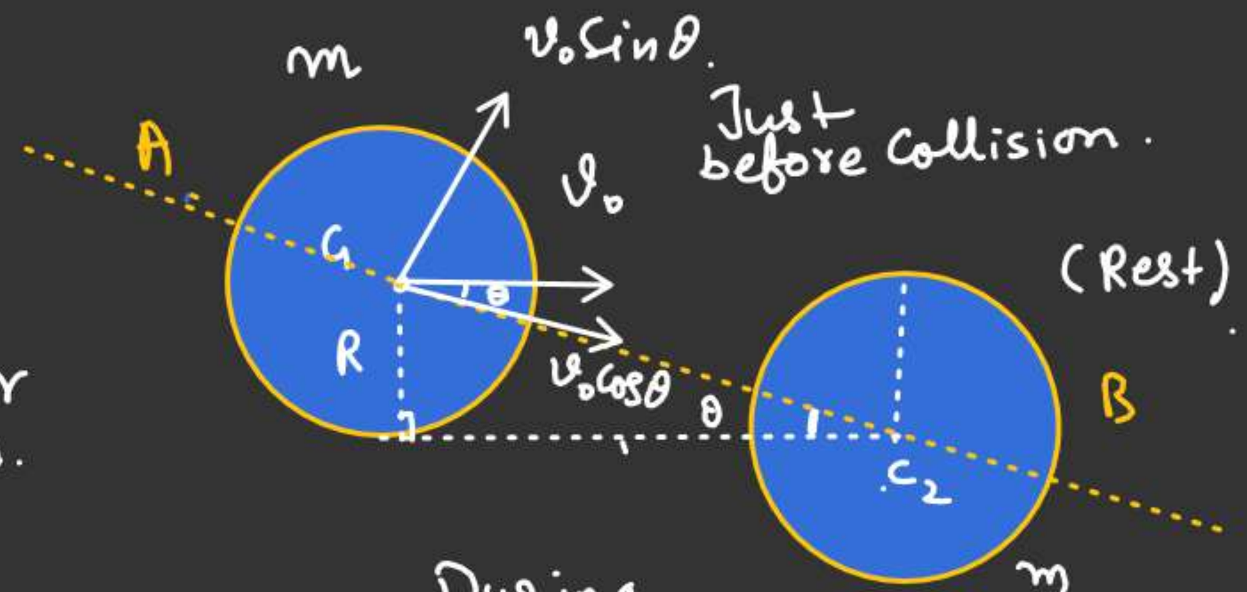
Nishant Jindal

H.W

If $e = \frac{1}{2}$.

Find Speed of ball A and B. Just after Collision



L.M.C (about Common Normal)

$$m v_1 + m v_2 = m v_0 \cos\theta \quad (\theta \to 30^\circ)$$

$$v_1 + v_2 = \frac{\sqrt{3} v_0}{2} \quad \text{—} \; (1)$$

Equation of e (Common Normal)

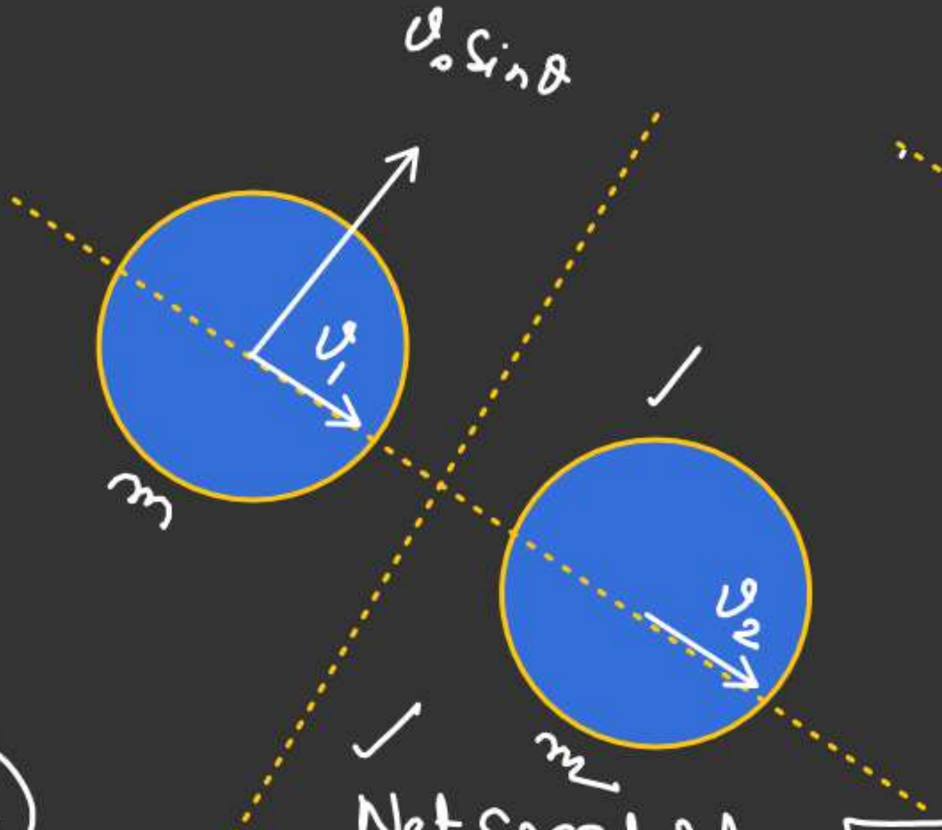
$$e = \frac{v_2 - v_1}{v_0 \cos\theta}$$

