Equations of Rotational Motion:

Translational Motion	Rotational Motion
x, x_0	Angular Position $\rightarrow \theta, \theta_0$
Displacement $\rightarrow s, \Delta x = x - x_0$	Angular Disp $\rightarrow \Delta\theta = \theta - \theta_0$
Velocity $\rightarrow u, v$	Angular velocity $\rightarrow \omega_0, \omega$
Acceleration $\rightarrow a = \frac{dv}{dt}$	Angular acceleration $\alpha = \frac{d\omega}{dt}$
For $a = \text{const}$	$\alpha = \text{const}$
(i) $v = u + at$	(i) $\omega = \omega_0 + \alpha t$
(ii) $s = ut + \frac{1}{2}at^2$	(ii) $\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2$
(iii) $v^2 = u^2 + 2as$	(iii) $\omega^2 = \omega_0^2 + 2\alpha\Delta\theta$
(iv) $S_{nth} = u + \frac{1}{2}a(2n-1)$	(iv) $\Delta\theta_{nth} = \omega_0 + \frac{1}{2}\alpha(2n-1)$

$v = u + at$

(1) $\underline{\omega = \omega_0 + \alpha t}$: $\quad \because \alpha = \frac{d\omega}{dt}$

Let at $t = 0$, angular vel $= \omega_0$

and at $t = t$, ang. vel $= \omega$

or $\quad d\omega = \alpha \cdot dt \quad$ —— (1)

Integrating both the sides of Eq (1)

$$\int_{\omega_0}^{\omega} d\omega = \int_{t=0}^{t} \alpha \cdot dt$$

$$\int x^n dx = \frac{x^{n+1}}{n+1}$$

$$\int dx = \int x^0 dx = x$$

$$[\omega]_{\omega_0}^{\omega} = \alpha \int_0^t dt$$

$$\omega - \omega_0 = \alpha [t]_0^t \Rightarrow \omega - \omega_0 = \alpha(t - 0)$$

$$\omega - \omega_0 = \alpha t$$

$$\boxed{\omega = \omega_0 + \alpha t}$$

$\because v = \frac{dx}{dt}$

$S = ut + \frac{1}{2}at^2$

2. $\underline{\Delta\theta = \omega_0 t + \frac{1}{2}\alpha t^2}$: $\quad \because \omega = \frac{d\theta}{dt}$

Let
at $t = 0$, angular vel $= \omega_0$
and angular position $= \theta_0$
At $t = t$, ang. vel $= \omega$
and ang position $= \theta$

$d\theta = \omega \cdot dt \quad$ —— (1)

Integrating Eq (1) $\quad \int_{\theta_0}^{\theta} d\theta = \int_0^t \omega \cdot dt$