Nishant Jindal

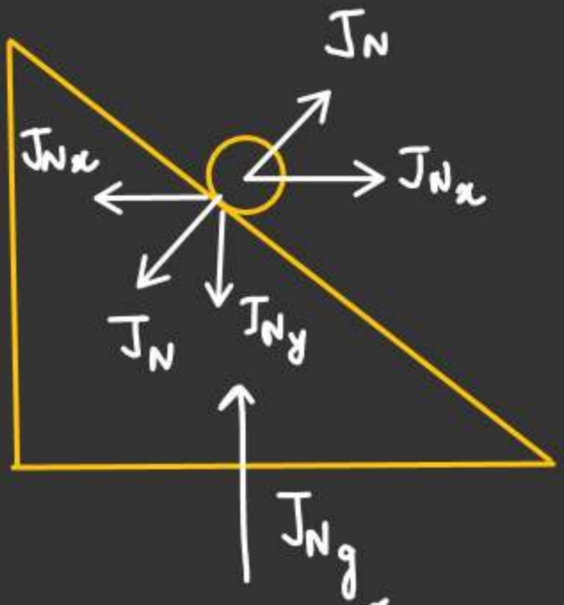
Just after Collision let velocity of ball be v_1 & wedge be v_2

L.M.C in x-direction

$\Delta p = 0$

$0 = mv_1 - Mv_2$ —(1)

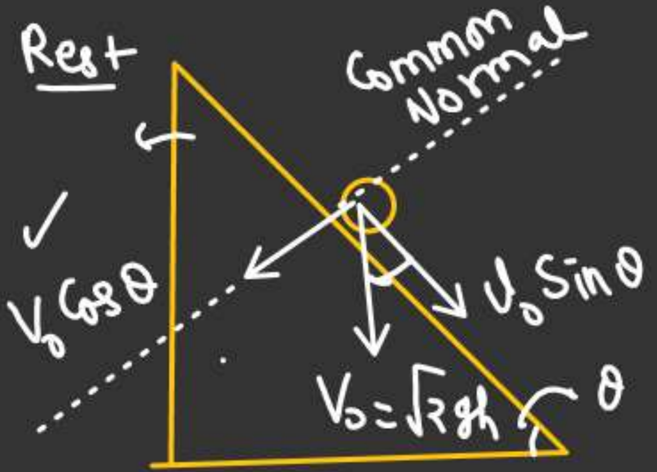
$\Rightarrow v_1 = \frac{M}{m} v_2$

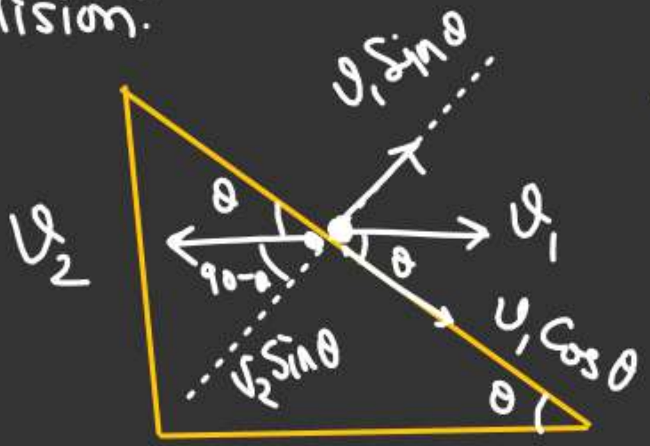


Just after Collision.