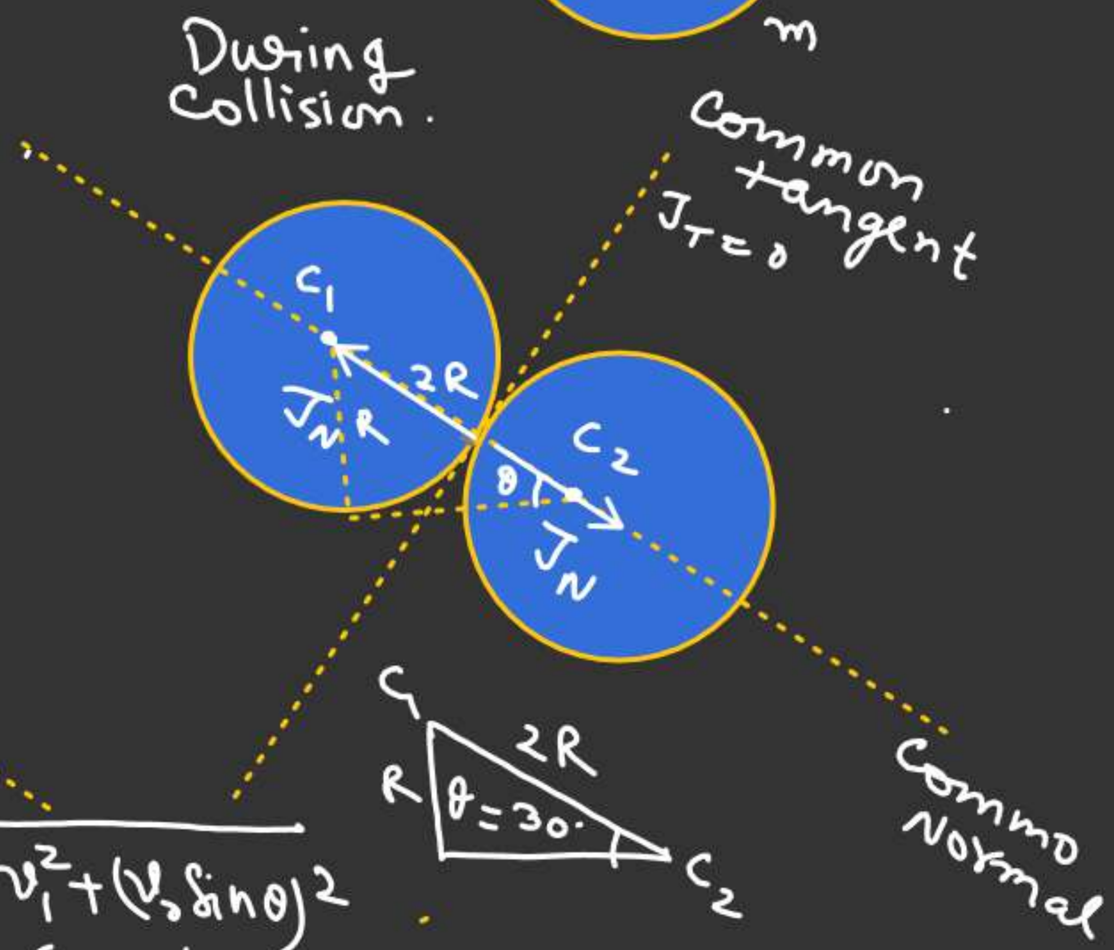
$$\left(\tfrac{1}{2}\right) e\, v_0 \cos\theta = v_2 - v_1$$

$$\frac{\sqrt{3} v_0}{4} = v_2 - v_1 \quad \text{—} \; (2)$$

$$v_1 = \left(+\frac{\sqrt{3} v_0}{8}\right)$$

$$v_2 = \left(\frac{3\sqrt{3} v_0}{8}\right)$$





Net Speed of A $= \sqrt{v_1^2 + (v_0 \sin\theta)^2}$

Net Speed of B $= v_2$

For B

$$J_N = (\Delta p)_{\text{ball } B} = (m v_2)$$

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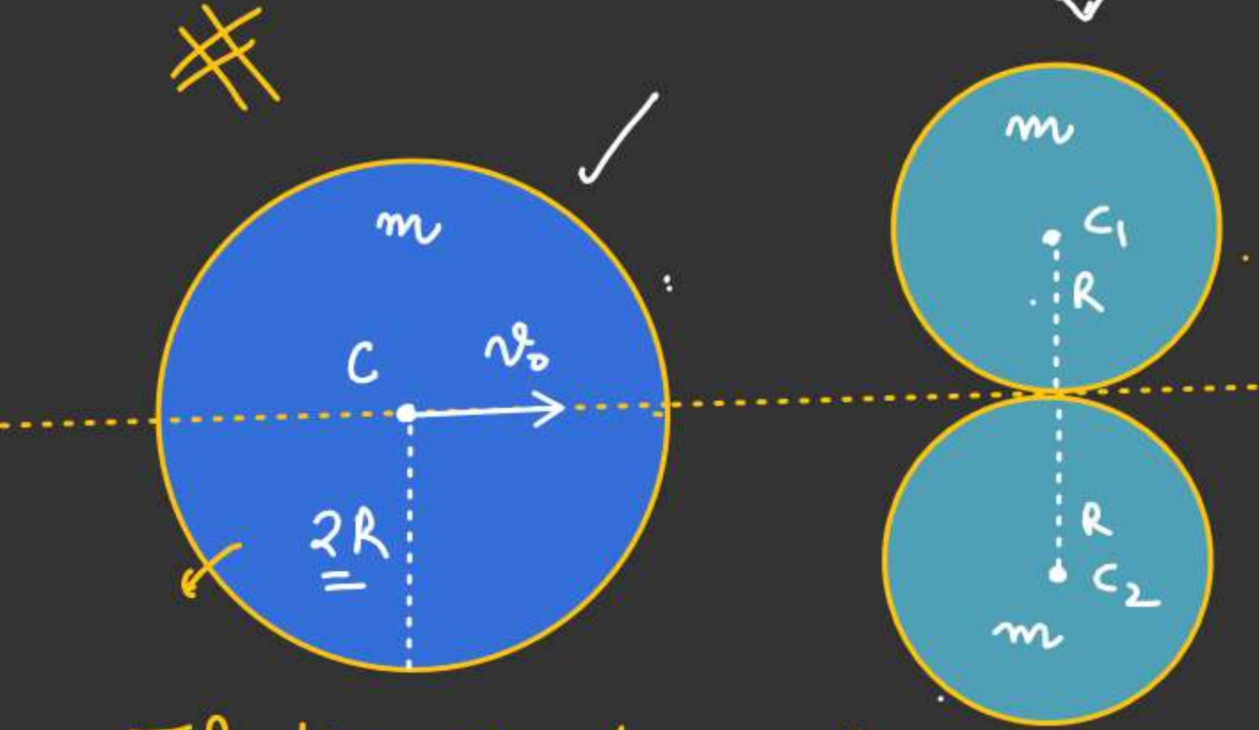
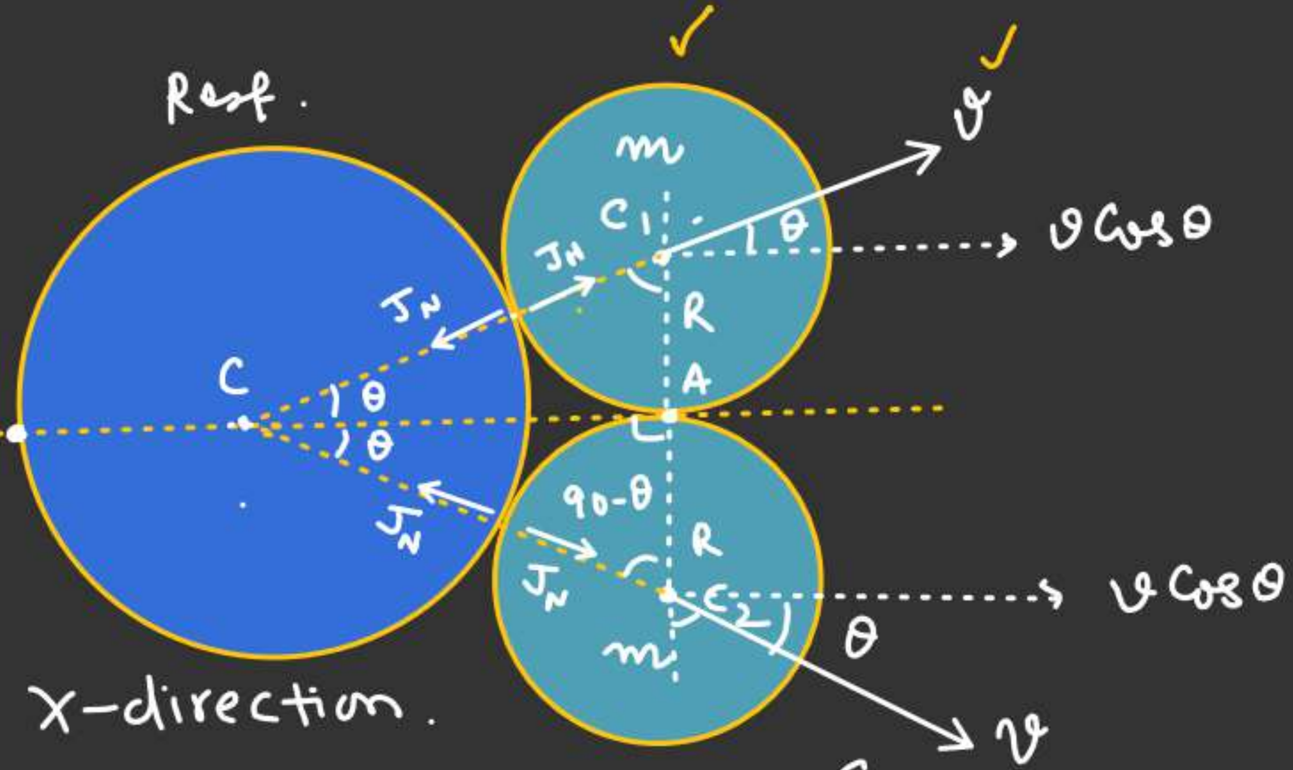




