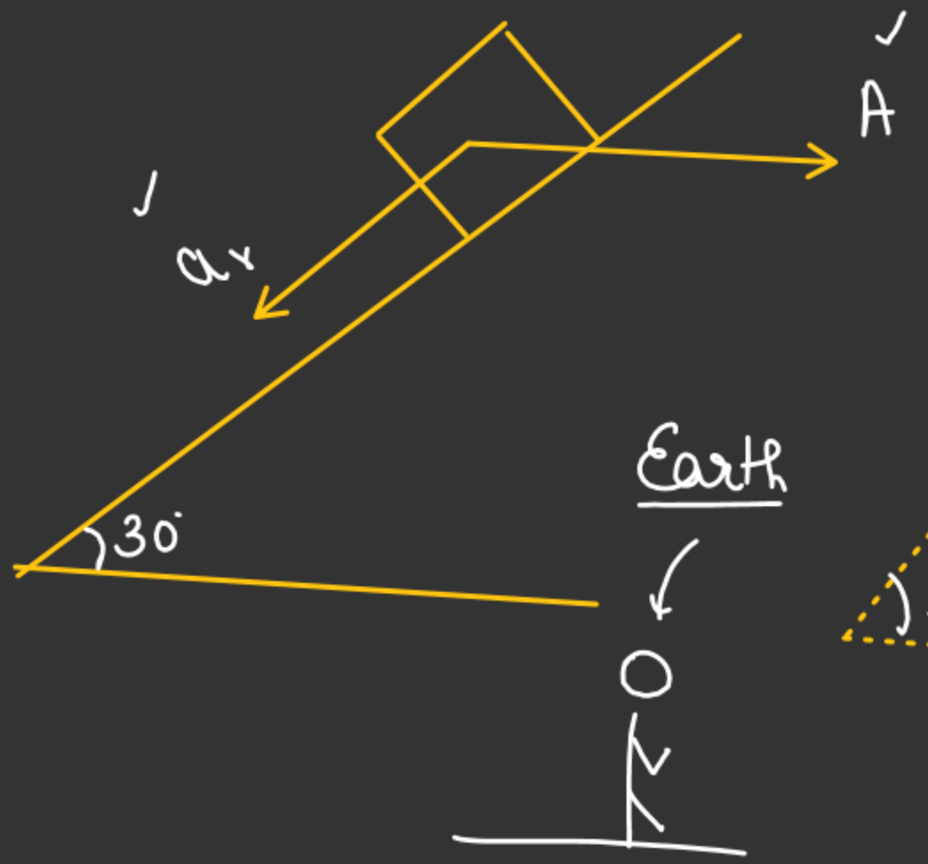
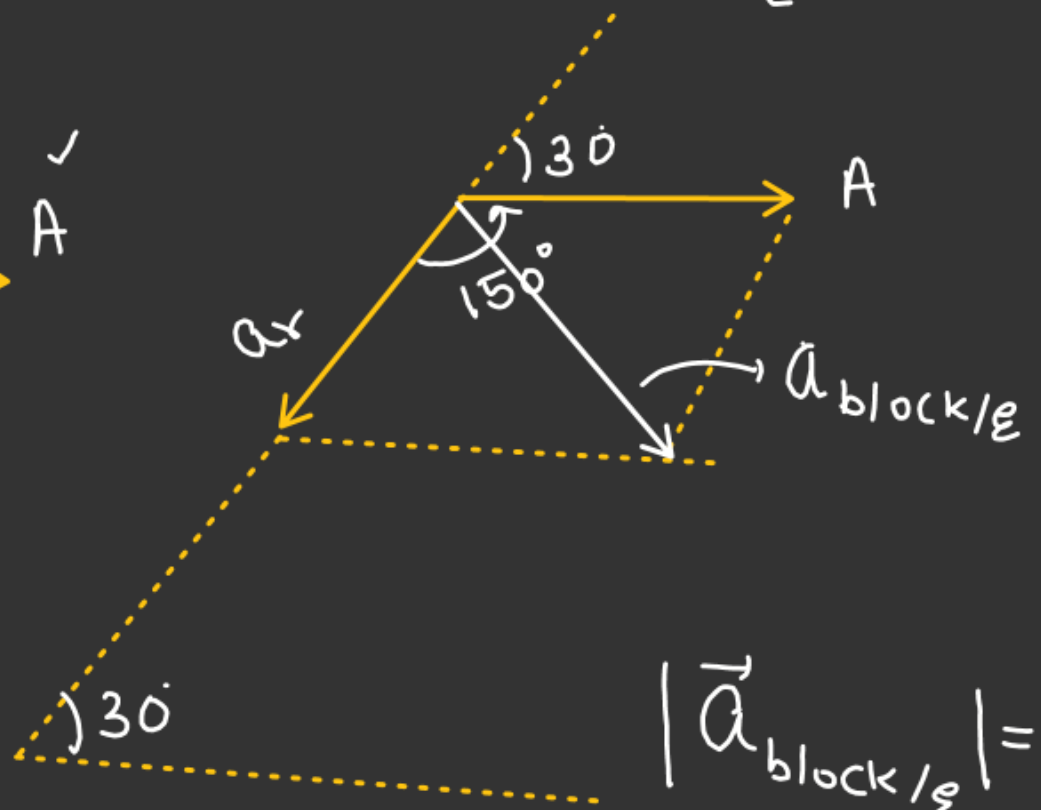
w.r.t earth, accleration of block



