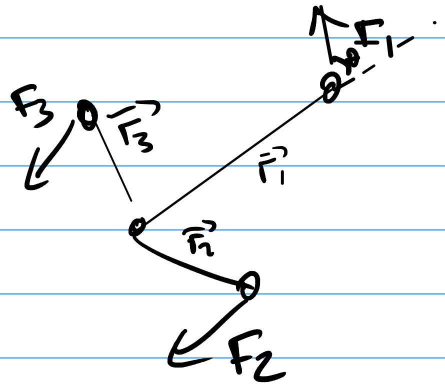


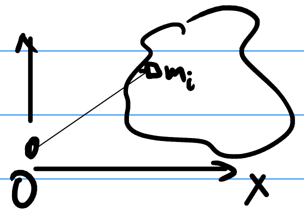
$$\vec{\tau}_{net} = \sum \vec{\tau}_i =$$

$$= \sum \vec{r}_i \times \vec{F}_i$$

$$= \sum r_i \cdot F_i \cdot \sin\theta \ \hat{cw}$$

Static equilibrium

$$\sum_{ext} \vec{F}_i = 0 \quad ; \quad \sum_{ext} \vec{\tau}_i = 0$$



$$\vec{\tau}_g = \sum \vec{r}_i \times m_i \vec{g} =$$

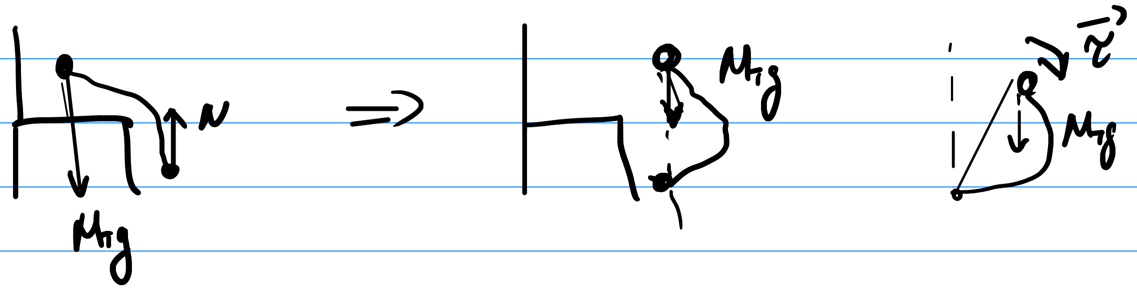
$$= \sum_i r_\perp \cdot m_i g \;\hat{cw} \qquad \sum m_i$$

$$= \left(\frac{\sum x_i \cdot m_i}{M_T} \right) g \,\hat{cw} \cdot M_T$$

$$\vec{R}_{cm} = \frac{\sum m_i \vec{r}_i}{M_T}$$

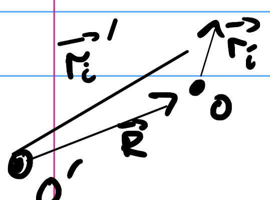
$$= X_{cm} \cdot M_T g \;\hat{cw} =$$

$$\boxed{\vec{\tau}_g = \vec{R}_{cm} \times M_T \vec{g}}$$



if $\sum \vec{F}_{ext_i} = 0$ and $\sum \vec{\tau}_{ext} = 0 = \sum \vec{r}_i \times \vec{F}_i$

$$\Rightarrow \vec{\tau}\,'_{ext} = 0$$



$$\vec{r}_i\,' = \vec{R} + \vec{r}_i$$

$$\vec{\tau}\,' = \sum_i \vec{r}_i\,' \times \vec{F}_i$$

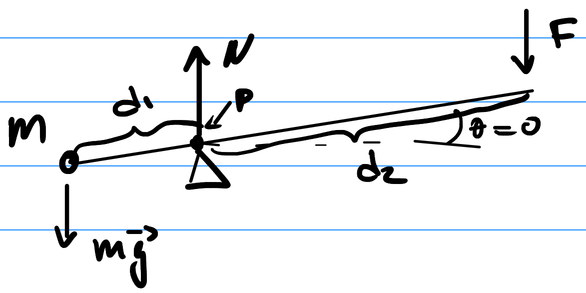
$$= \sum_i (\vec{R} + \vec{r}_i) \times \vec{F}_i$$