If bigger disc at rest after Collision find

1) $e = ?$

2) Impulse b/w bigger disc & Smaller disc.

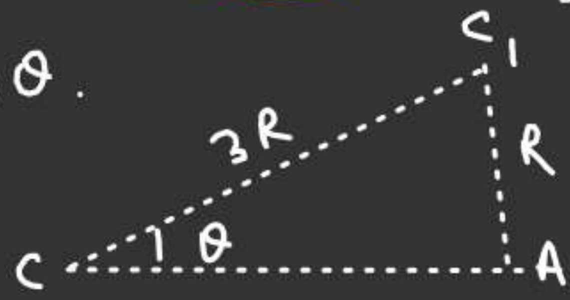
L.M.C in x-direction.

$$\cancel{m} v_0 = 2\cancel{m} v\cos\theta$$

$$v_0 = 2v\cos\theta$$

$$v = \frac{v_0}{2\cos\theta} = \left(\frac{3v_0}{4\sqrt{2}}\right)$$

$e = ??$ (Common Normal)



$$CA = \sqrt{9R^2 - R^2} = \sqrt{8R^2} = 2\sqrt{2}R.$$

$$\cos\theta = \frac{CA}{CC_1} = \frac{2\sqrt{2}R}{3R} = \left(\frac{2\sqrt{2}}{3}\right)$$

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$$v = \frac{v_0}{\cos\theta} = \frac{3v_0}{4\sqrt{2}} \checkmark \quad , \quad \cos\theta = \frac{2\sqrt{2}}{3}$$

