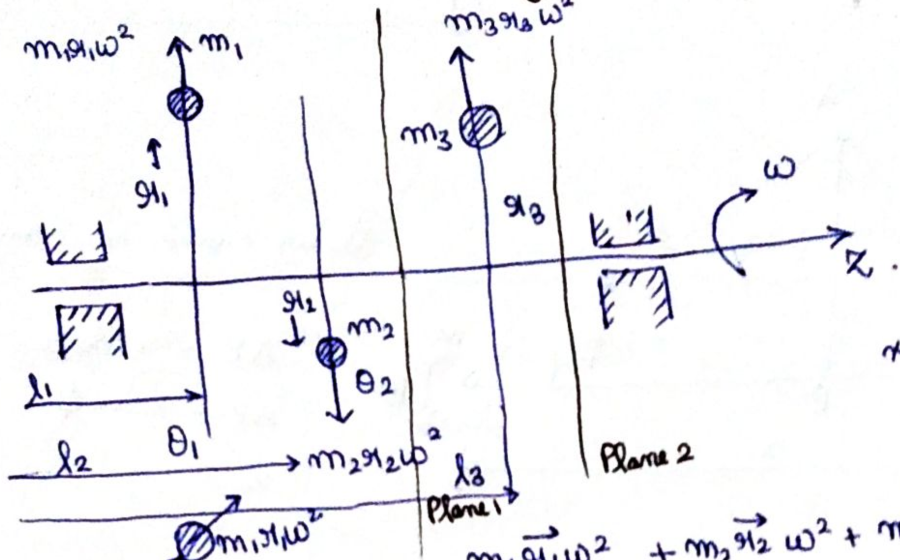
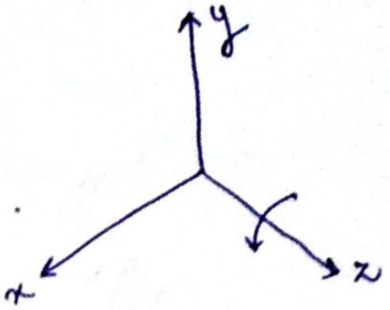
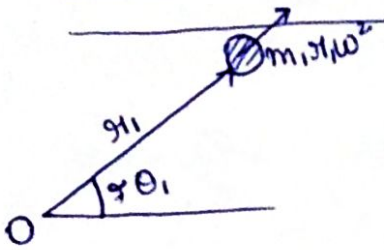
Dynamic Balancing -

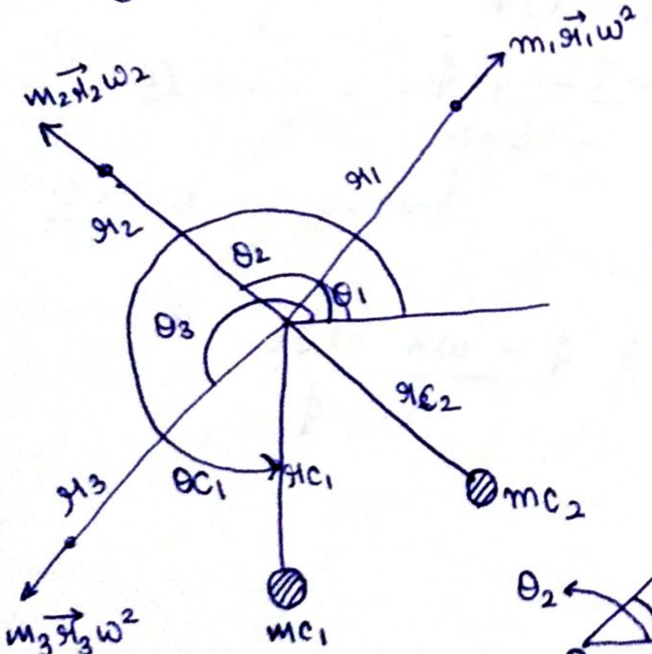


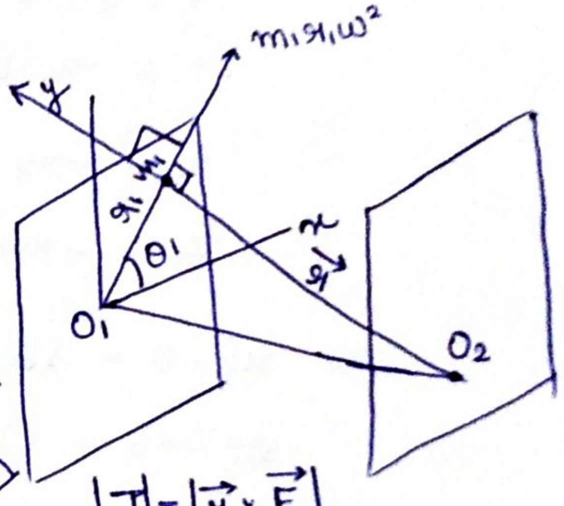




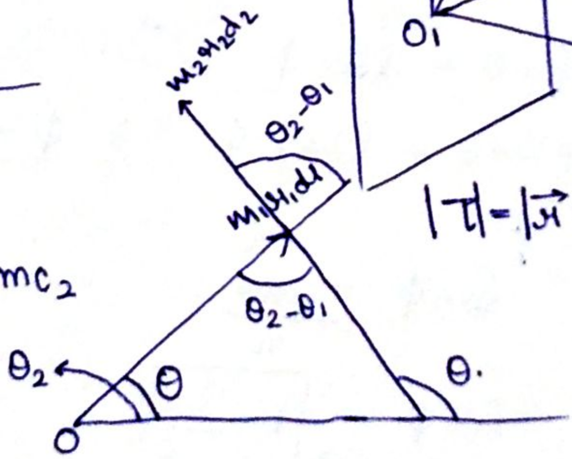
$$m_1\vec{r_1}\omega^2 + m_2\vec{r_2}\,\omega^2 + m_3\vec{r_3}\,\omega^2 = 0$$