$$= \underbrace{\sum_i \vec{R} \times \vec{F}_i}_{\vec{R} \times (\sum \vec{F}_i) = 0} + \underbrace{\sum \vec{r}_i \times \vec{F}_i}_{=0} = 0 \quad \therefore$$

Lever

$$\sum \vec{F_i} = 0$$

$$\sum \vec{\tau_i} = 0$$



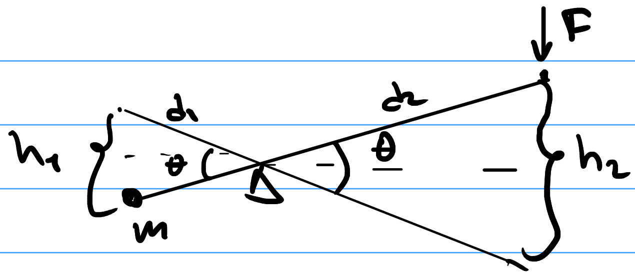
$$\sum \vec{F_i} = m\vec{g} + \vec{N} + \vec{F}$$

w.r.p : $\sum \vec{\tau_i} = d_1 \cdot mg\,\widehat{ccw} +$

$$+\, d_2 F \cdot \underbrace{\widehat{cw}}_{= -\widehat{ccw}}$$

$$= (d_1 mg - d_2 F)\,\widehat{ccw} = 0$$

$$F = \frac{d_1}{d_2} mg$$

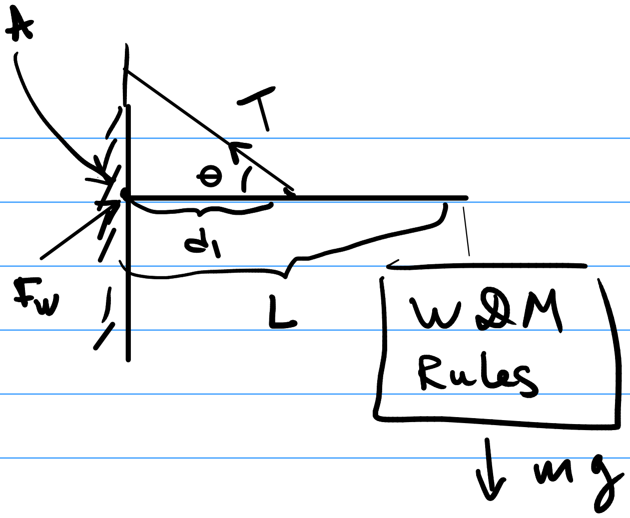


$$W_F = F \cdot h_2$$

$$\frac{h_1}{d_1} = \frac{h_2}{d_2} \Rightarrow h_2 = \frac{d_2}{d} h_1$$

$$W_F = F \cdot \frac{d_2}{d_1} h_1 = mg\,\cancel{\frac{d_1}{d_2} \cdot \frac{d_2}{d_1}}\, h_1$$

$$W_F = mgh_1$$



$$\sum \vec{F_i} = 0 =$$

$$= m\vec{g} + \vec{T} + \vec{F_w}$$

$$\sum_i \vec{\tau_i} = 0 =$$

W.R.A & $\sum \vec{\tau_i} = L\cdot mg\ \hat{cw}$

$+\ T\sin\theta\cdot d_1\ \hat{ccw}$

$+\ \cancel{F_w\cdot 0} \to 0$

$$T = \frac{L\cdot mg}{d_1 \sin\theta}$$