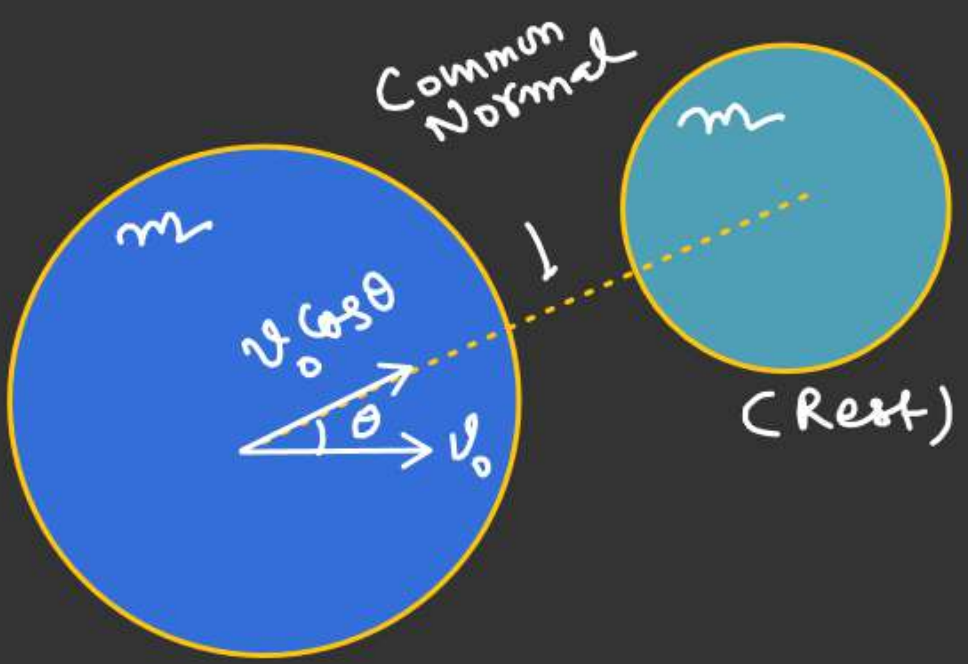
$$e = \frac{v}{v_0\cos\theta}$$

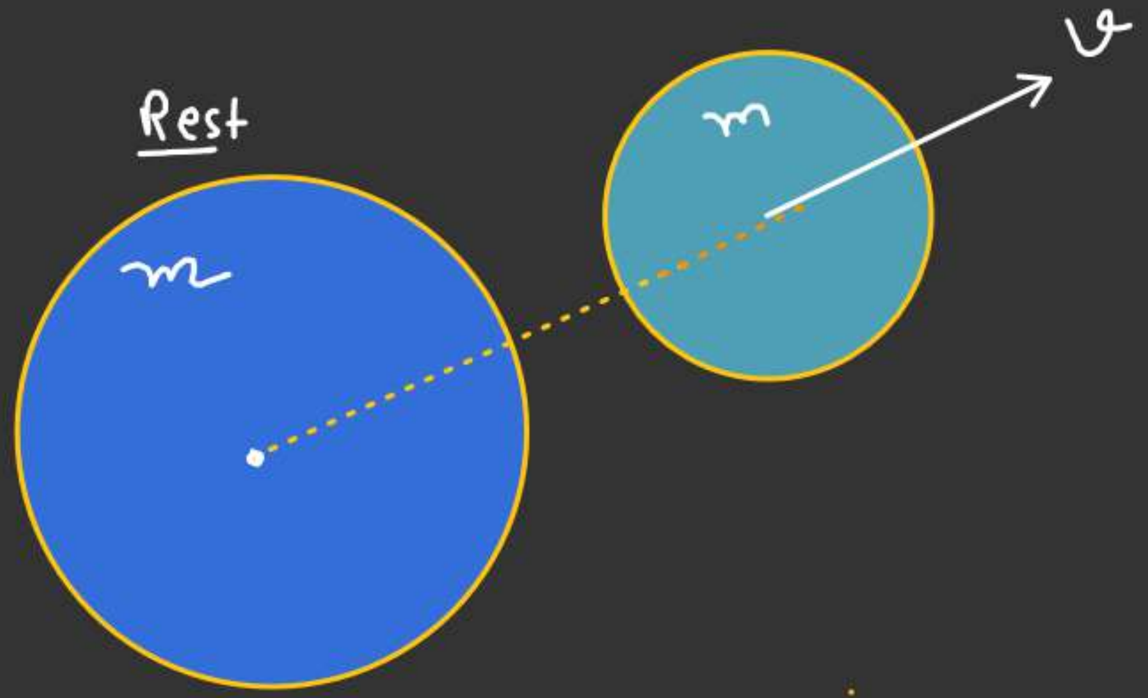
$$e = \left(\frac{3\cancel{v_0}}{4\sqrt{2}}\right) \times \frac{1}{\cancel{v_0}} \times \frac{3}{2\sqrt{2}}$$

$$e = \left(\frac{9}{16}\right) \underline{\text{Ans}}$$

$$J_N = mv = m\left(\frac{3v_0}{4\sqrt{2}}\right)$$

$$J_N = \left(\frac{3mv_0}{4\sqrt{2}}\right) \underline{\text{Ans}}$$





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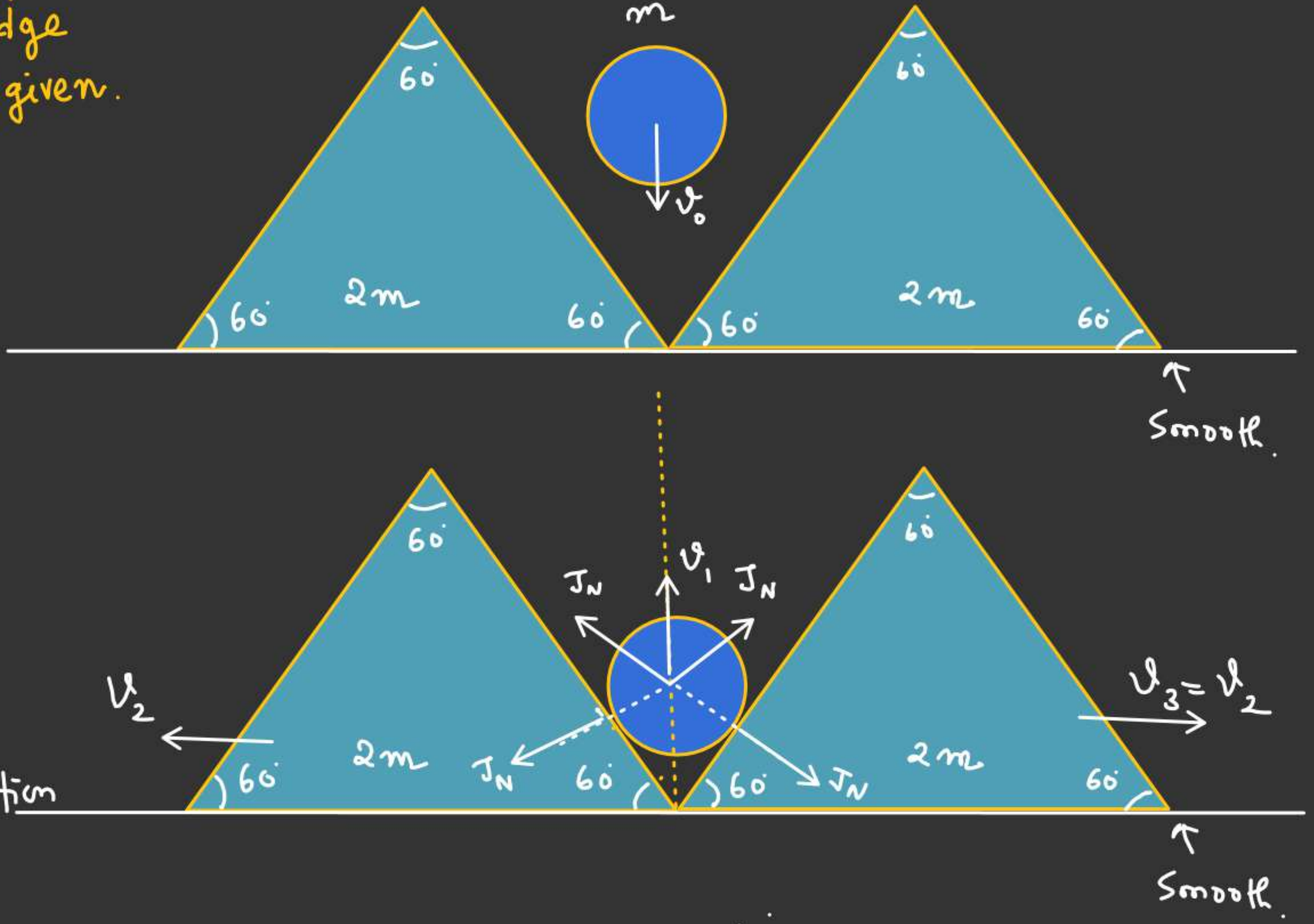
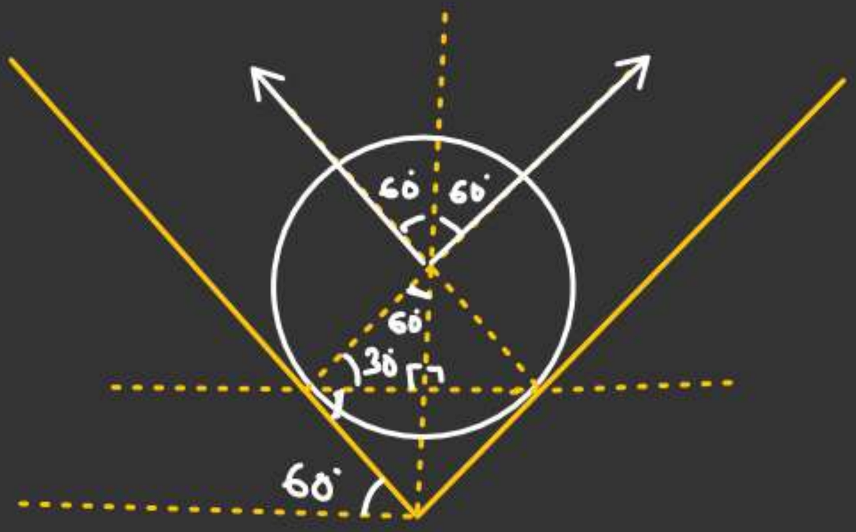
Ball Collide Symmetrically with two wedge. Find velocity of wedge just after Collision. ($e = \frac{1}{2}$) given.



