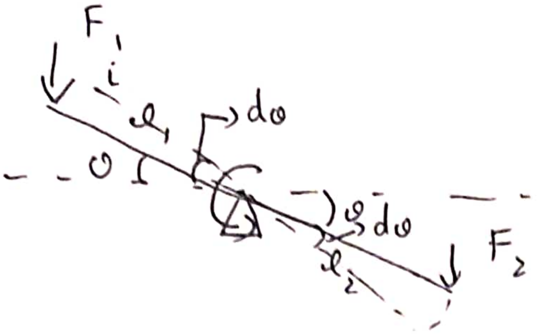
31-10-2020 DIY Lecture Live Session 13 S. Tarun Prasad ME17B114

(1.)



Virtual work done by the 2 forces,

$F_1 l_1 \cos\theta\, d\theta$, $-F_2 l_2 \cos\theta\, d\theta$

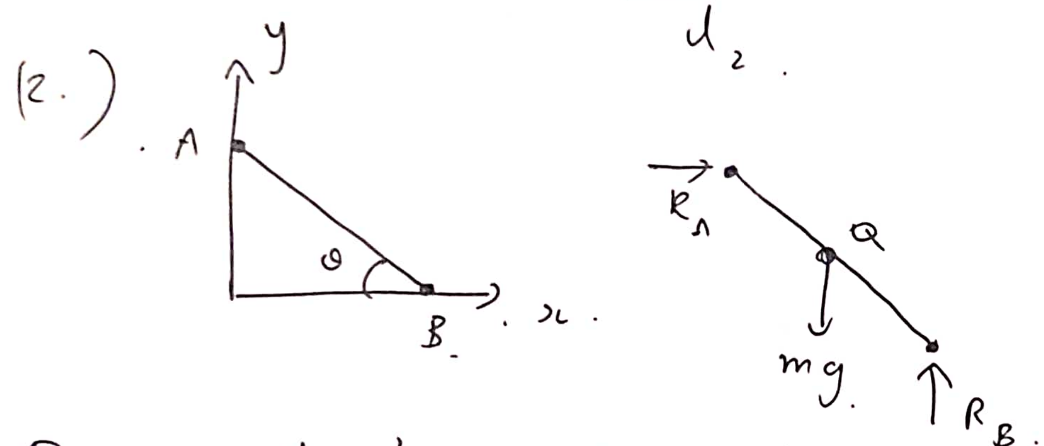
where the dotted line is the initial.

As the total virtual work is 0,

$$F_1 l_1 \cos\theta\, d\theta = F_2 l_2 \cos\theta\, d\theta.$$

$$\Rightarrow \quad F_2 = \frac{F_1 l_1}{l_2}.$$

(2.)



By Newton's second law,

$$m\ddot{\vec{r}} = R_A \hat{i} + (R_B - mg)\hat{j}.$$

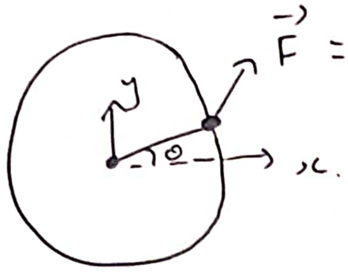
$$\Rightarrow \quad m\ddot{x} = R_A$$

$$m\ddot{y} = R_B - mg.$$

For torque balance about centre of mass Q.

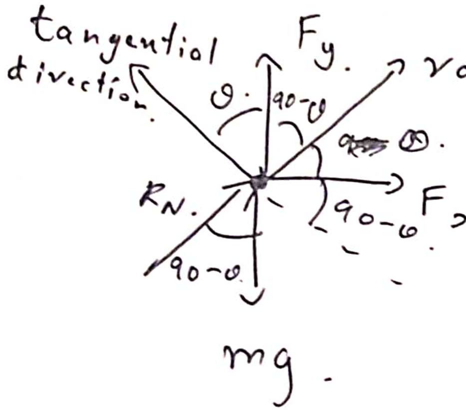
$$\Rightarrow I_Q \alpha = \frac{md^2}{12}\alpha = -R_A \frac{d}{2}\sin\theta + R_B \frac{d}{2}\cos\theta$$

(3.)



$$\vec{F} = F_x \hat{i} + F_y \hat{j}$$

B Using Newton-Euler method :



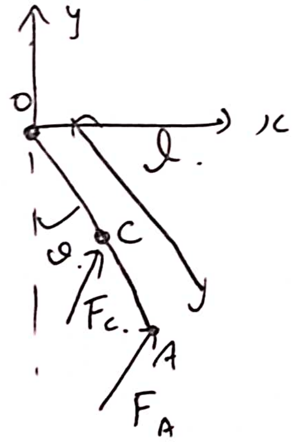
~~Balance~~

Taking the force components along tangential and radial directions,

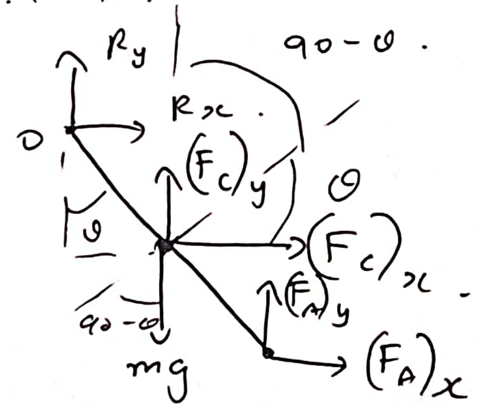
$$m a_{rad} = R_N + F_y \sin\theta + F_x \cos\theta.$$

$$m a_{tang} = F_y \cos\theta - F_x \sin\theta.$$

(4).



F.B.D:



$$I_0\alpha = \frac{ml^2}{3}\alpha = \left(\frac{(F_c)_y \sin\theta + (F_c)_x \cos\theta - mg\sin\theta}{2}\right) l + \left((F_A)_y \sin\theta + (F_A)_x \cos\theta\right) l$$