Rotational Motion

Friday, December 6, 2013 12:07 PM

A wheel starts from rest and turns through 56 radians at an angular acceleration of 3.5 rad/s^2. What is

- The time required
- The final angular velocity in rad/sec

$v_i = 0$
$x = 56$
$a = 3.5$
$t = ?$

$x = v_i t + \frac{1}{2} a t^2$
$56 = \frac{1}{2} \cdot 3.5 \cdot t^2$
$56 = 1.75 t^2$
$32 = t^2$ $t \approx 5.66 s$

$v_f = ?$
$v_f^2 = v_i^2 + 2ax$
$= 0^2 + 2 \cdot 3.5 \cdot 56$
$= 392$
$v_f = \sqrt{392} = 19.8$ rad/s

Equations of constant acceleration				Rotational Motion

$v_f = v_i + at$
$v_f^2 = v_i^2 + 2ax$
$x = v_i t + \frac{1}{2} a t^2$
$x = \frac{1}{2}(v_f + v_i) t$

$\omega_f = \omega_i + \alpha t$
$\omega_f^2 = \omega_i^2 + 2\alpha\theta$
$\theta = \omega_i t + \frac{1}{2} \alpha t^2$
$\theta = \frac{1}{2}(\omega_f + \omega_i) t$

$x \rightarrow \theta$ angular displacement
$v_i \rightarrow \omega_i$ angular initial velocity
$v_f \rightarrow \omega_f$ angular final velocity
$a \rightarrow \alpha$ angular acceleration
$t \rightarrow t$ time same

Linear vs. Angular

$s = r\theta$ θ in rad

$s/t = r\theta/t$

$v = r\omega$

$\frac{v}{t} = \frac{r\omega}{t}$

$s = r\theta$
$v = r\omega$
$a = r\alpha$
must be in rad

$$\frac{}{t}$$

$$v = r\omega$$

$$\frac{v}{t} = \frac{r\omega}{t}$$

$$a = r\alpha$$

$s = r\theta$
$v = r\omega$
$a = r\alpha$
must be in rad