L·M·C in x-direction.

$$0 = -2mv_2 + 2mv_3$$

$$v_2 = v_3$$



$$2J_N \cos 60° = (\Delta p)_{\text{ball in y-direction}}$$

$$J_N = mv_1 - (-mv_0)$$

$$J_N = m(v_1 + v_0) \quad \text{—} \ (1)$$

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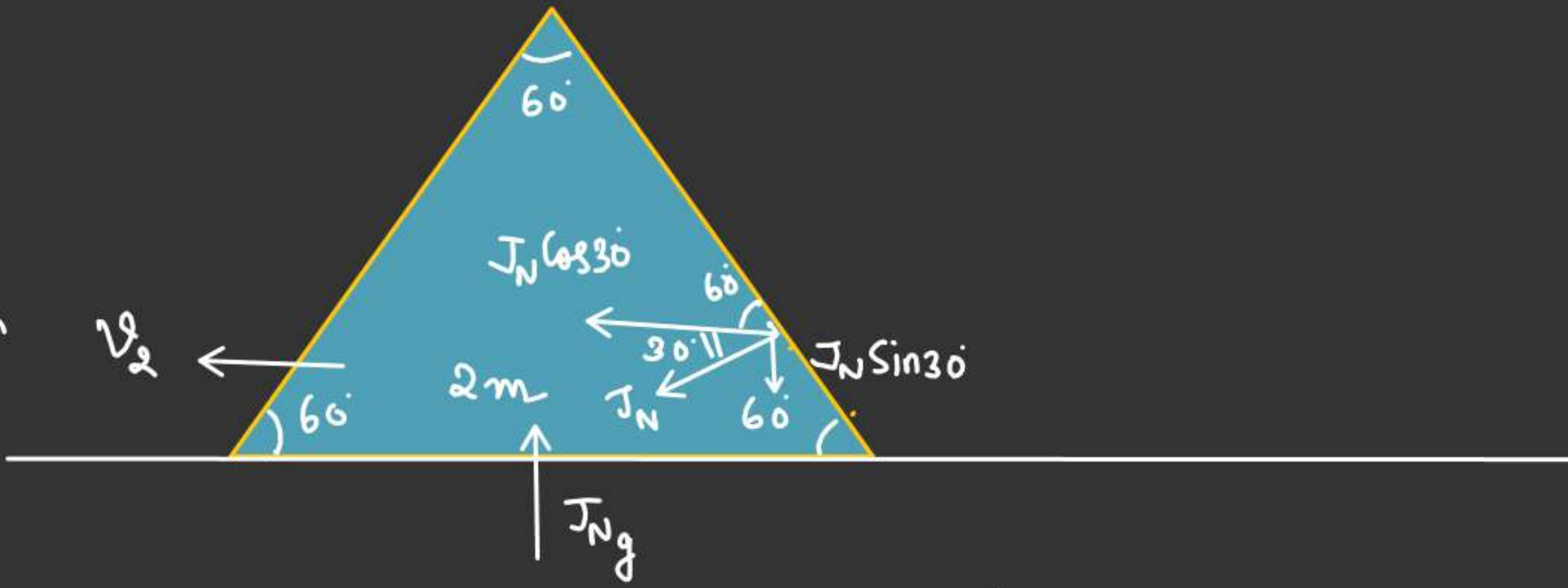
$$\boxed{J_N = m(v_1 + v_0) - (1)}$$

For Wedge impulse Equation.

$$J_N \cos 30^\circ = (\Delta p)_{\text{wedge in } x\text{-direction}}$$

$$\frac{\sqrt{3} J_N}{2} = 2mv_2 - 0$$

$$\boxed{\frac{\sqrt{3}}{4m} J_N = v_2 - (2)}$$



Equation of e

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Equation of e

$$\frac{1}{2} = e = \frac{v_1 \cos 60^\circ + v_2 \cos 30^\circ}{v_0 \cos 60^\circ}$$

