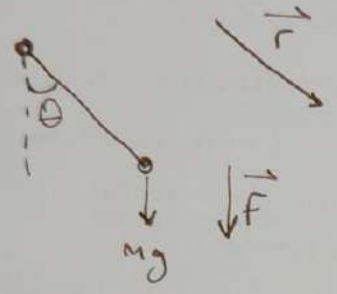
$$I\ddot{\theta} = -mgr_G \sin\theta$$

Minus comes from torque equation.

$$\vec{\tau} = \vec{r} \times \vec{F} \quad \text{(cross product)}$$



$$\vec{F} = -mg\vec{j}.$$

$$\vec{r} = r\sin\theta\vec{i} - r\cos\theta\vec{j}$$

$$\vec{\tau} = (r\sin\theta\vec{i} - r\cos\theta\vec{j}) \times (-mg\vec{j}) \quad [\text{cross product!!}]$$



$$i \times j = k \qquad i^2 = j^2 = k^2 = 0$$

$$\vec{\tau} = -mgr\sin\theta\,\vec{k}$$

magnitude