Equation of e

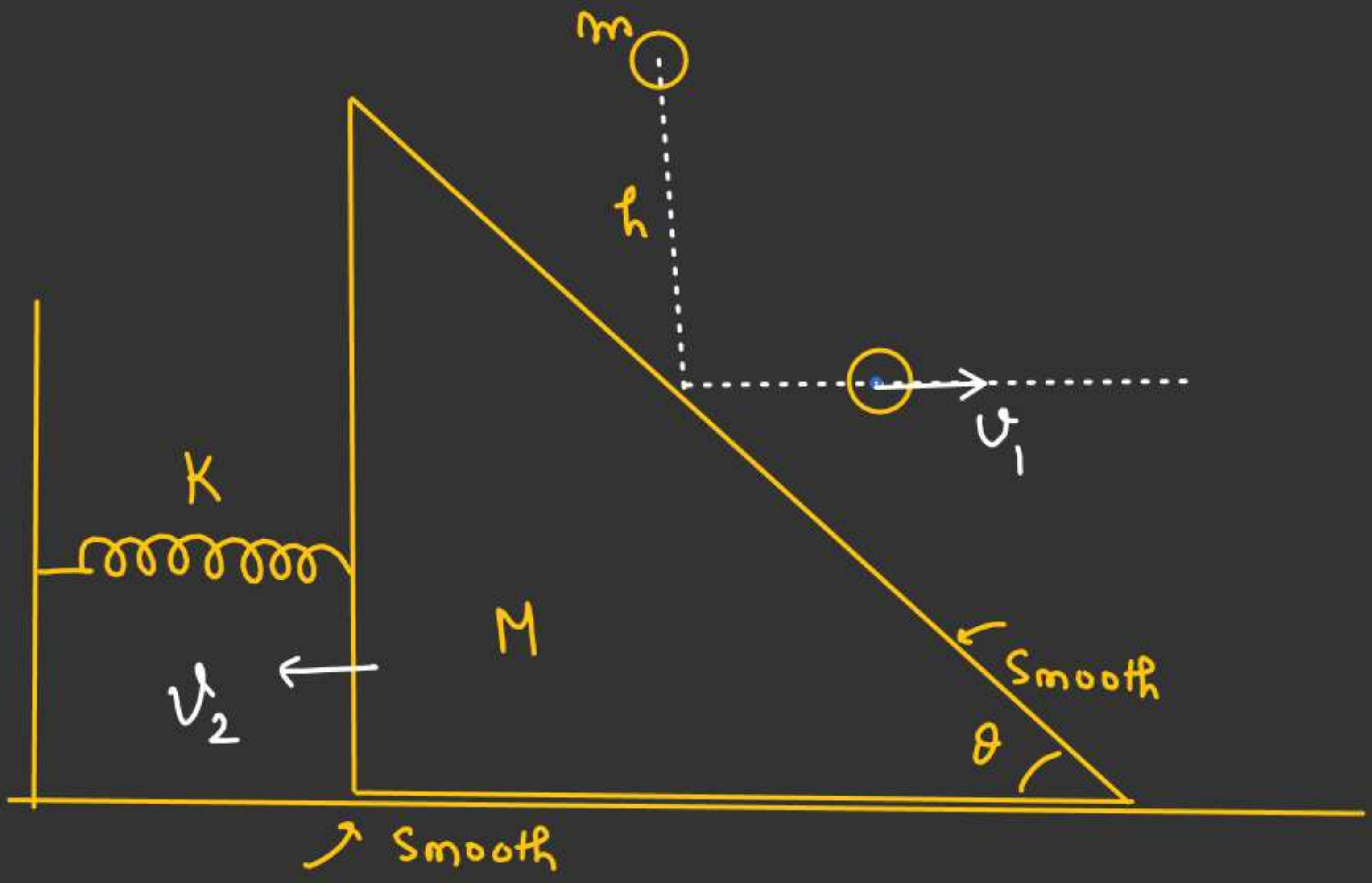
Along Common-Normal





$$e = \frac{(v_1+v_2)\sin\theta}{v_0 \cos\theta}$$

$$e v_0 \cos\theta = (v_1+v_2)\sin\theta \quad \text{—(2)}$$



After Collision ball become horizontal. Find maximum compression in the spring

e = coefficient of Restitution b/w ball and wedge.

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$$v_1 = \frac{M}{m} v_2 \quad - (1)$$

$$e v_0 \cos\theta = (v_1 + v_2)\sin\theta \quad - (2)$$

$$e v_0 = \left(\frac{M}{m} + 1\right) v_2 \tan\theta$$

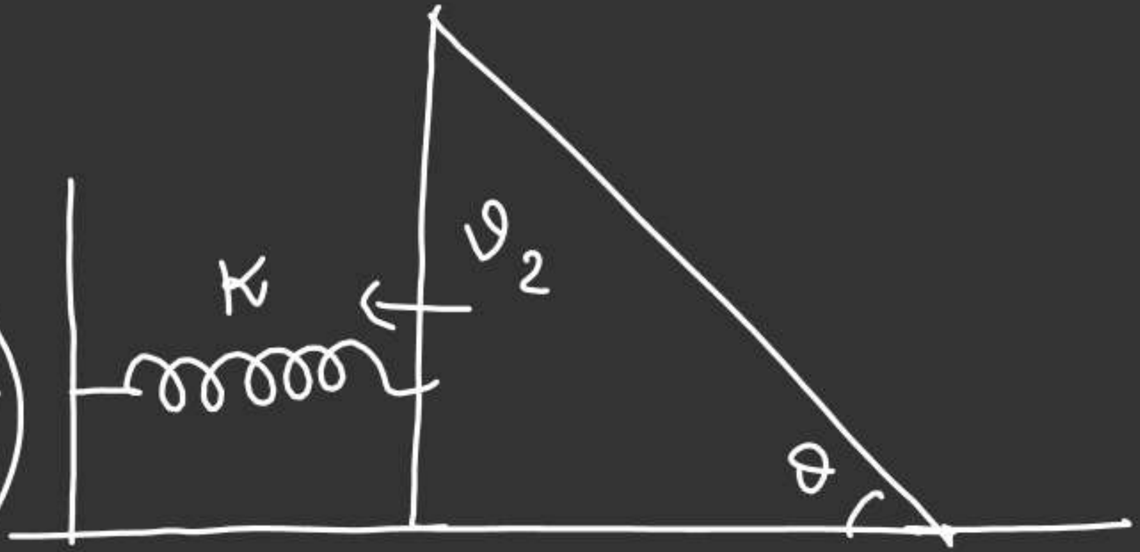
$$v_2 = \frac{m e v_0 \cot\theta}{(M+m)}$$