$$\frac{v_0 \cos 60^\circ}{2} = v_1 \cos 60^\circ + v_2 \cos 30^\circ$$

$$\frac{v_0}{4} = \frac{v_1}{2} + \frac{\sqrt{3}\, v_2}{2}$$

$$\boxed{\frac{v_0}{2} = v_1 + \sqrt{3}\, v_2} \quad - (3)$$

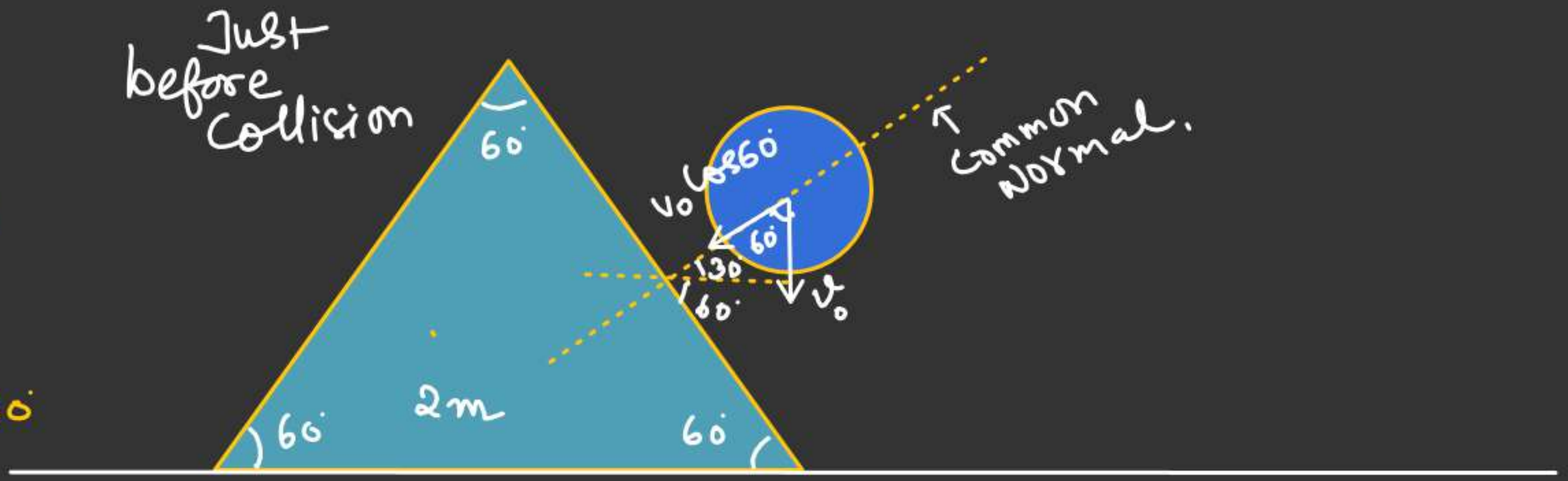
Solve from Eq (1), (2) + (3)

