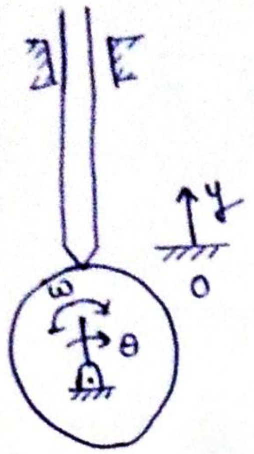
Displacement Diagram -



(i) Displacement of follower is moving with uniform velocity.

$$y = f(\theta) \\ = f(\omega t)$$

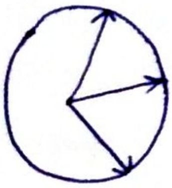
$$y = at + c$$

$$\dot{y} = a.$$

$$\omega = \frac{d\theta}{dt}$$

$$\omega = \frac{\theta}{t}$$

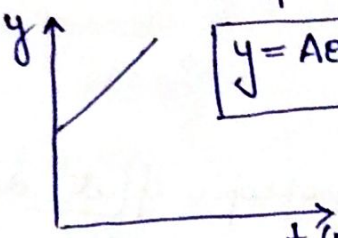
$$\theta = \omega t$$



$$\dot{y} = \frac{dy}{dt} = c$$

$$y = ct + \cancel{c_0}\, c_0$$

$$y = \left(\frac{c}{\omega}\right)t + c_0$$



→ Straight line.

$$\boxed{y = A\theta}$$

(ii) Uniform acceleration -

↳ $\boxed{y = a\theta^2 + b\theta + c}$

↳ Parabolic

$$a = c$$

$$\frac{d^2y}{dt^2} = c$$

$$\frac{dy}{dt} = ct + B$$

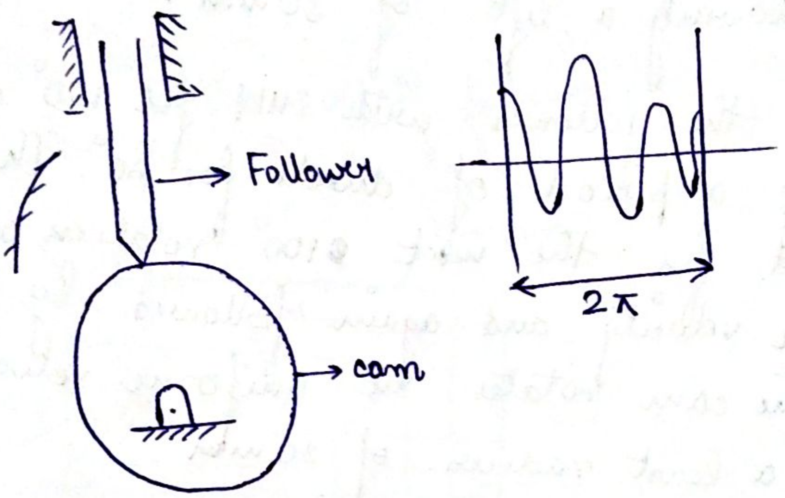
$$y = \frac{ct^2}{2} + Bt + D$$

$$= \frac{c}{2}\left(\frac{\theta}{\omega}\right)^2 + Bt + D$$

(iii) The motion of the follower is in SHM -

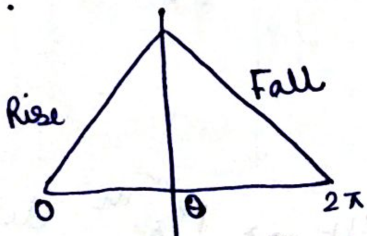
$$\boxed{y = A\sin(\omega t + \phi) + c}$$

(iv) The motion of the follower is cycloidal -

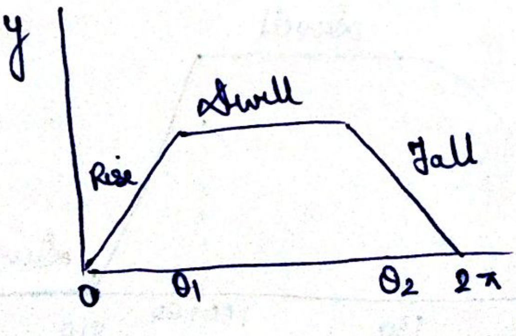


Classification of follower motion -

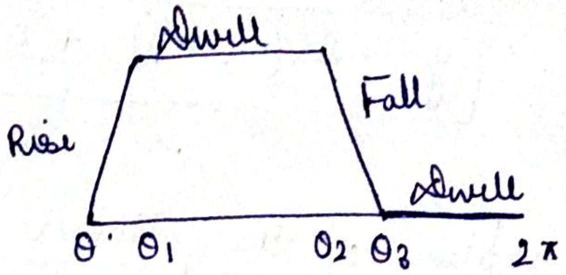
(i) Rise - fall -
follower rises till particular angle & then fall after that angle.