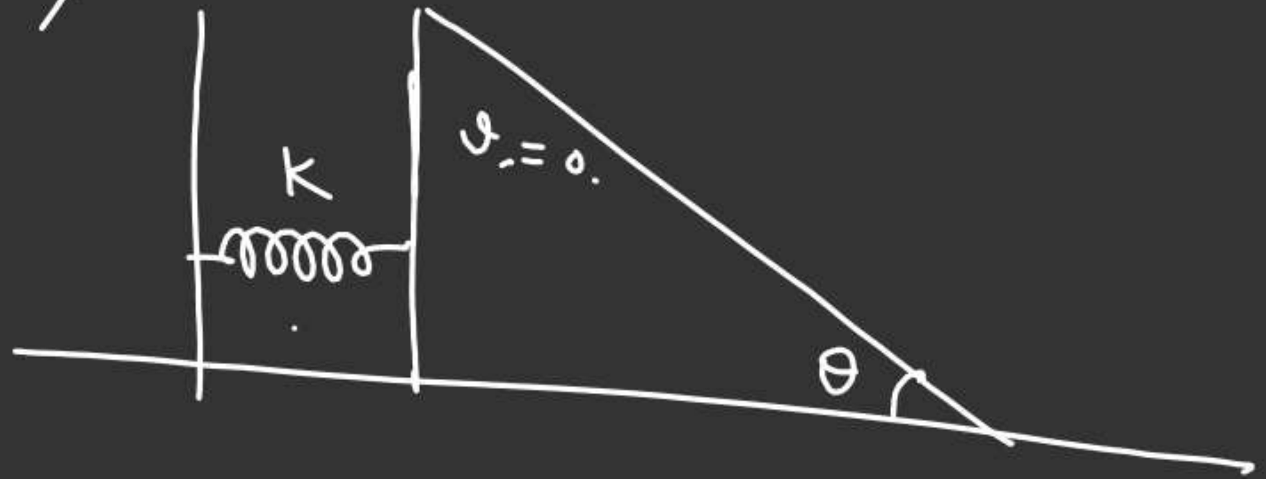
Energy Conservation

$$\cancel{\frac{1}{2}} M v_2^2 = \cancel{\frac{1}{2}} K X_{max}^2$$

$$\sqrt{\frac{M}{K}} \cdot v_2 = X_{max}$$

$$X_{max} = \sqrt{\frac{M}{K}} \left(\frac{m e v_0 \cot\theta}{M+m}\right)$$





