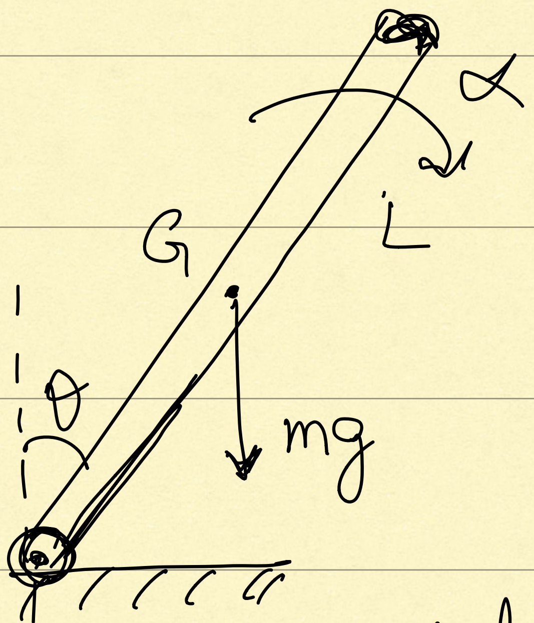
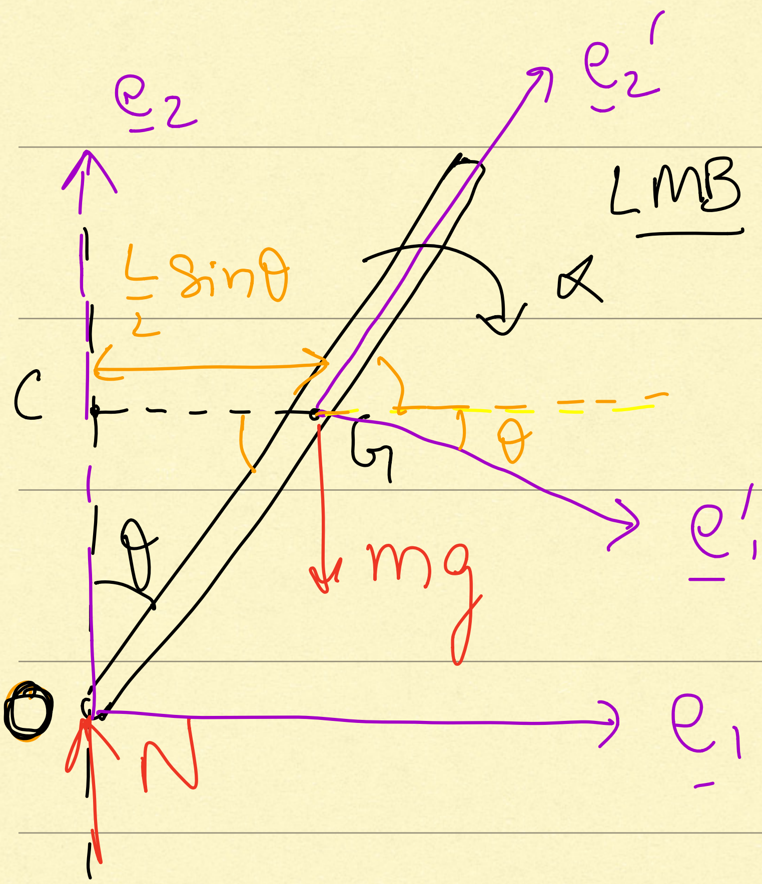


Determine the normal reaction and the angular acceleration immediately after the release of the rod.