$$\vec{a}_{block/E} = \left[\vec{a}_{block/trolley} + \vec{a}_{trolley/E}\right]$$



$$|\vec{a}_{block/E}| = \sqrt{a_r^2 + A^2 + 2Aa_r\cos 150^\circ}$$

$$= \sqrt{a_r^2 + A^2 + 2Aa_r\cos(180-30^\circ)}$$

$$= \sqrt{\underline{a_r^2} + \underline{A^2} - 2Aa_r\cos 30^\circ}$$

Find Normal reaction due to the Cylindrical Surface on the ground.

1) Uniform i.e having mass M. $\Rightarrow$ Mg

2) Non-Uniform i.e $[\rho = \rho_0 y]$, [y from top]

$\rho =$ Volume mass density ($\rho_0 =$ Constant)

$$\rho = \frac{\text{Mass}}{\text{Volume}} = \left(\frac{M}{V}\right)$$

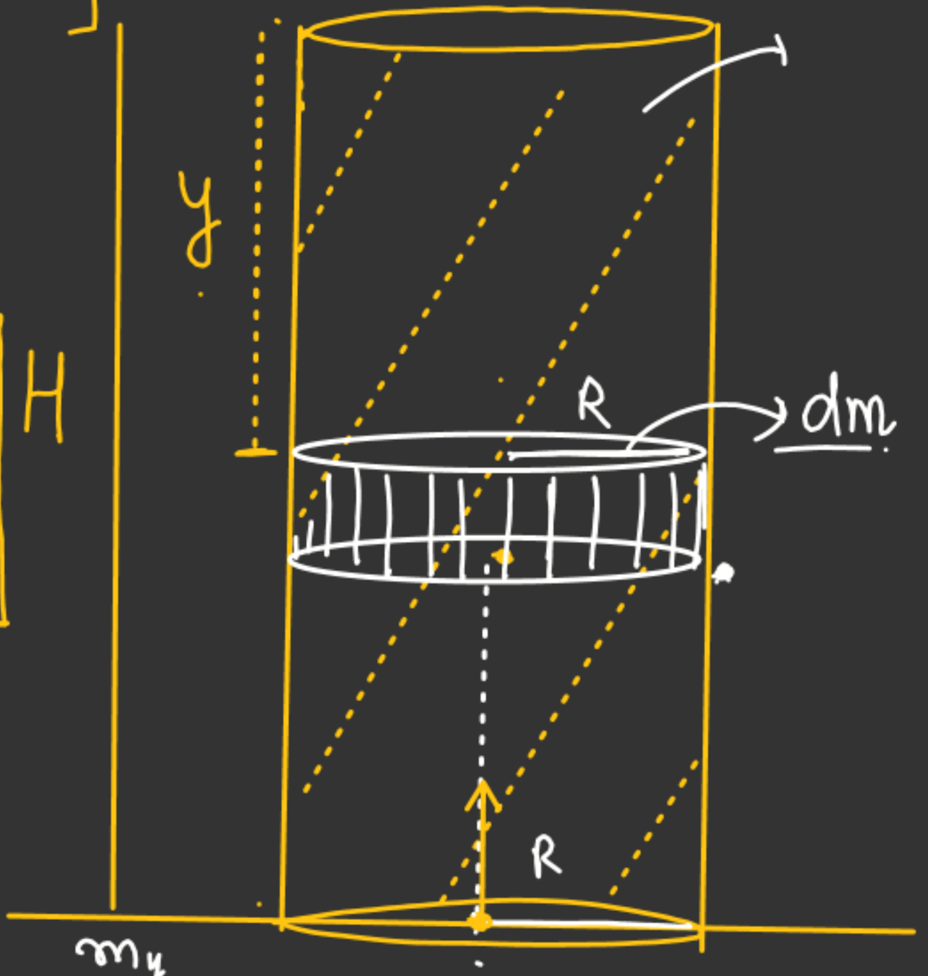
Since 'dy' is very small so, volume mass density for dy length is constant.

