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Contact force

↳ It is force of interaction b/w molecules of two different surfaces when they are in Contact with each other.

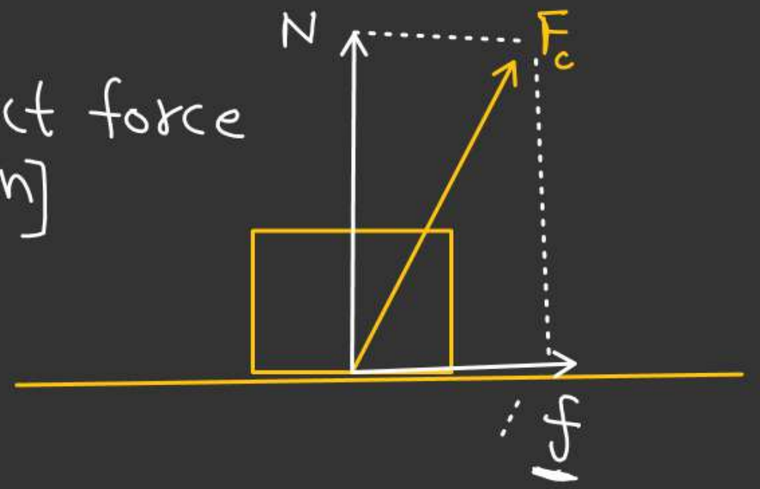
⇒ Contact force has two components.

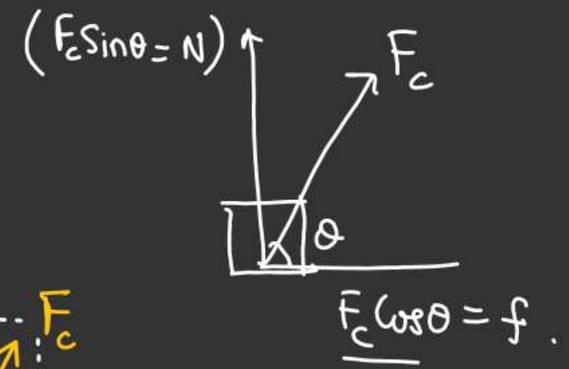
Horizontal Component of Contact force is Called [friction]

Vertical Component of Contact force is Called [normal reaction]

$$\vec{F_c} = f\hat{i} + N\hat{j}$$

$$|\vec{F_c}| = \sqrt{f^2 + N^2}$$





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Contact force as Normal reaction

F_C ↓ (Contact force)

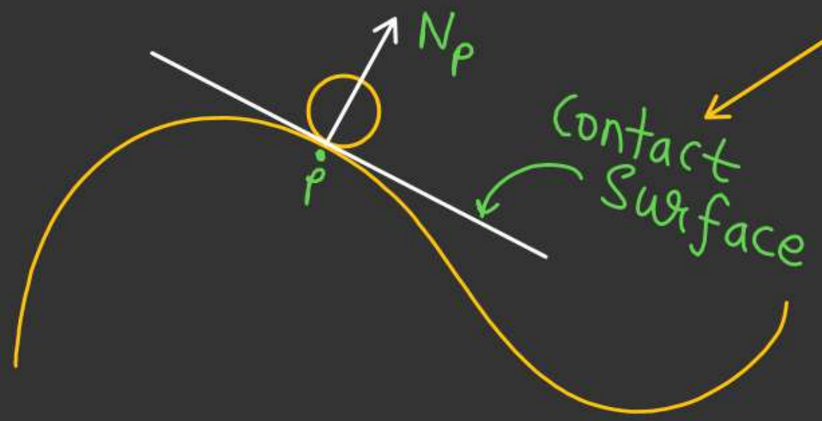
$$F_c = \sqrt{N^2 + f^2}$$

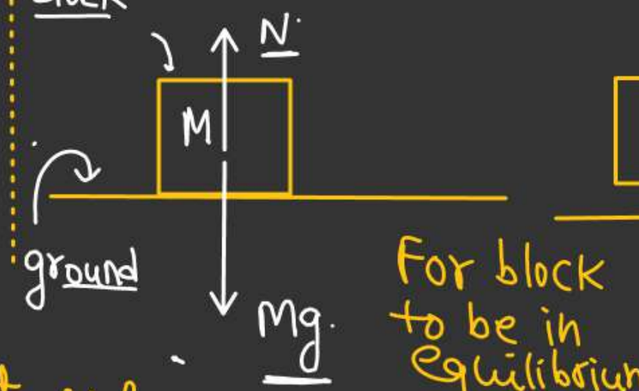
if $f = 0$

$$F_c = N$$

Normal reaction

- It always acts perpendicular to Contact surface.
- For Curved surfaces normal reaction is always perpendicular to tangent drawn at the point of contact