(ii) Rise - Dwell - Fall -

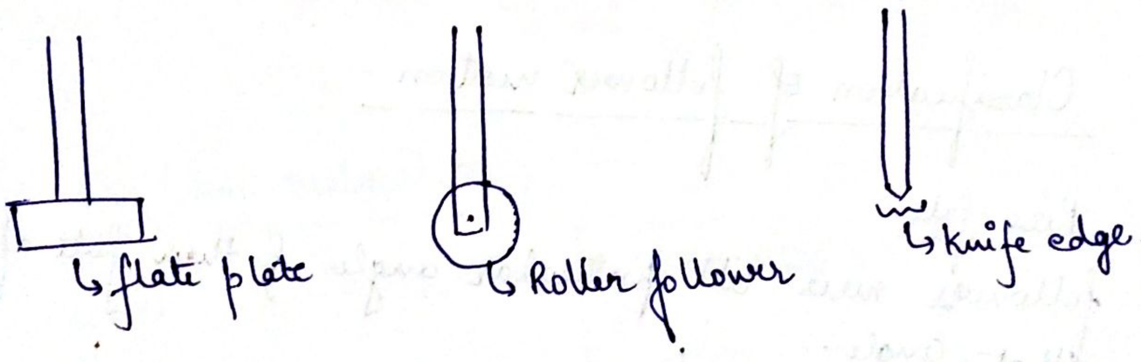


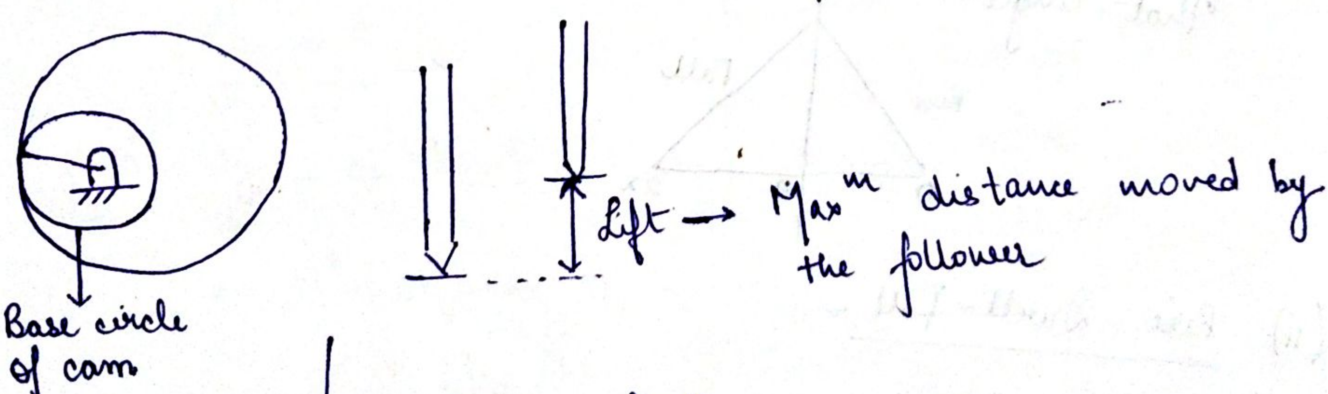
(iii) Rise - dwell - fall - dwell -

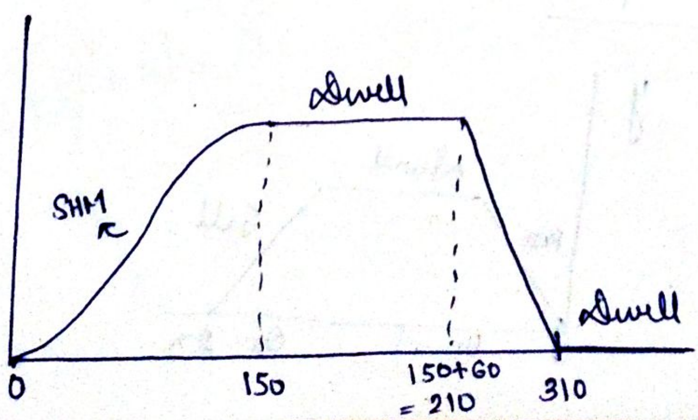


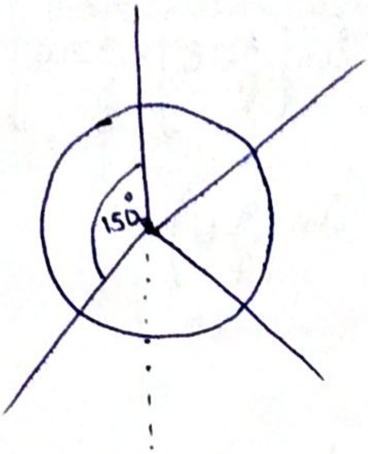
Q) Draw the profile of a cam of operating a knife edge ~~follo~~. follower having a lift of 30 mm.