$$(\rho_y = \rho_{y+dy} \text{ as } dy \text{ is very small})$$

let, dV be the volume of dy length of the cylinder.

$$dV = (\pi R^2 dy)$$

$$dm = \rho_y dV = \rho_0 y \pi R^2 dy$$



$$\int_0^{m_y} dm = \rho_0 \pi R^2 \int_0^y y\,dy$$

$$\boxed{m_y = \frac{\rho_0 \pi R^2 y^2}{2}}$$

$$M_T = \left[\frac{\rho_0 \pi R^2 H^2}{2}\right]$$

$$N_g = M_T g$$

$$\boxed{N_g = \frac{\rho_0 \pi R^2 H^2 g}{2}}$$

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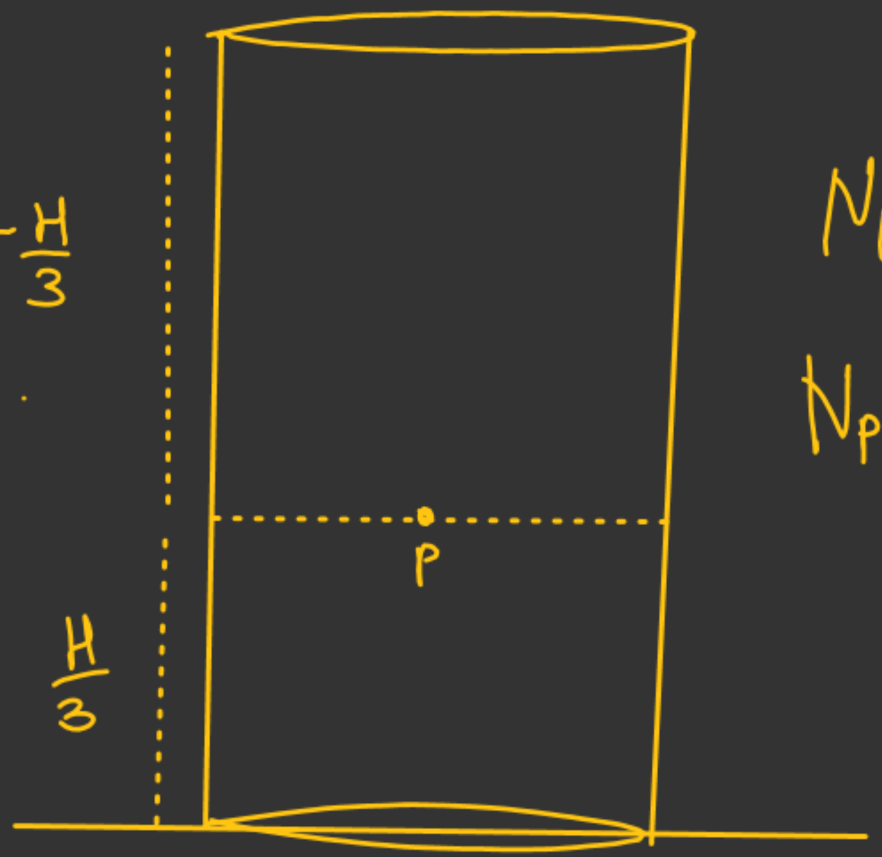
$N_P = ??$