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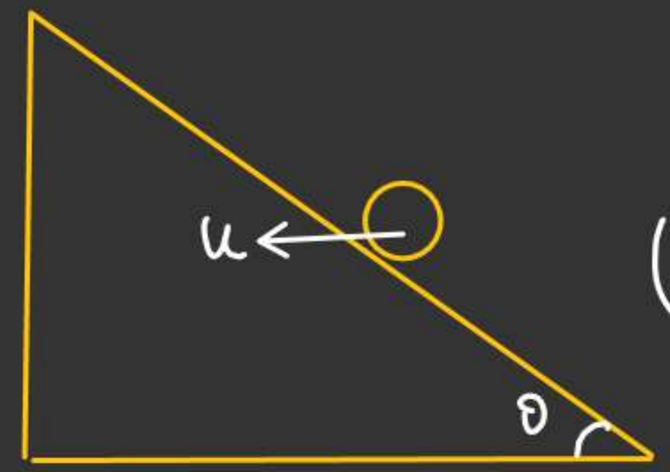
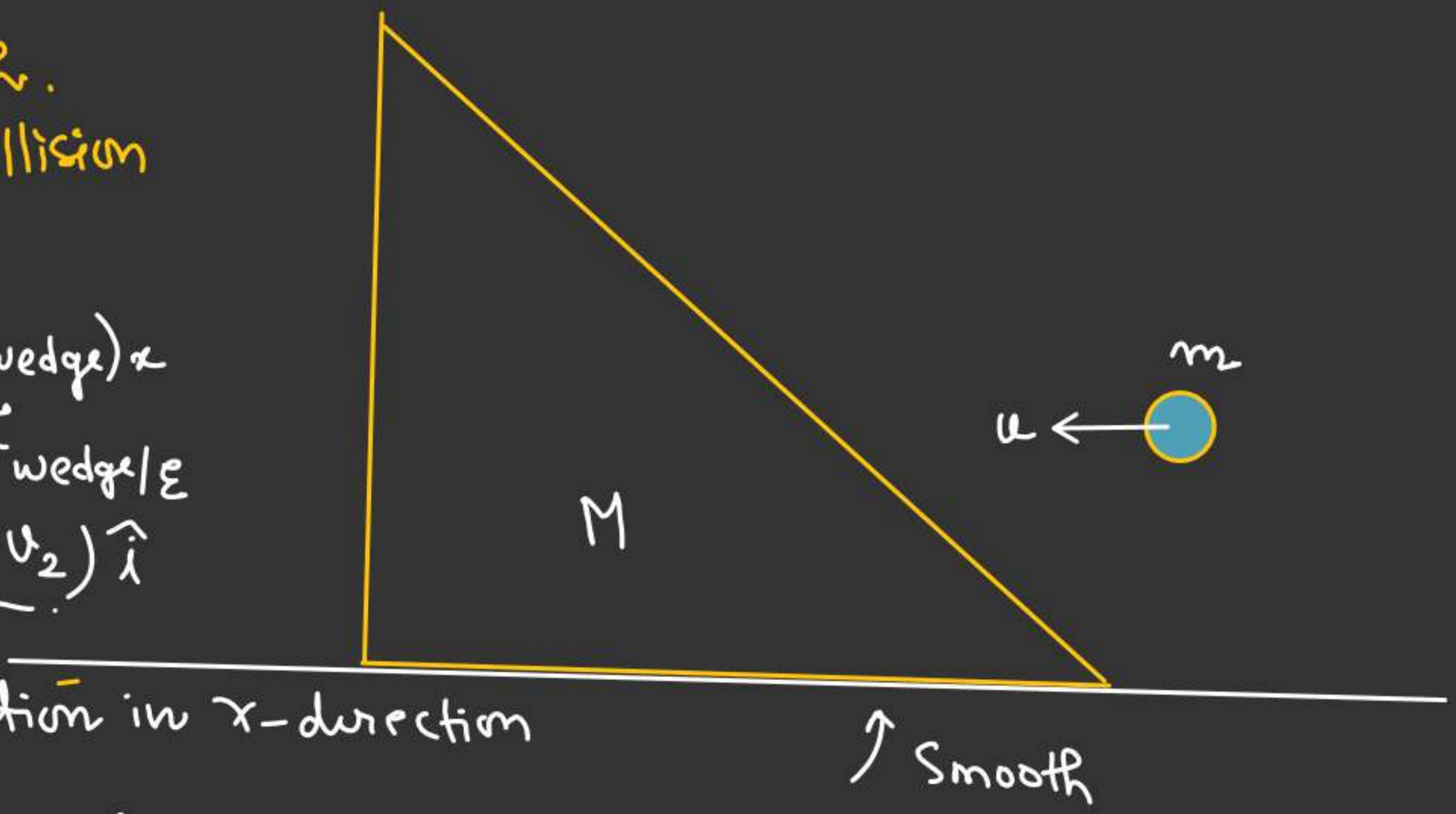
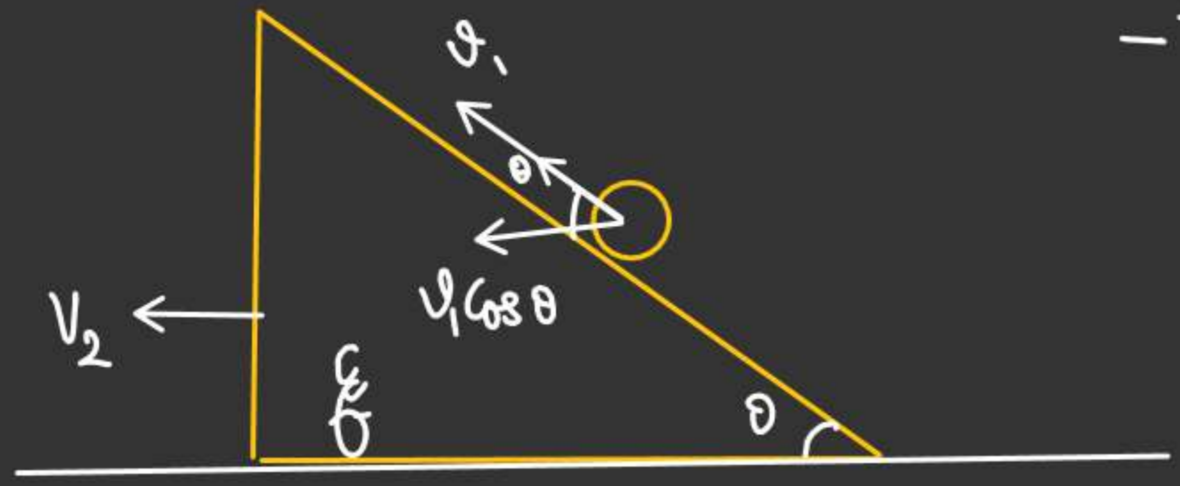
Q: Ball after collision with the wedge ascent on the inclined plane. All contact surfaces are smooth. Find velocity of wedge just after collision