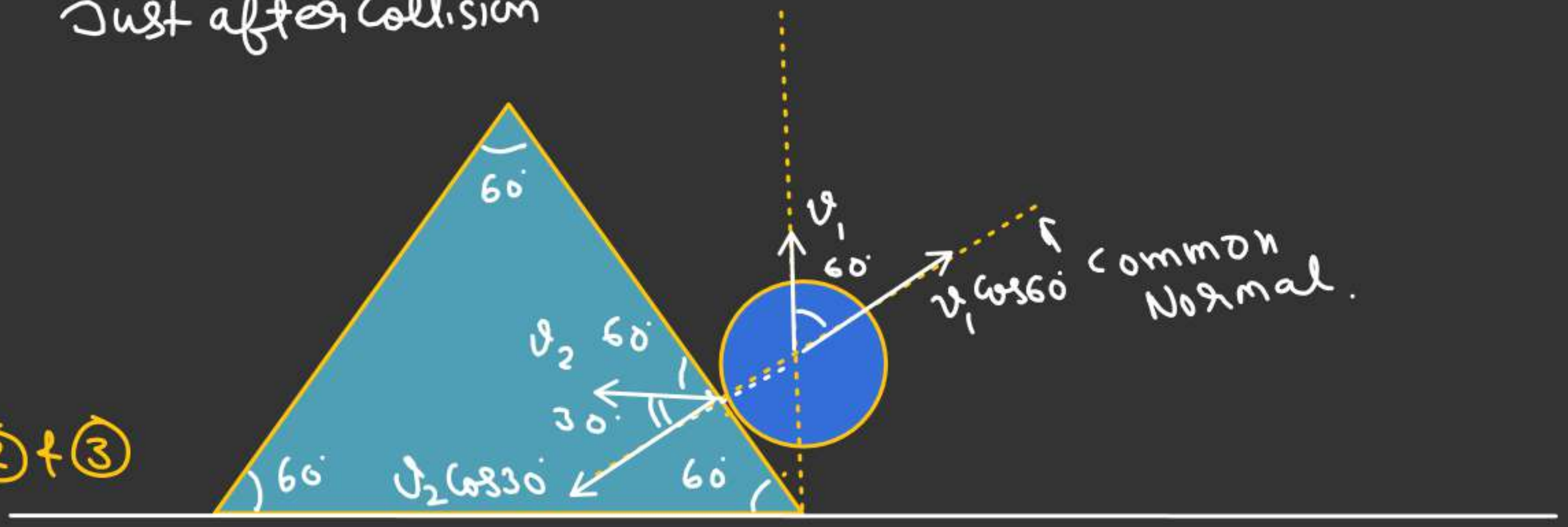
find

$J_N = ?$

$v_1 = ?$

$v_2 = ?$





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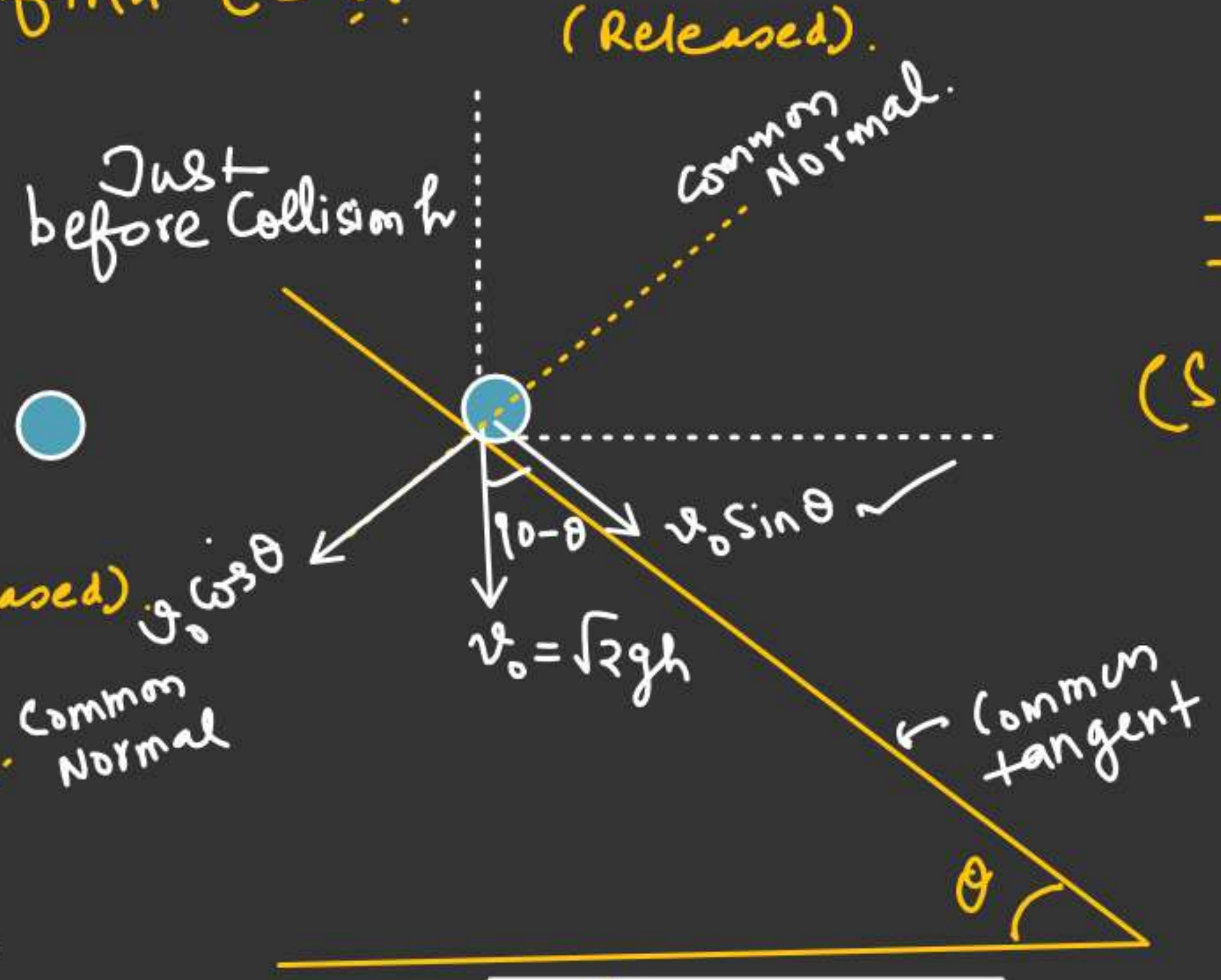
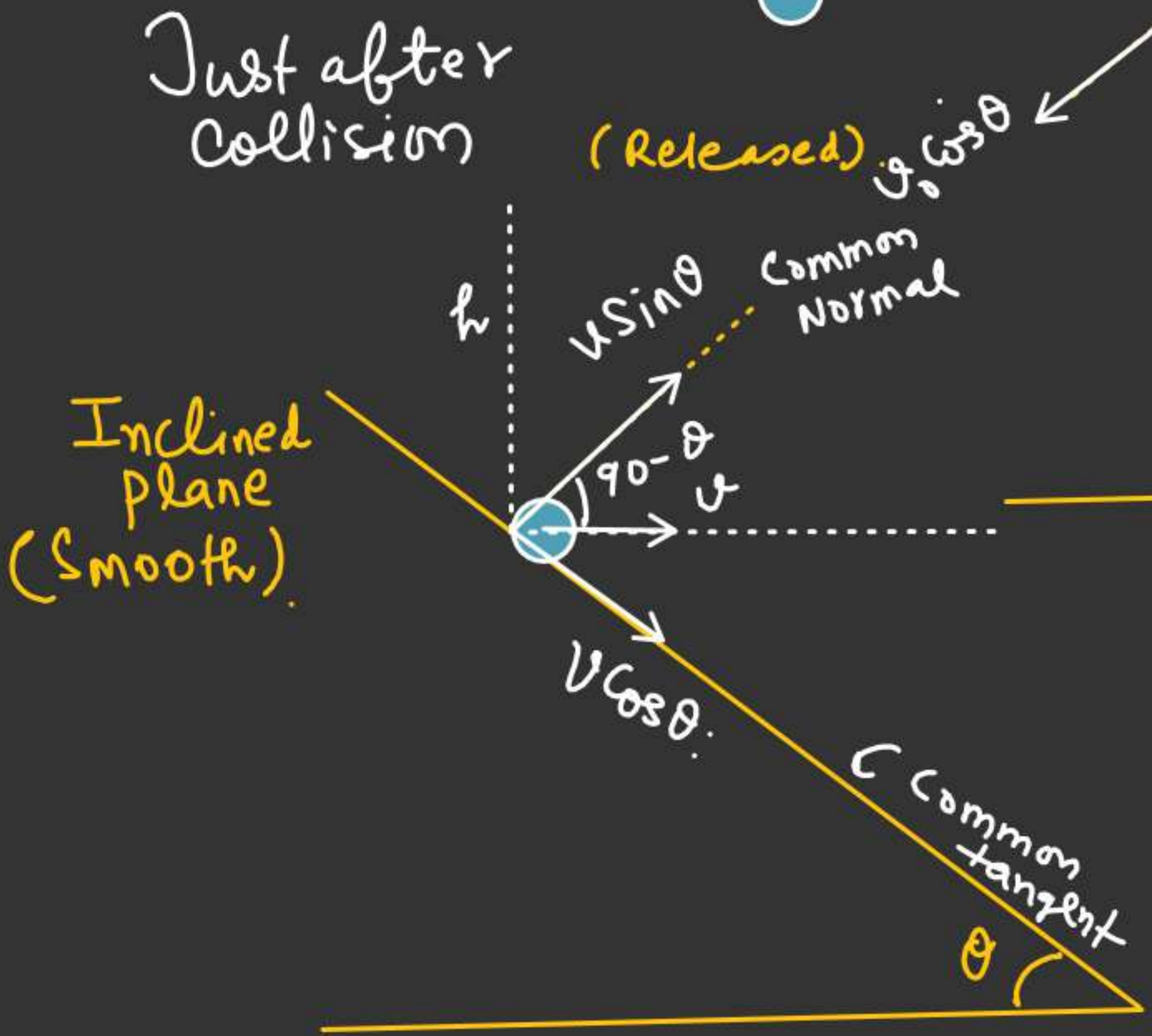
After Collision ball become horizontal. find $e = ??$