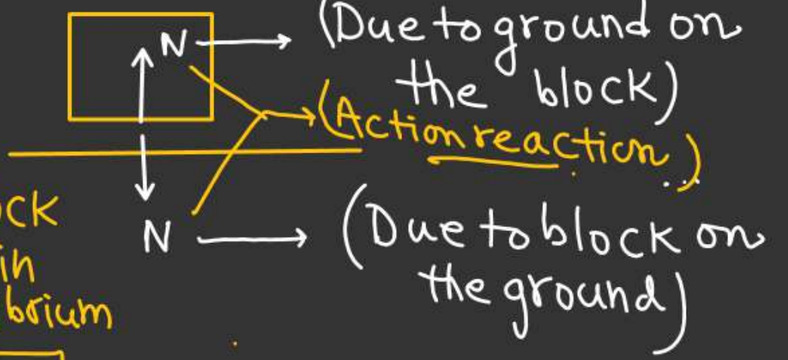




For block to be in equilibrium

$$N = Mg$$

But N & Mg are not ← action-reaction pair



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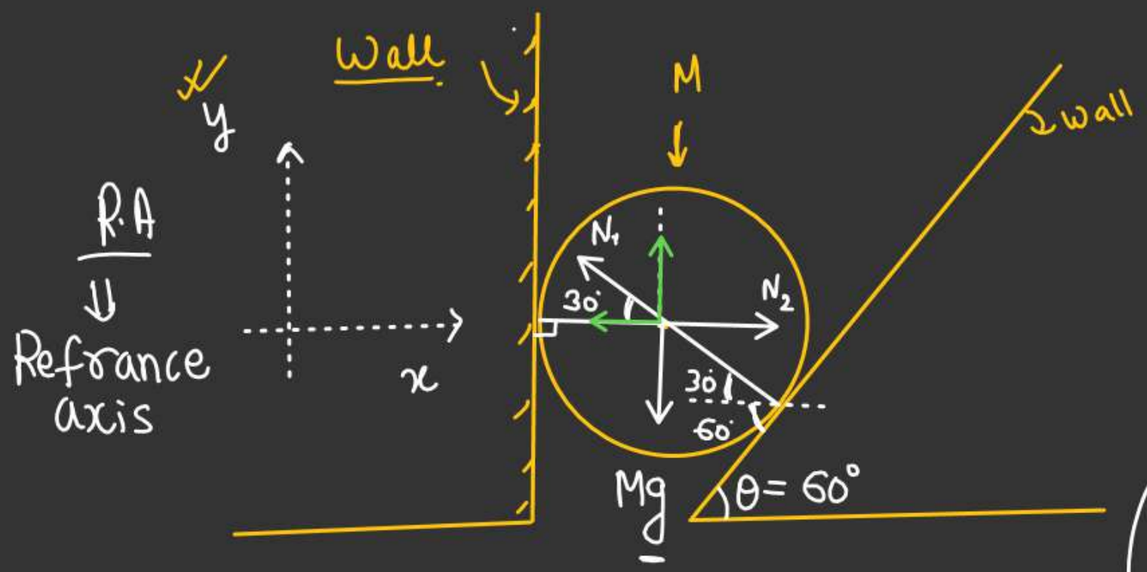
Q. For Spherical Surfaces, Normal reaction always passes through the Center of the Sphere.



Find Normal reaction at each Contact Surface if Sphere is in equilibrium.

For Equilibrium of Sphere

$N_2 = N_1 \cos 30°$ (Along x-axis)

$Mg = N_1 \sin 30°$ [Along y-direction]