$$(\vec{v}_{ball/E})_x = (\vec{v}_{ball/wedge})_x + \vec{v}_{wedge/E}$$

$$(\vec{v}_{ball/E})_x = -(v_1\cos\theta + v_2)\hat{i}$$



L.M.C Conservation in x-direction

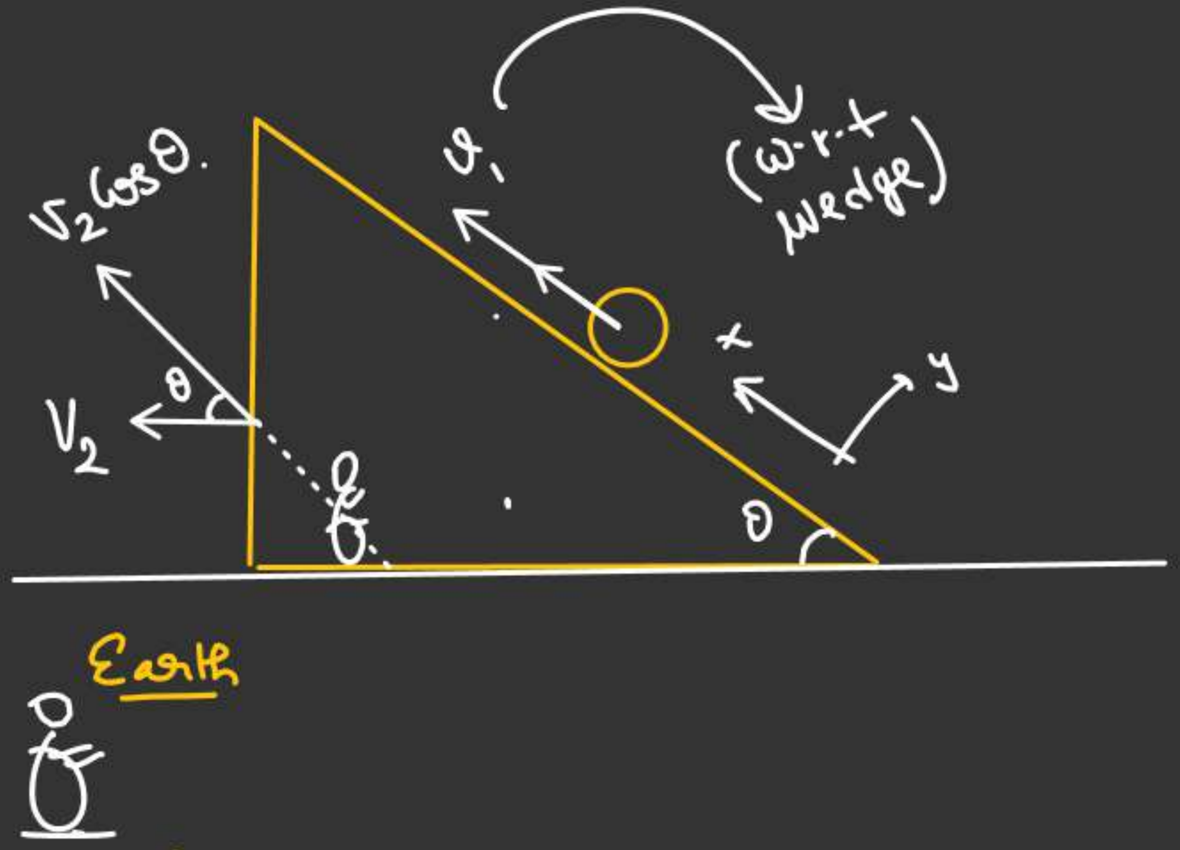
$$-mu = -Mv_2 - m(v_2 + v_1\cos\theta)$$

$$mu = (M+m)v_2 + (m\cos\theta)v_1 \quad - (1)$$

$$e = 0$$

$mu = (M+m)v_2 + (m\cos\theta)v_1$ — (1)