$y = H - \frac{H}{3}$

$y = \frac{2H}{3}$

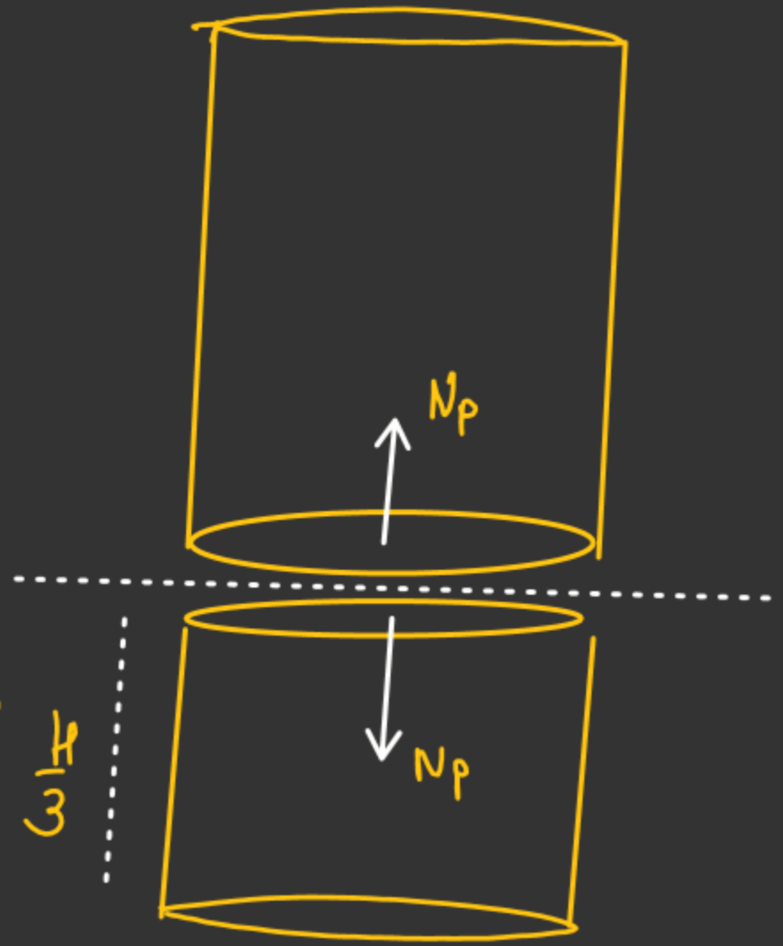


$$N_y = \left(\frac{\rho_0 \pi R^2 y^2}{2}\right) g$$

$$N_P = \frac{g \rho_0 \pi R^2}{2} \left(\frac{2H}{3}\right)^2$$

$$N_P = \frac{g \rho_0 \pi R^2}{\cancel{2}} \times \left(\frac{\cancel{4} H^2}{9}\right)$$