The cam raises the follower with SHM for 150° of its rotation followed by a period of dwell for 60°. The follower descended for the next 100° rotation of the cam with uniform velocity and again followed by a dwell period. The cam rotates at uniform velocity of 120 rpm and has a least radius of 20 mm.

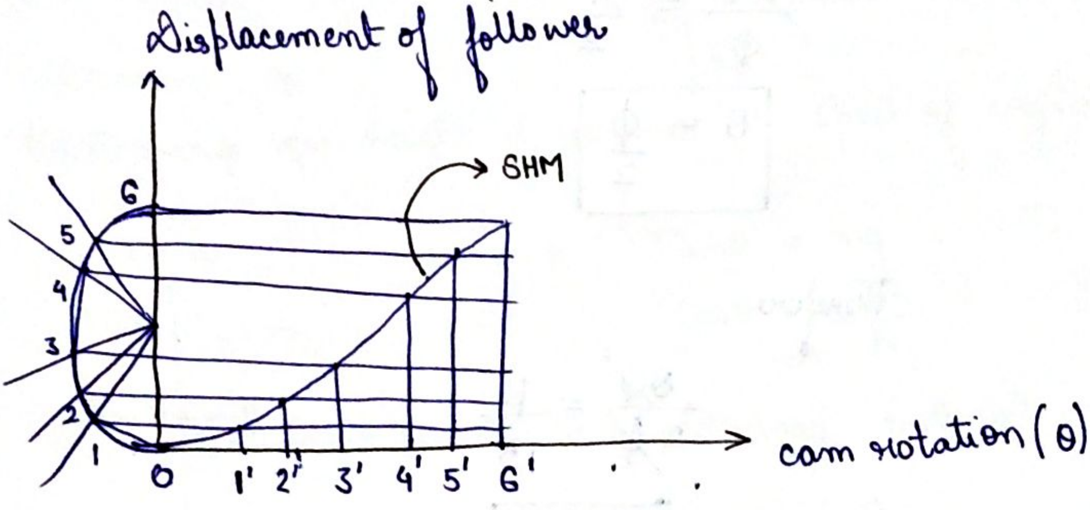






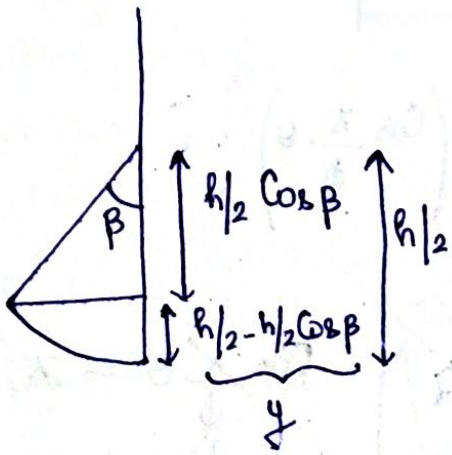


$6\,cm = 150°$



$0 \leq \theta \leq \phi$

$0 \leq \beta \leq \pi$



$$y = \frac{h}{2} - \frac{h}{2}\cos\beta$$

$$\boxed{\frac{\theta}{\phi} = \frac{\beta}{\pi}}$$

$$\beta = \frac{\theta \cdot \pi}{\phi}$$

$$\Rightarrow \quad y = \frac{h}{2} - \frac{h}{2}\cos\left(\frac{\theta \cdot \pi}{\phi}\right)$$

$$y = f(\theta)$$

$$\frac{dy}{dt} = \frac{d f(\theta)}{dt} = \frac{d f(\theta)}{d\theta} \times \frac{d\theta}{dt}$$

$$\frac{dy}{dt} = f'(\theta) \cdot \omega$$

$$V = \frac{dy}{\cancel{d}} \dot{y} = \frac{h}{2}\left[0 + \sin\left[\frac{\pi}{\phi}\cdot\theta\right]\cdot\frac{\pi}{\phi}\cdot\omega\right]$$

$$V = \frac{h}{2}\cdot\frac{\pi}{\phi}\omega\cdot\sin\left(\frac{\pi}{\phi}\theta\right).$$

$V_{max} \rightarrow$

$$\sin\frac{\pi}{\phi}\cdot\theta = 1$$

$$\frac{\cancel{\pi}\theta}{\phi} = \frac{\cancel{\pi}}{2}$$

$$\boxed{\theta = \frac{\phi}{2}}$$

Therefore,

$$\frac{\theta\cancel{\phi}}{2\cancel{\phi}} = \frac{\beta}{\pi}$$

$$\boxed{\beta = \frac{\pi}{2}}$$

$$a = \ddot{y} = \frac{h}{2}\frac{\pi^2}{\phi^2}\cdot\omega^2\left(\cos\frac{\pi}{\phi}\cdot\theta\right)$$

$a_{max} \rightarrow$

$$\cos\frac{\pi}{\phi}\cdot\theta = 0$$

$$\boxed{\theta = 0}$$

$$\cos\frac{\cancel{\pi}}{\phi}\cdot\theta = \cancel{\pi}$$

$$\boxed{\phi = \theta}$$