↳ from rest

$\underline{\omega} = 0$



LMB

$$\sum \underline{F} = m\underline{a}^G$$

$$\uparrow (N - mg)\,\underline{e}_2$$

AMB

$$\underline{M}_c = \underline{r}^{G/C} \times m\,\underline{a}^G + I_3^G \underline{\alpha}$$

↑
total Moment about C

$$\underline{M}_c = -\left(mg\,\frac{L}{2}\sin\theta \right)\underline{e}_3 .$$

$$I_3^G = \frac{1}{12} m L^2 .$$

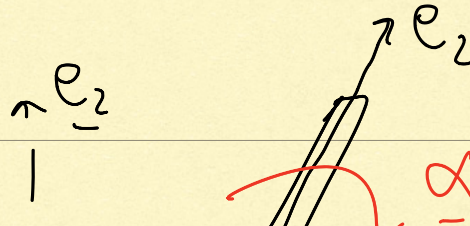
$$\underline{\alpha} = -\alpha\,\underline{e}_3 \quad , \quad \underline{\omega} = \underline{0}$$

$$\underline{r}^{G/c} = \frac{L}{2}\sin\theta\,\underline{e}_1$$

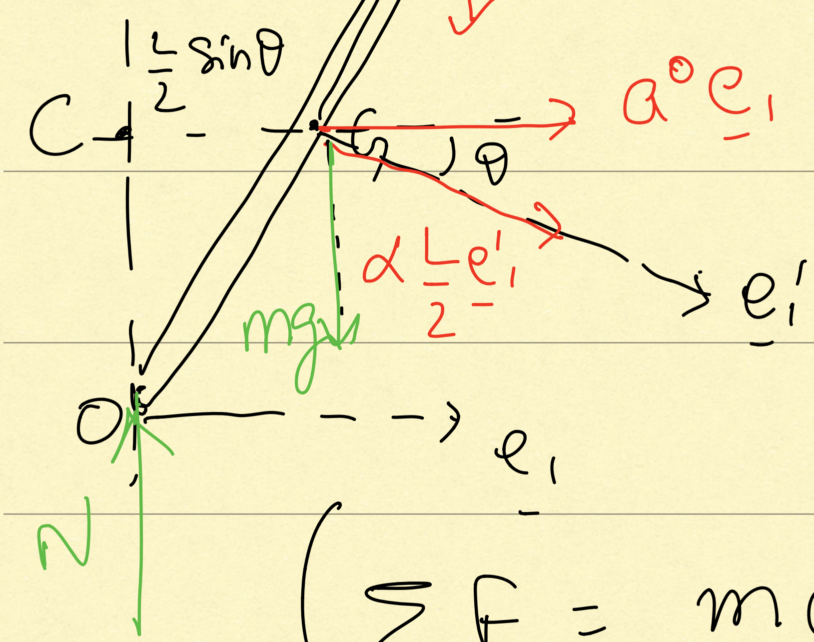
$$\underline{a}^G = \underbrace{\underline{a}^O}_{a^O\underline{e}_1} + \cancel{\underline{\omega}} \times (\underline{\omega} \times \underline{r}^{G/O}) + \underbrace{\underline{\alpha}}_{-\alpha\underline{e}_3} \times \underbrace{\underline{r}^{G/O}}_{\frac{L}{2}\underline{e}_2'}$$

$$\underline{e}_3' = \underline{e}_3$$

$$\underbrace{= a^O\underline{e}_1 + \alpha\frac{L}{2}\underline{e}_1'}_{\underline{a}^G}$$



$\underline{\alpha} = -\alpha\,\underline{e}_3$



N, α

$$\left(\sum F = m\underline{a}^G\right) \cdot \underline{e}_2$$

$$N - mg = -m\alpha \frac{L}{2}\sin\theta \qquad (1)$$

$(\underline{e}_1' \cdot \underline{e}_2 = -\sin\theta)$

$$\left(\underline{M}_c = \underline{r}^{G/c} \times \underline{a}^G + I_3^G \underline{\alpha}\right) \cdot \underline{e}_3$$

$$-mg\frac{L}{2}\sin\theta = -\left(m\alpha\frac{L}{2}\sin\theta\right)\frac{L}{2}\sin\theta - \frac{1}{12}mL^2\alpha \qquad (2)$$

$$\Rightarrow \boxed{\alpha = \frac{2g\sin\theta}{L\left(\frac{1}{3} + \sin^2\theta\right)}}$$

put in 1

$$\boxed{N = \frac{mg}{1 + 3\sin^2\theta}}$$