$$= \left(\frac{g \rho_0 \pi R^2 H^2}{9}\right) \text{ Newton}$$



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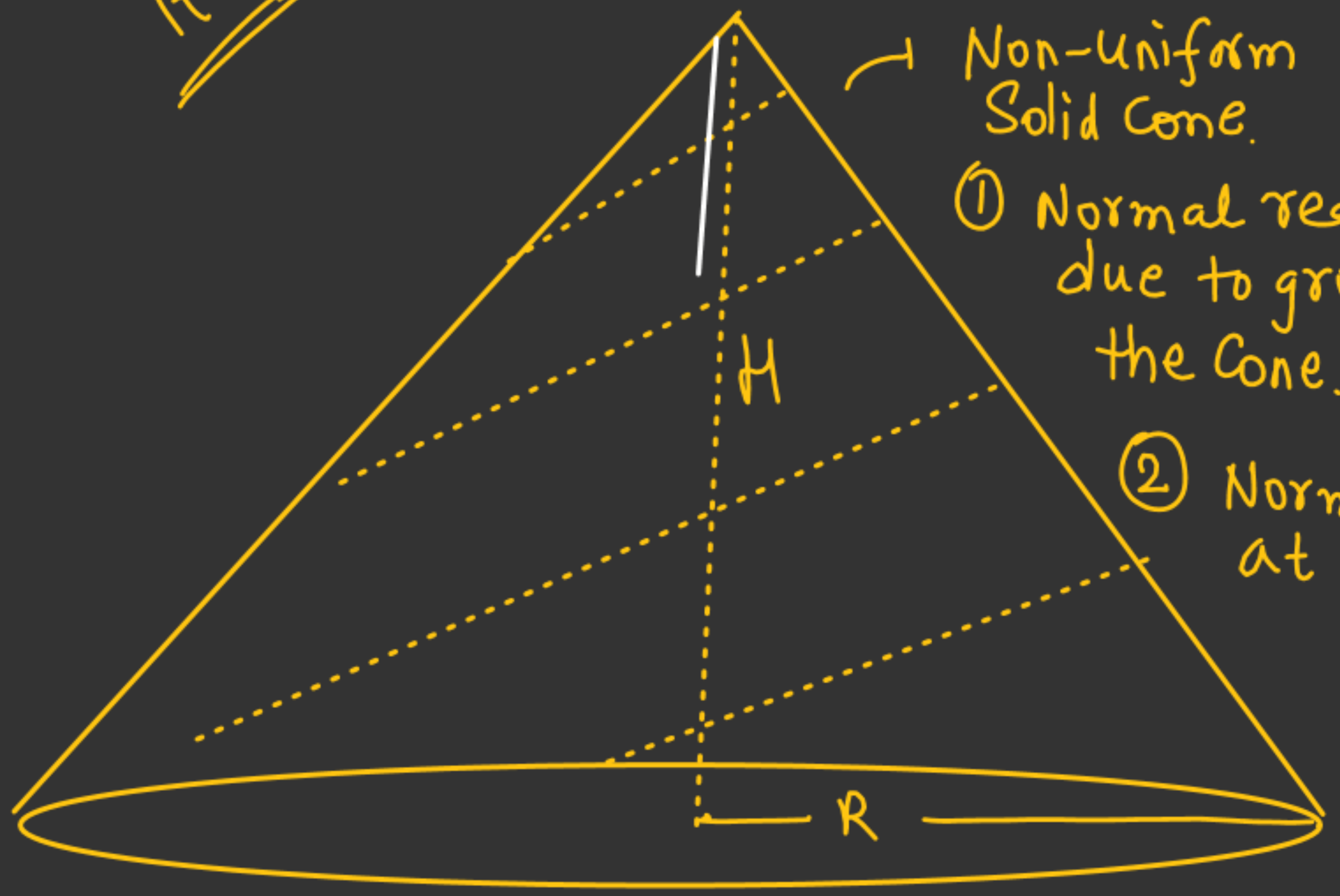
H.W.

$$\boxed{\rho = \rho_0 y}$$



Non-Uniform Solid Cone.

① Normal reaction due to ground on the Cone.

② Normal reaction at $\frac{H}{2}$.

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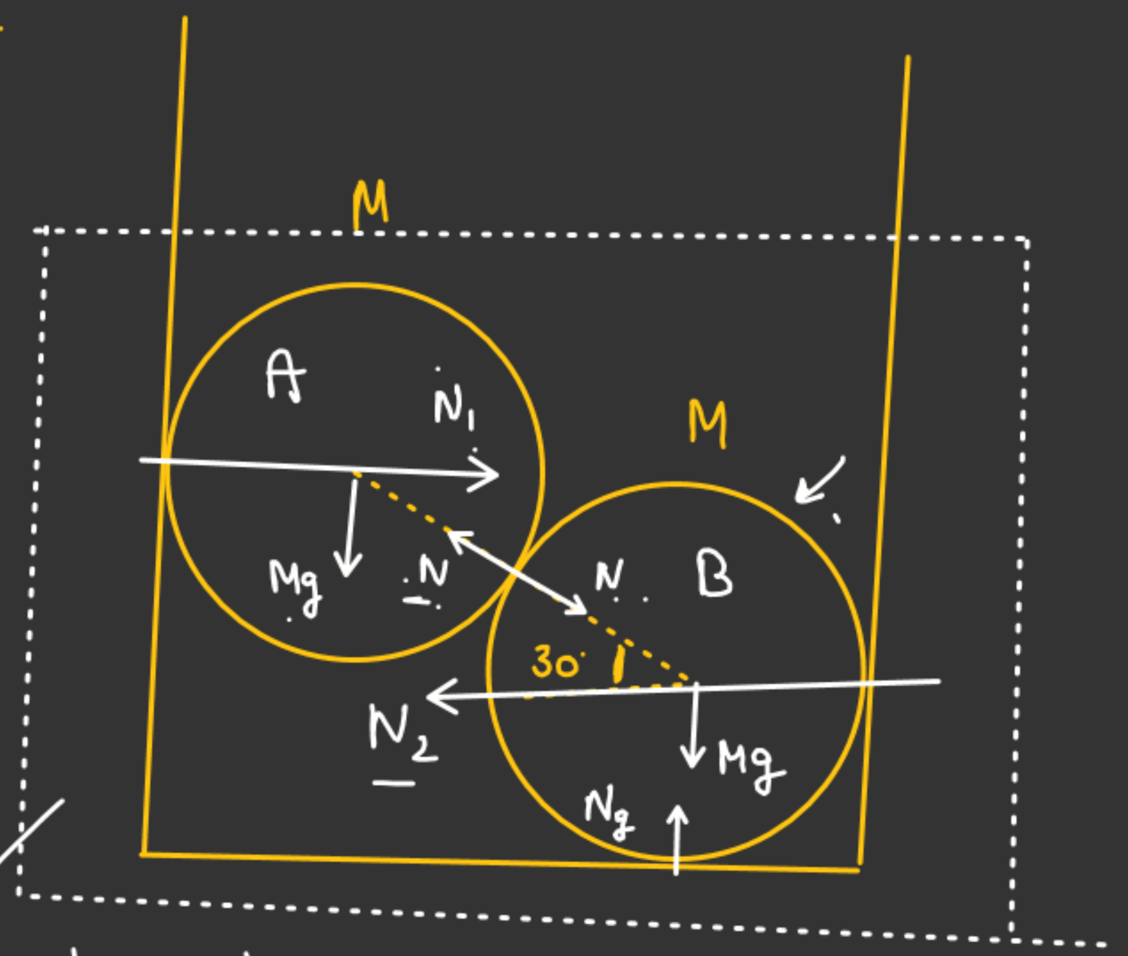
(A)