$N_1 = \dfrac{Mg}{\sin 30°} = 2Mg$

$N_2 = (2Mg) \times \dfrac{\sqrt{3}}{2} = \sqrt{3}Mg$

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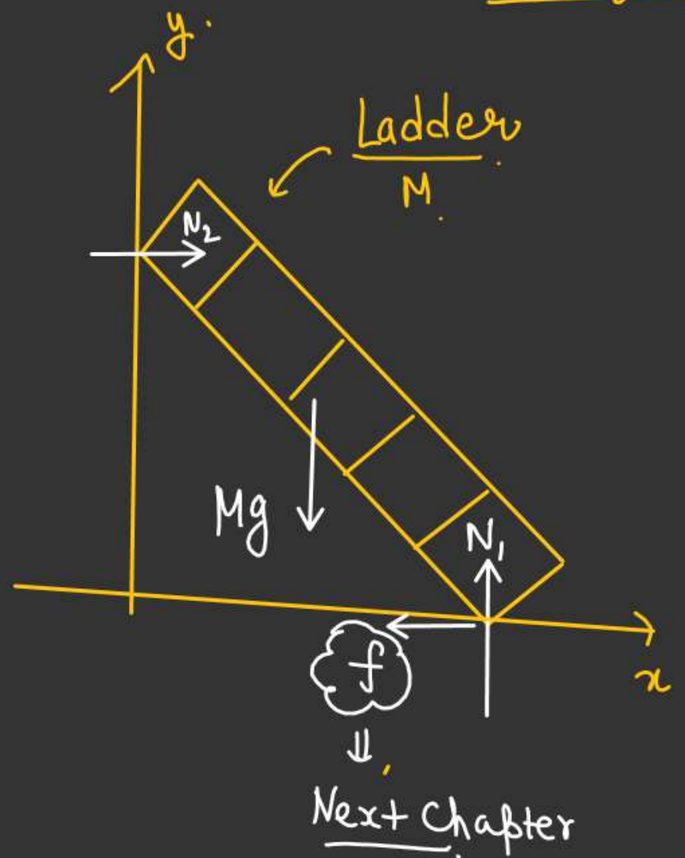
Contact force on the ladder



⇓

Next Chapter

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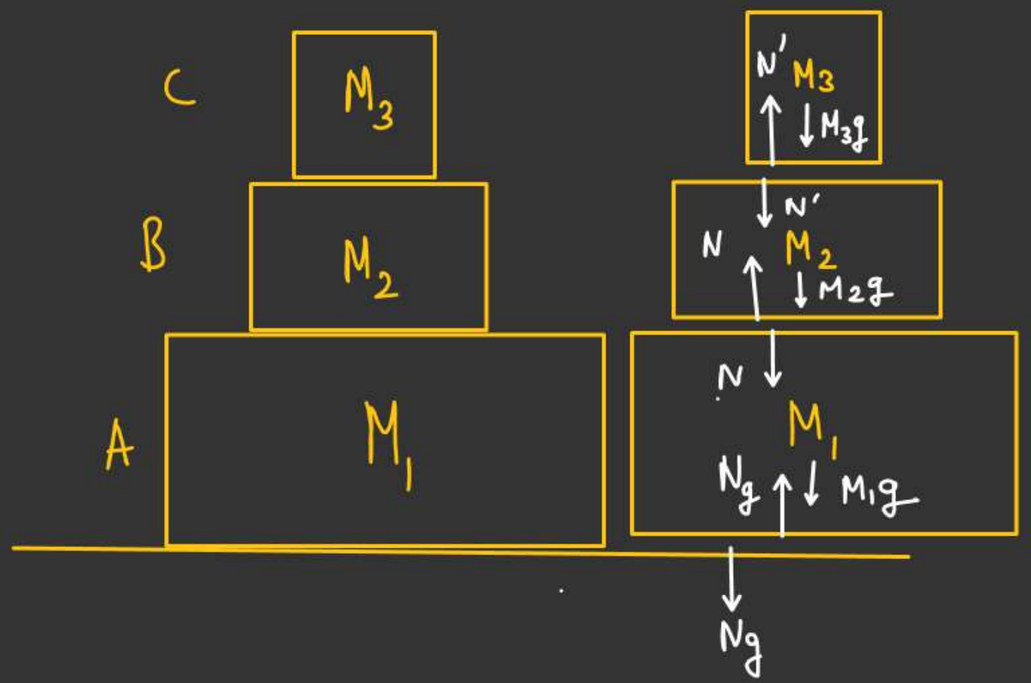
Normal reaction in Case of multiple block system :→

Find Normal reaction b/w each blocks.



N_g = Normal reaction b/w block-1 and ground.

N = Normal reaction b/w block 1 & block 2.

N' = Normal reaction b/w block 2 & block 3.

For M_3

$N' = M_3g$.

For M_2

$N = M_2g + N'$

$N = M_2g + M_3g$.

$N = (M_2 + M_3)g$.

For M_1

$N_g = N + M_1g$.

$N_g = (M_2 + M_3)g + M_1g$

$N_g = (M_1 + M_2 + M_3)g$.