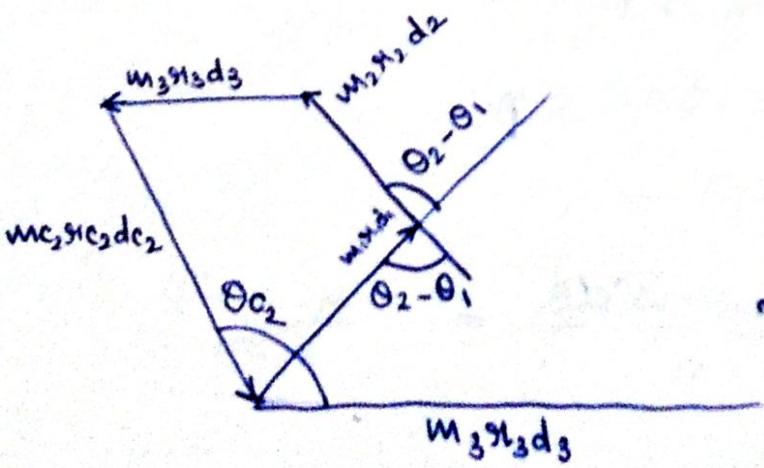
$$m_1\vec{r_1} + m_2\vec{r_2} + m_3\vec{r_3} = 0$$

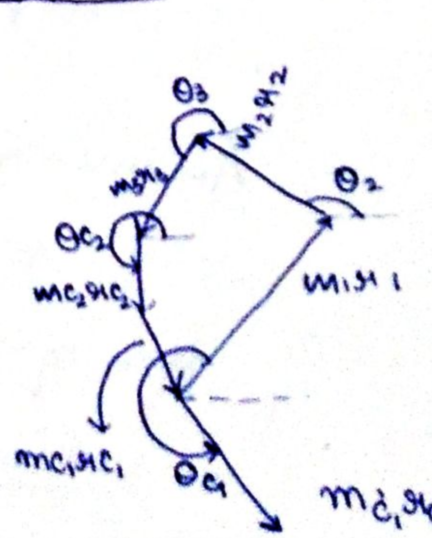




$$|\vec{T}| = |\vec{r} \times \vec{F}|$$



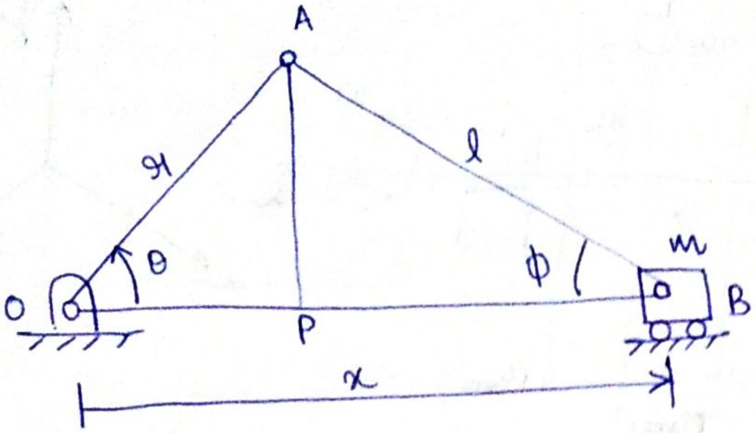




$$m_{c_1} r_{c_1} = y$$

$$r_{c_1} = \frac{y}{m_{c_1}}$$

Balancing of ~~the~~ reciprocating mass -



Slider-crank mechanism.

$AP = r\sin\theta$

$AP = l\sin\phi$

x

$$OB = OP + PB$$

$$x = r\cos\theta + l\cos\phi$$

$$\dot{x} = -r\omega\sin\theta + l(-\sin\phi)\dot{\phi}.$$

$$\dot{x} = -r\omega\sin\theta - \underline{l\sin\phi\cdot\dot{\phi}} \quad \text{-----} \ (1)$$

$$-r\sin\theta$$

$$\ddot{x} = -r\omega^2\cos\theta$$

$$\to \frac{-r\sin\theta\cdot\omega\cos\theta}{n}$$

$\Rightarrow \quad r\sin\theta = l\sin\phi$

$\omega r\cos\theta = l\cos\phi\cdot\dot{\phi} \quad \Rightarrow \quad \dot{\phi} = \dfrac{\omega r\cos\theta}{l\cos\phi}$

$\Rightarrow \quad \sin\phi = \dfrac{\sin\theta}{n}.$

$$\cos\phi = \sqrt{1 - \frac{\sin^2\theta}{n^2}}$$

Assume $n >> 1$

$$n^2 - \sin^2\theta \approx n.$$

from eq^n (1) -

$$\frac{-r\sin\theta\cdot\omega\cos\theta}{n} = -\frac{r\omega\sin 2\theta}{2n}.$$