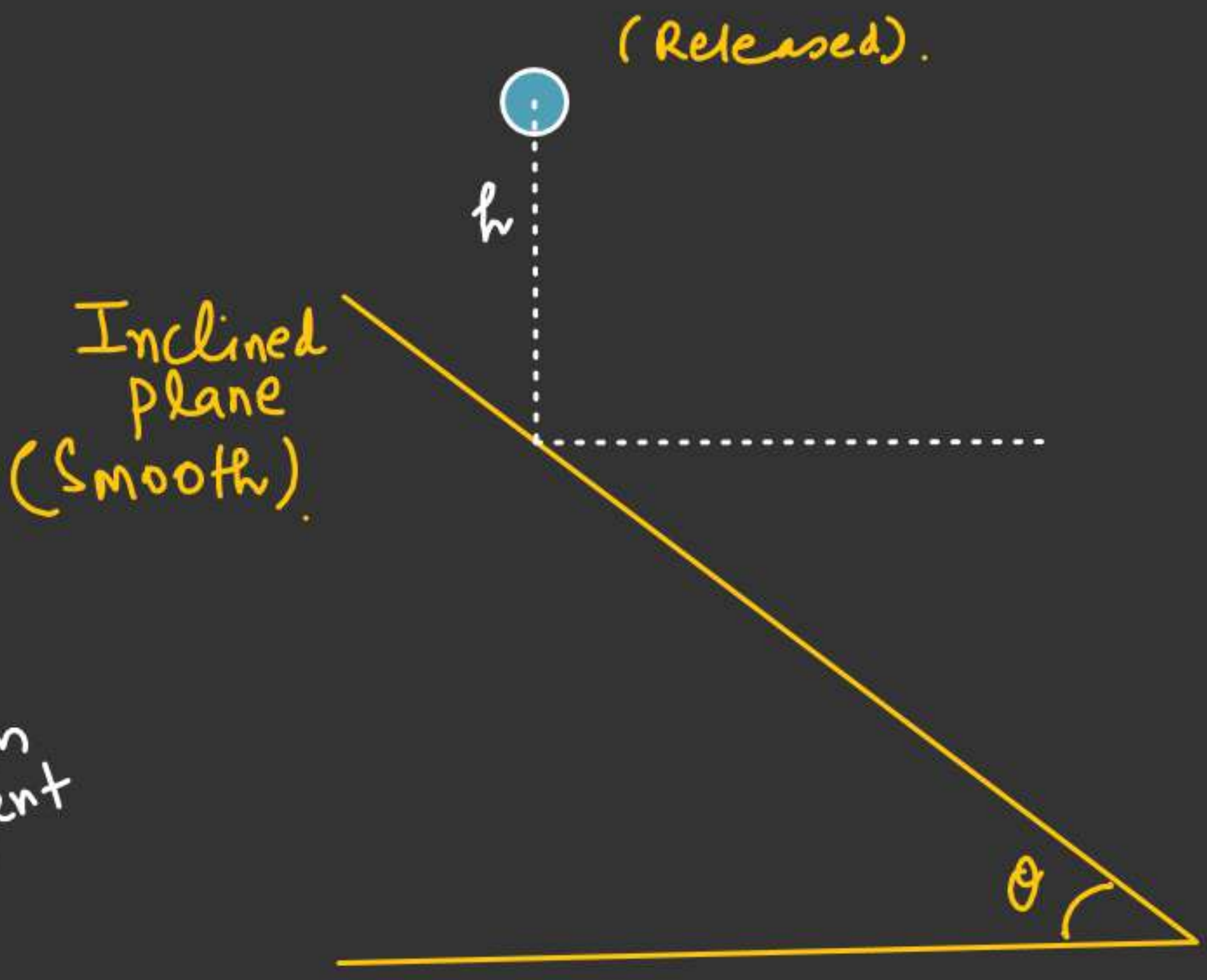


if $e = 1$

$\tan^2\theta = 1$

$\theta = 45^\circ$

$\Rightarrow v = v_0$



$v_0 \sin\theta = v\cos\theta$ (common tangent)

$$e = \frac{v\sin\theta}{v_0\cos\theta} \quad \text{— (1)}$$

$$e\, v_0\cos\theta = v\sin\theta \quad \text{— (2)}$$

$$\frac{\tan\theta}{e} = \cot\theta$$

$$\boxed{e = \tan^2\theta}$$

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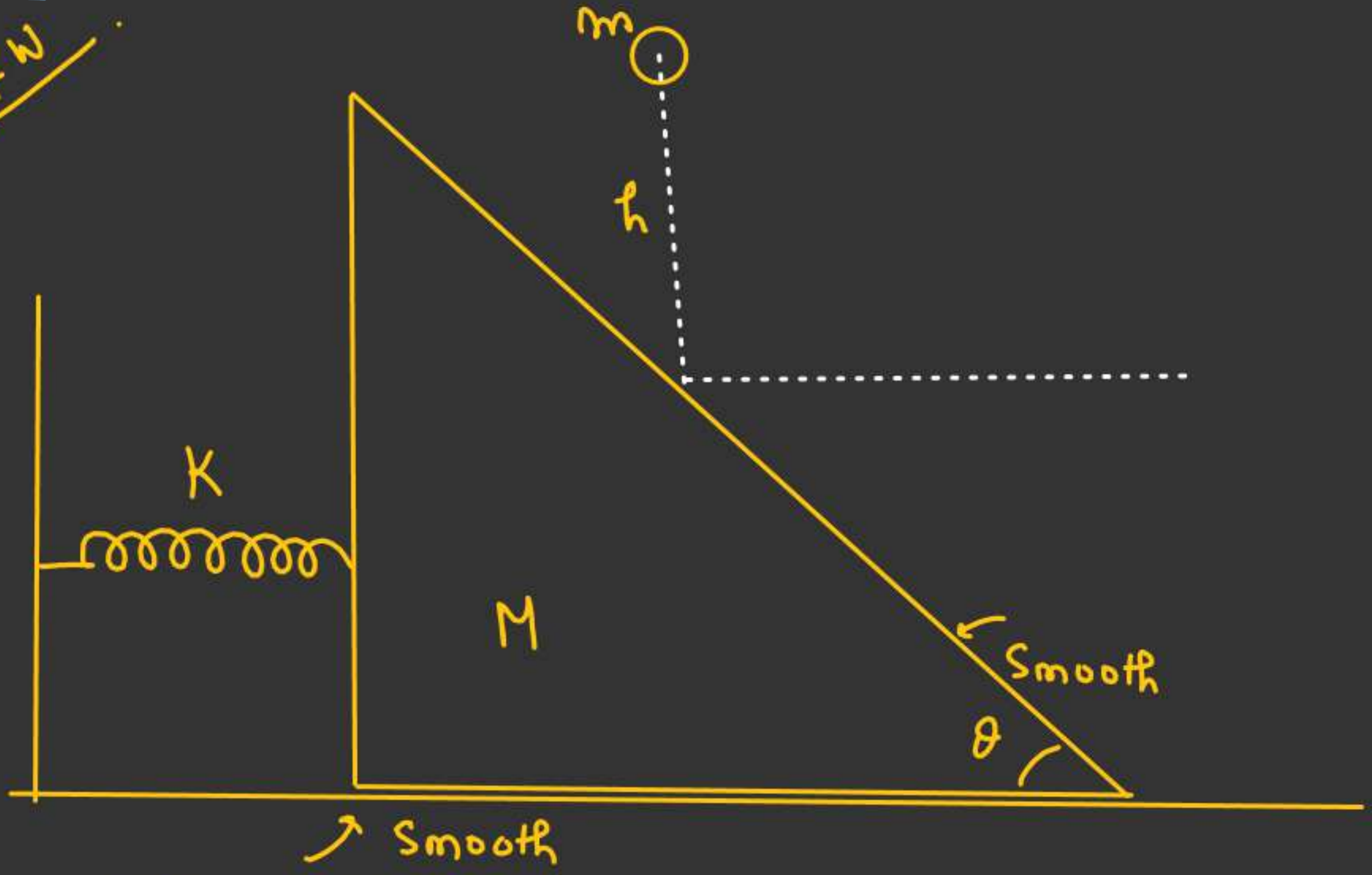

After Collision ball become horizontal. Find maximum Compression in the spring