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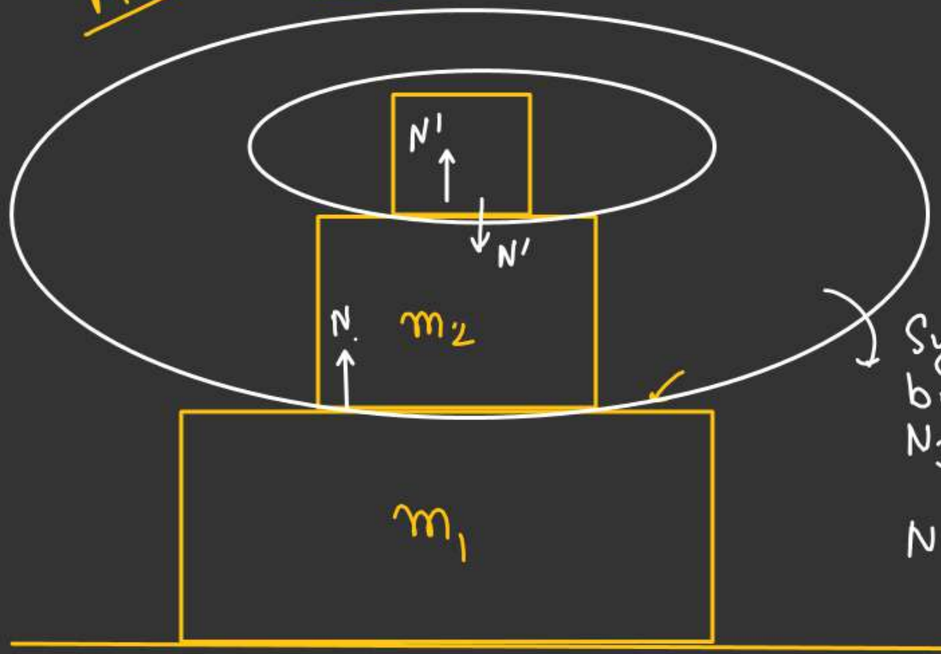
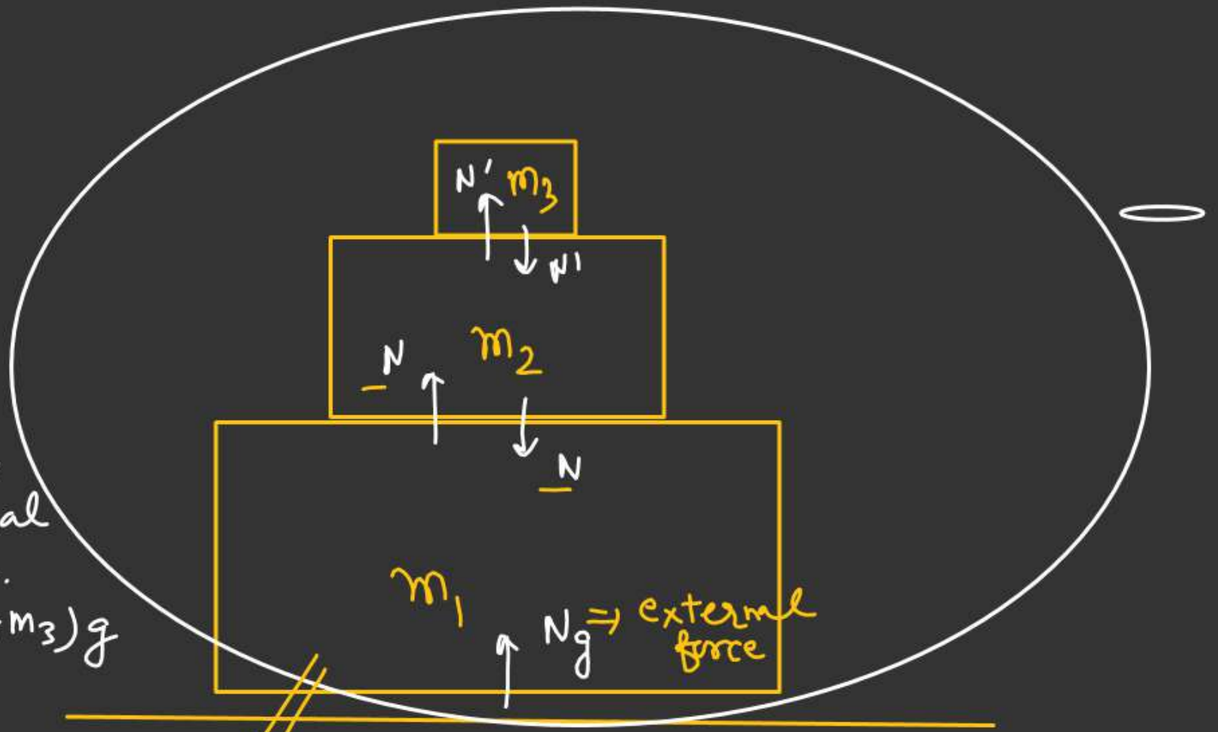
M-2. (Trick)



System boundary N_3 internal force.

$N = (m_2+m_3)g$



For this System boundary N & N' are internal forces.

$N_g = (m_1+m_2+m_3)g$.

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Find Normal reaction between all Contact Surfaces.