$e = 0$ (Along common-tangent just after collision)



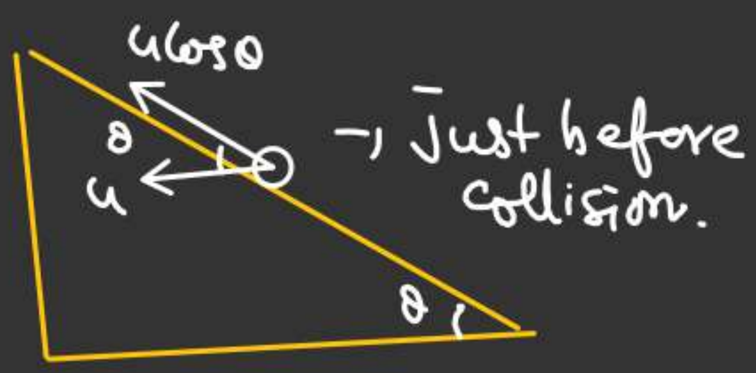
$(\vec{v}_{ball/E}) = \vec{v}_{ball/wedge} + \vec{v}_{wedge/E}$

$(\vec{v}_{ball/E}) = (v_1 + v_2\cos\theta)\,\hat{i}$

Along common tangent

[Velocity along common tangent of the ball remain same just before & just after collision as No impulse along common-Normal]

$u\cos\theta = v_1 + v_2\cos\theta$ — (2)



$$v_2 = \frac{Mu\sin^2\theta}{(M+m\sin^2\theta)}$$ Ans From (1) & (2)

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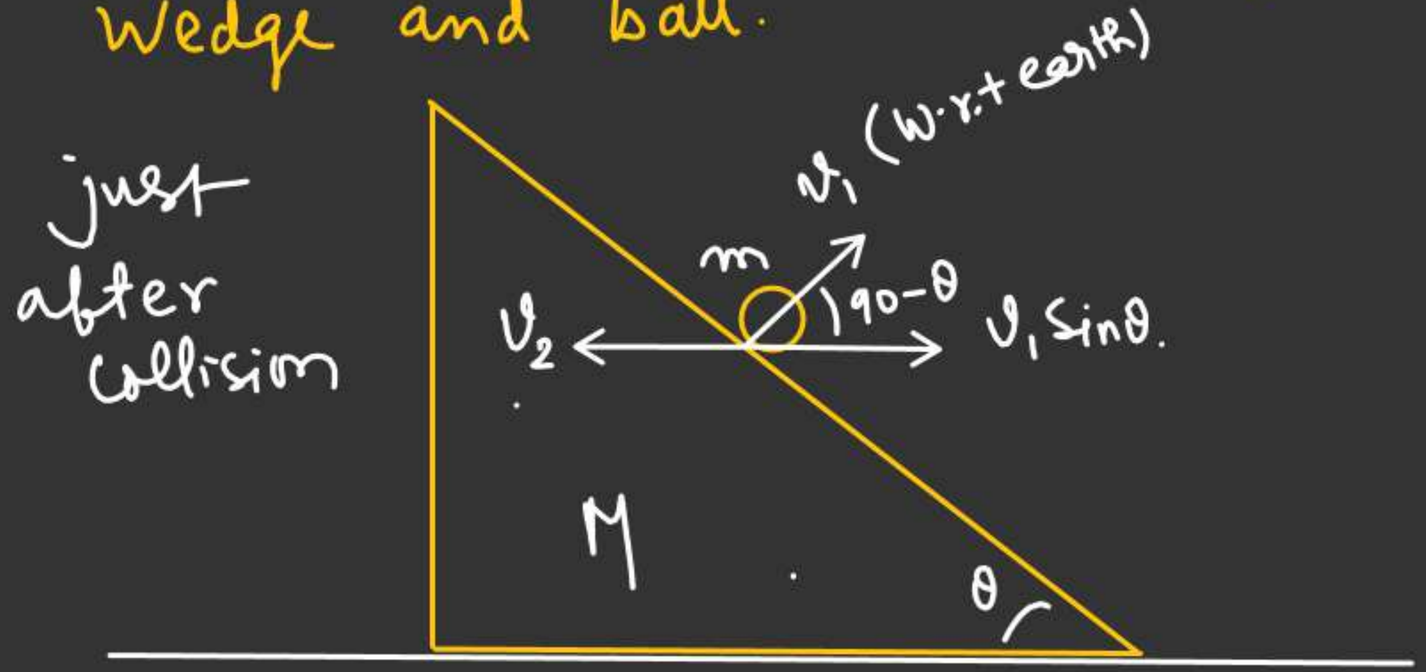
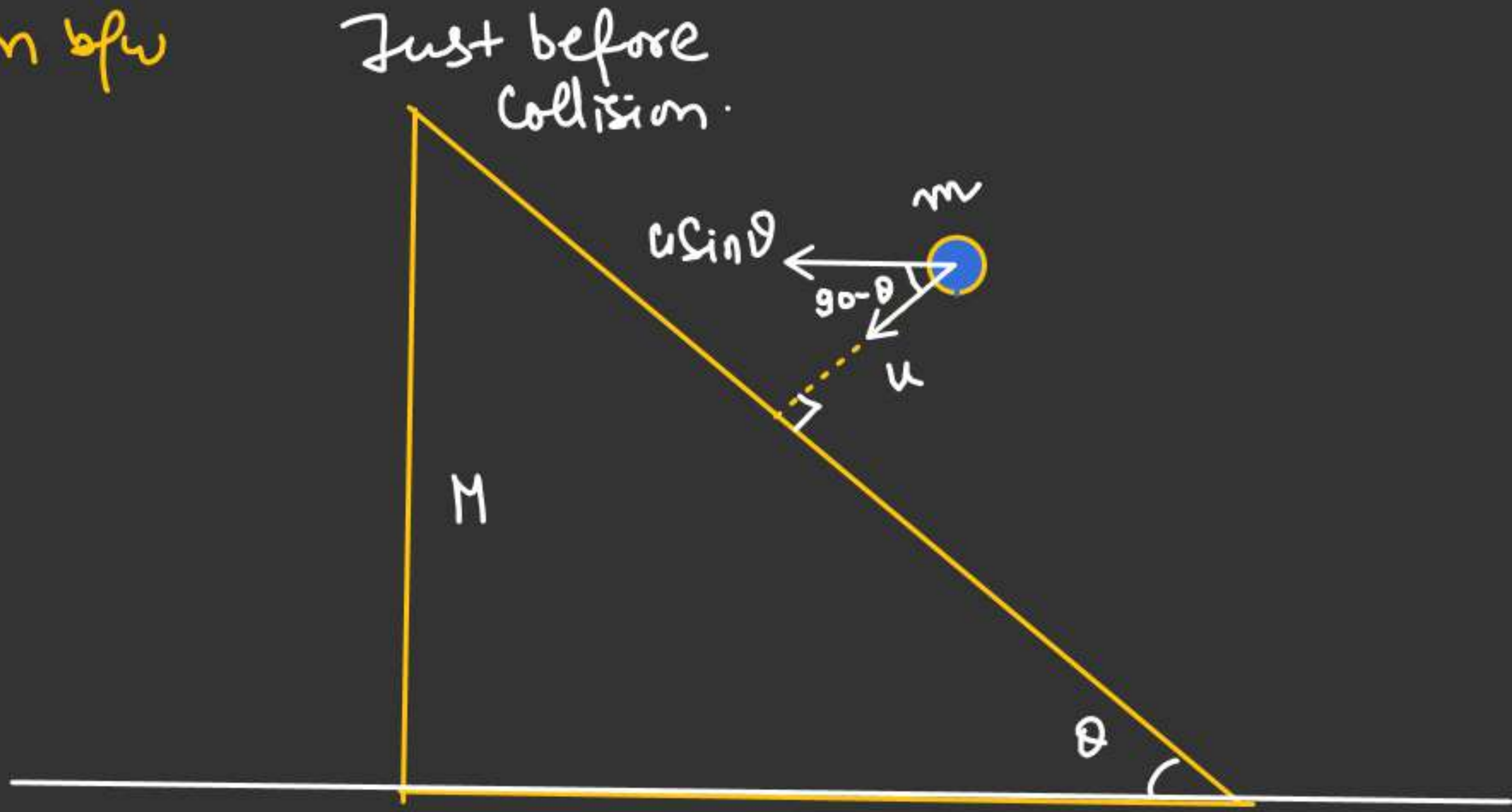
velocity of ball & wedge just after collision. e be the coffⁿ of restitution b/w wedge and ball.

