CIRCULAR MOTION

- **RELATION B/w $\vec{\omega}$ & $\vec{V}$**

Distance $\Rightarrow S = R\theta$

Velocity $\Rightarrow V = R\frac{d\theta}{dt} \Rightarrow \boxed{V = R\omega}$

Velocity $\Rightarrow \boxed{\vec{V} = \vec{R} \times \vec{\omega}}$

- **Acceleration (a)**

$a = \alpha R(\hat{e}_t) + \omega^2 R(-\hat{e}_r)$

$|\vec{a_t}| = \alpha R \quad |\vec{a_r}| = \omega^2 R = \frac{V^2}{R}$

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- **Uniform Circular motion**

$a_t = 0$, $\alpha = 0$, $V \Rightarrow$ Const

$a_r = \omega^2 R$, $|a_r| \Rightarrow$ Const

Timeperiod $= \frac{2\pi}{\omega}$

- **Radius of Curvature**

$y = f(x) \rightarrow$ eq^n of path

$$RoC = \frac{[1 + (y')^2]^{3/2}}{y''}$$

- **Forces (dynamics)**

$F_r = \frac{MV^2}{R} = M\omega^2 R$
(centripetal)

- **Rotor**

$\omega \geq \sqrt{\frac{g}{\mu R}}$

- **Banking of the roads**

$V = \sqrt{gR\tan\theta}$ (no frixion)

$V_{max} = \sqrt{\frac{gR(\mu + \tan\theta)}{(1 - \mu\tan\theta)}}$ (frixion)

- **Death well**

$V \geq \sqrt{\frac{gR}{\mu}}$

$V_{min} = \sqrt{\frac{gR}{\mu}}$