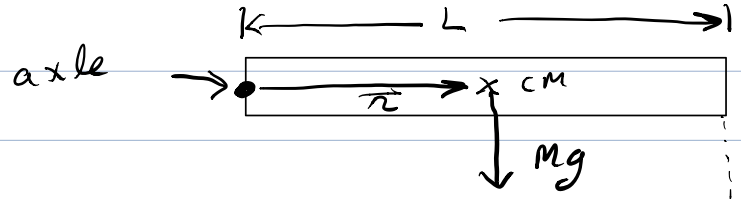
A long rod of length L is held horizontally and pivoted from one end. It is released from rest. What is the initial linear acceleration of the end?



Mass M

Plan: $\Sigma \tau = I\alpha$

Calculate torque about the axle.

Initially: $\tau = -Mg \cdot \frac{L}{2} \cdot \sin 90^\circ = -MgL/2$

- $-Mg$: clockwise force
- $\frac{L}{2}$: acts on CG
- $\sin 90^\circ$: angle between $\vec{r}$ and $\vec{F}$

$I = \frac{1}{3} M L^2$ (use chart)

$\therefore \quad \Sigma \tau = I\alpha$

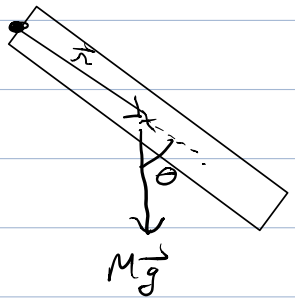
$-MgL/2 = \frac{1}{3} ML^2 \alpha$

$\alpha = -\frac{3g}{2L}$

What is a_{tan} of the end?

$a_{tan} = \alpha \cdot L = -\frac{3}{2} g$

Note: $\alpha \neq$ constant. Later on, the angle changes



Torque $= -Mg \frac{L}{2} \sin\theta$ is smaller since θ is smaller.