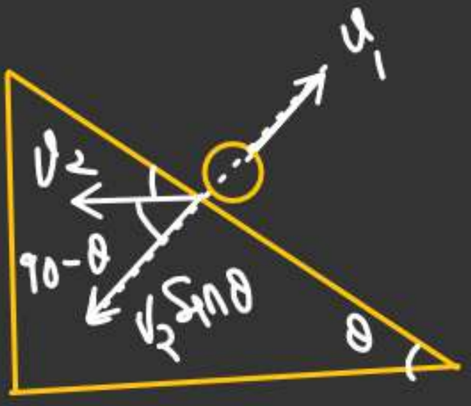




L.M.C in x- direction

$$-mu\sin\theta = mv_1\sin\theta - Mv_2 \quad (1)$$

Equation of e



$$e = \frac{v_1+v_2\sin\theta}{u}$$

$$eu = v_1+v_2\sin\theta \quad (2)$$

$$\left(\frac{mu\sin\alpha(1+e)}{M+m\sin^2\alpha} = v_2\right) \text{Ans}$$

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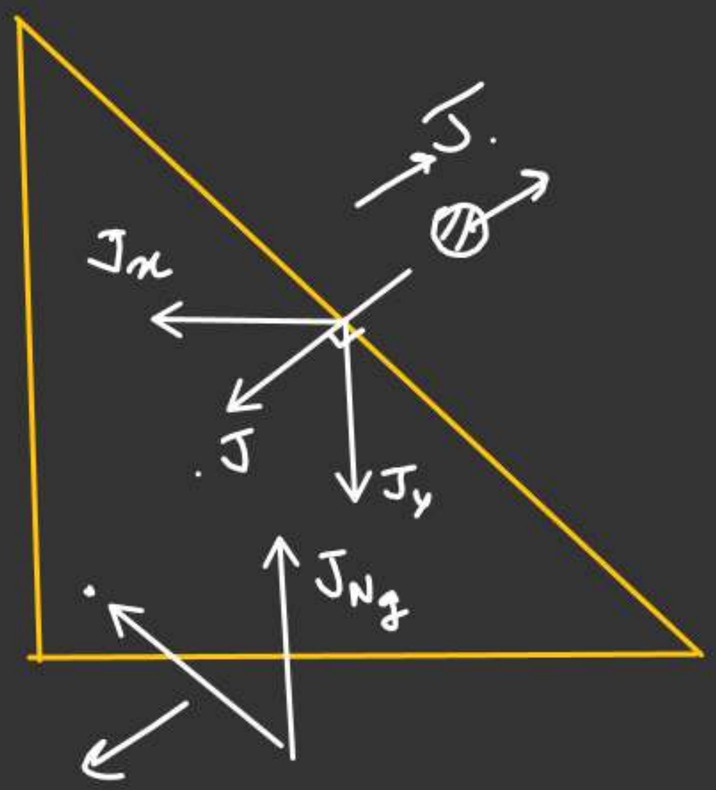
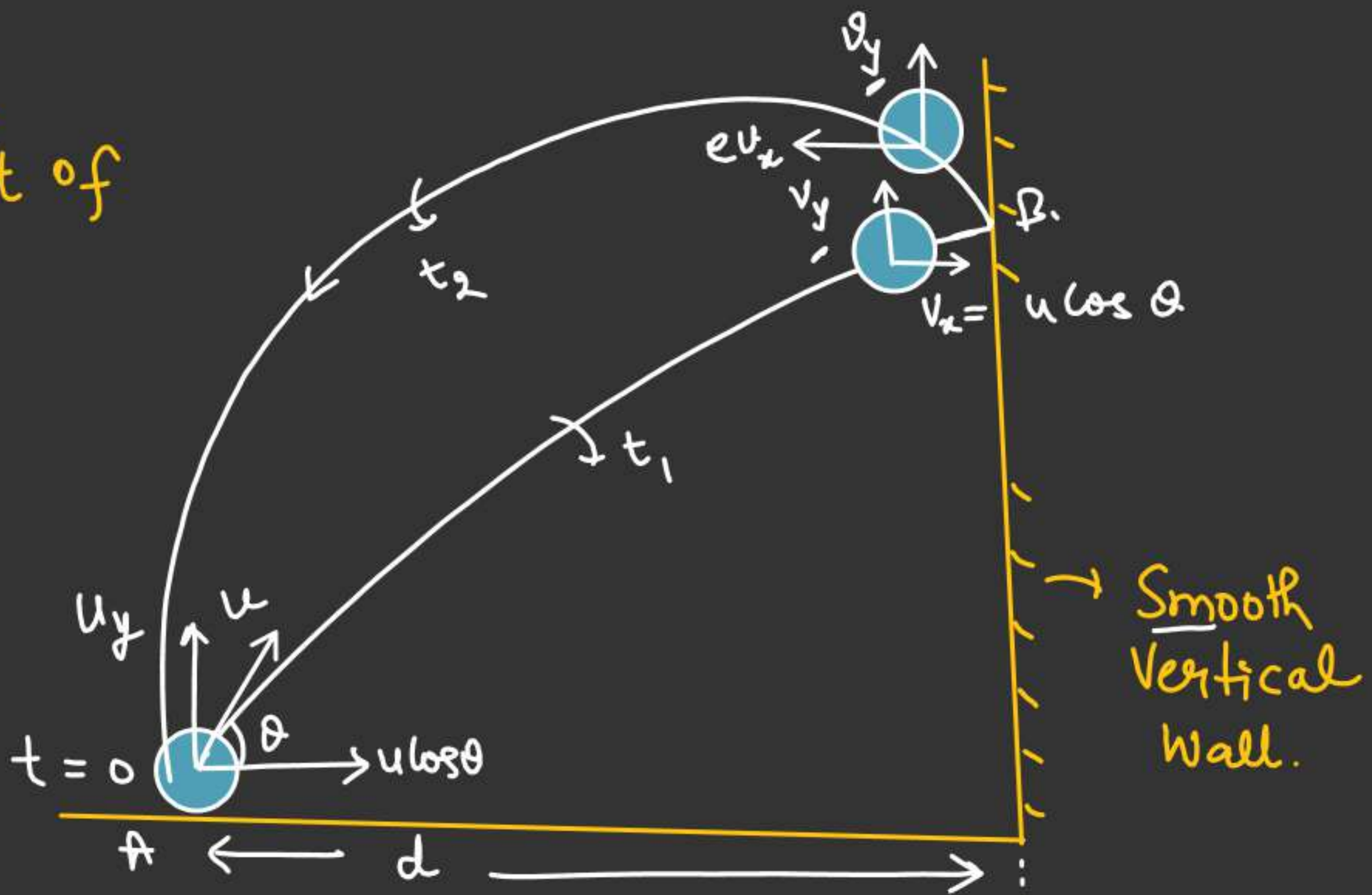


Component of J_{N_g} along common tangent so there is an external impulse along common tangent

So, velocity of ball along tangent not be same just before & just after

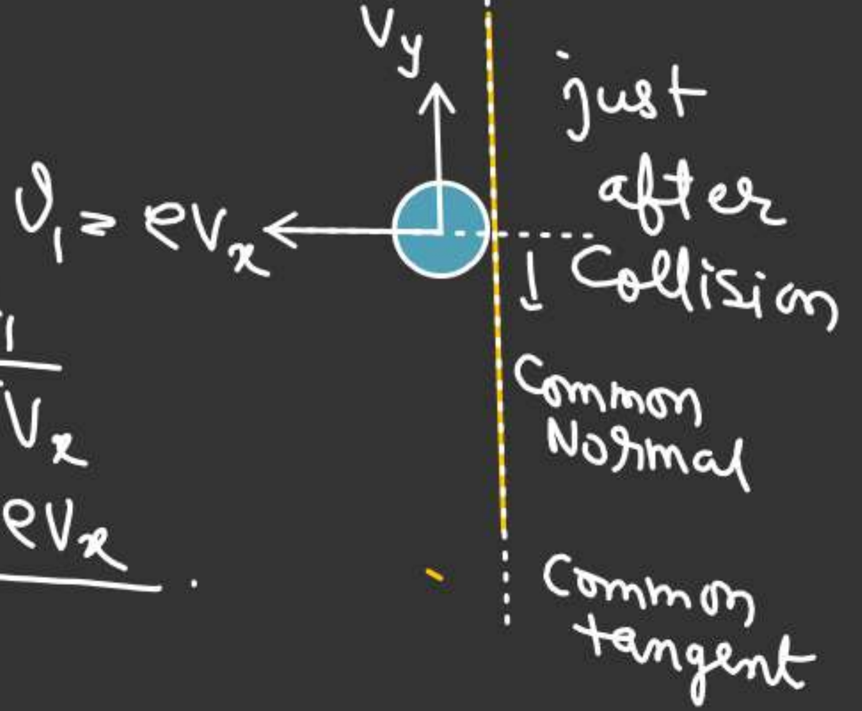
Q: Fin $u = ??$ So that ball again reaches to the point of projection.