Both the balls are in equilibrium.

a) find Normal reaction b/w both the walls on the balls.

b) Normal reaction b/w two balls.

c) Normal reaction due to ground



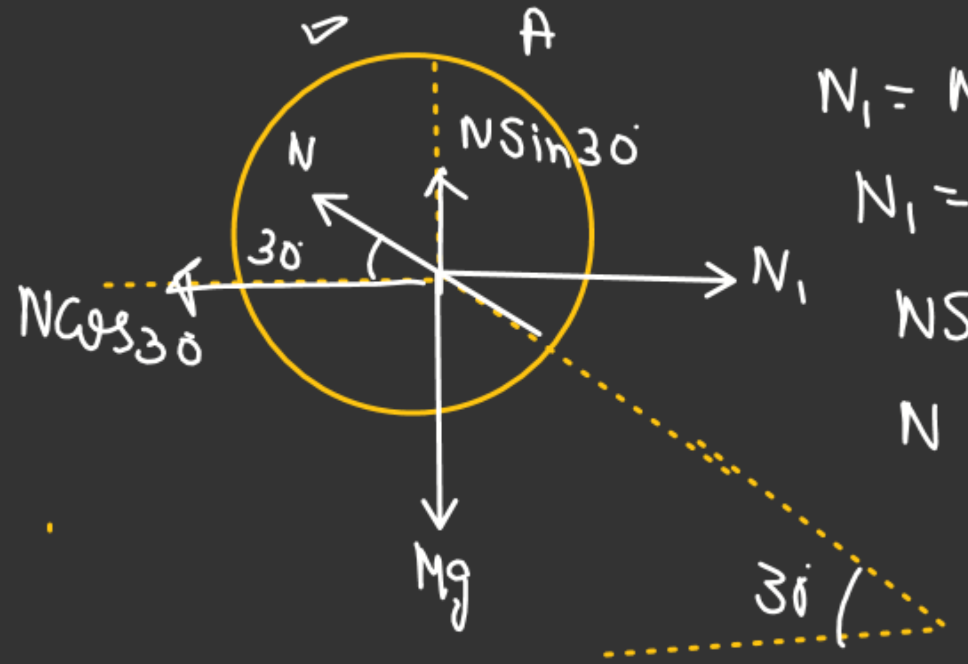
System boundary

N → (acts as a internal force)

In x-direction $[N_1 = N_2]$ — ①

In y-direction

$\boxed{N_g = 2Mg}$ — ②



$N_1 = N\cos 30°$

$N_1 = \frac{\sqrt{3}N}{2}$

$N\sin 30° = Mg$

$N = 2Mg \Rightarrow N_1 = \frac{\sqrt{3}}{2} \times 2Mg$

$N_1 = \sqrt{3}Mg$

$N_1 = N_2 = \sqrt{3}Mg$