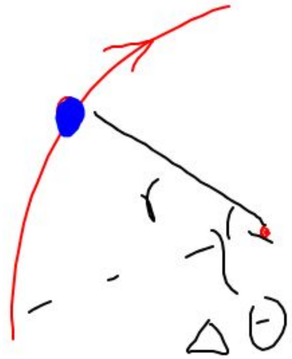
ROTATIONAL MOTION

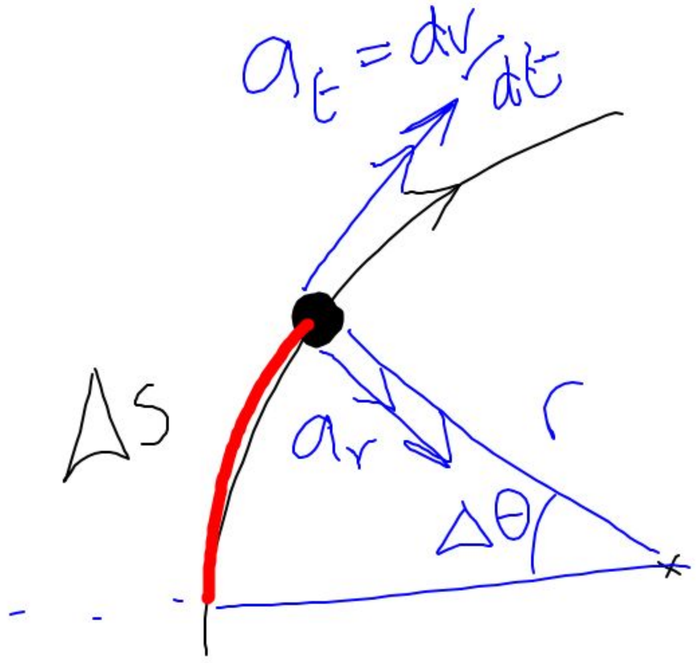


Linear (x, y) $\longrightarrow$ angular (r, θ)

$\Delta x, \Delta y$ $\qquad$ $\Delta\theta$ (radians)

V_x, V_y $\qquad$ $\frac{d\theta}{dt} = \omega$ angular velocity

a_x, a_y $\qquad$ $\frac{d^2\theta}{dt^2} = \alpha = \frac{d\omega}{dt}$ angular acceleration



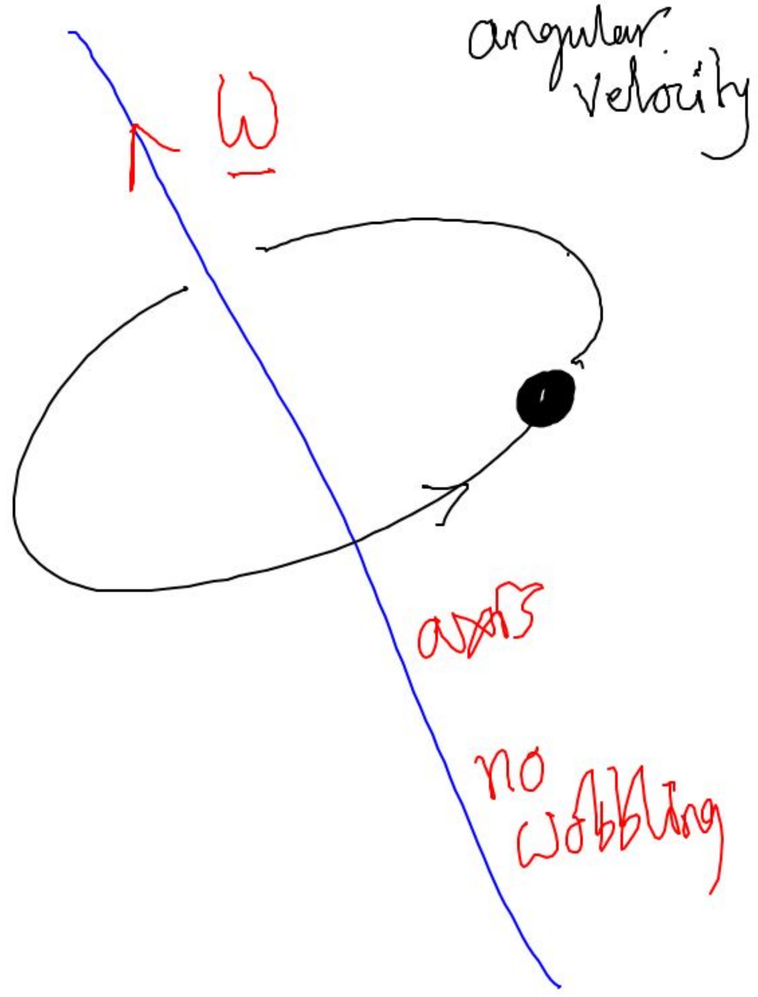
arc length $\Delta s = r\,\Delta\theta$ $\Delta\theta$ in radians

$$V_{avg} = \frac{\Delta s}{\Delta t} = r\frac{\Delta\theta}{\Delta t} = r\,\omega_{avg}$$

$$V = \frac{ds}{dt} = r\frac{d\theta}{dt} = r\omega$$

$$a_t = r\frac{d\omega}{dt} = r\alpha$$

$$a_r = \frac{V^2}{r} = r\omega^2$$



$\underline{\omega}$ direction along axis by RHR

$\underline{\alpha}$ Same $\underline{\omega}$ → speed up

$\underline{\alpha}$ opposite $\underline{\omega}$ → slowdown

$$\theta - \theta_0 = \Delta\theta = \cancel{\omega_0^{\,0}}\, t + \frac{1}{2}\alpha t^2$$

$$\omega = \cancel{\omega_0^{\,0}} + \alpha t$$

Start at rest

$$2\pi = \frac{1}{2}(1)t^2 \Rightarrow t^2 = 4\pi \Rightarrow t = 2\sqrt{\pi}$$

$$\omega = (1)2\sqrt{\pi} = 2\sqrt{\pi} \text{ rad/s}$$