$$T = t_1 + t_2 = \left(\frac{2u\sin\theta}{g}\right)$$

$$\left(\frac{d}{u\cos\theta} + \frac{d}{eu\cos\theta} = \frac{2u\sin\theta}{g}\right)$$

$u = ??$



$$e = \frac{v_1}{V_x}$$

$$v_1 = eV_x$$

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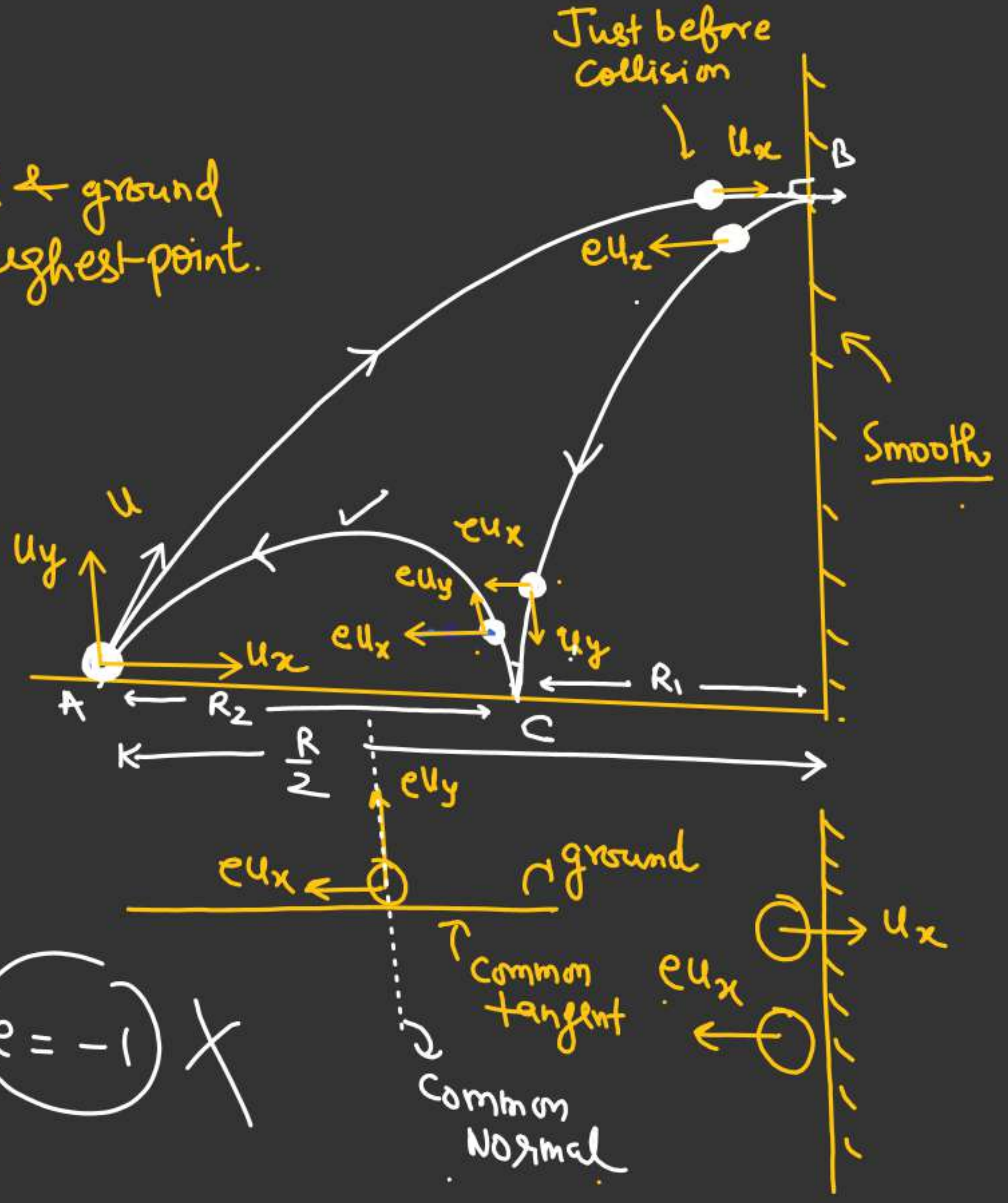
Find $e = ??$

$e =$ Cofficient of restitution b/w Wall & ball as well as ball & ground

ball Collide with the Wall at it's heighest point.



$$R = \frac{2u_x u_y}{g}$$

$$\frac{R}{2} = R_1 + R_2$$

$$\frac{\cancel{2}u_x u_y}{\cancel{2}g} = (eu_x)\,t_{BC} + \frac{2(eu_x)(eu_y)}{g}$$

$$\frac{u_x u_y}{g} = (eu_x)\left(\frac{u_y}{g}\right) + 2e^2\left(\frac{u_x u_y}{g}\right)$$

$$1 = e + 2e^2$$

$$2e^2 + e - 1 = 0$$

$$2e^2 + 2e - e - 1 = 0$$

$$2e(e+1) - 1(e+1) = 0$$

$e = \frac{1}{2}$ ✓, $e = -1$ ✗