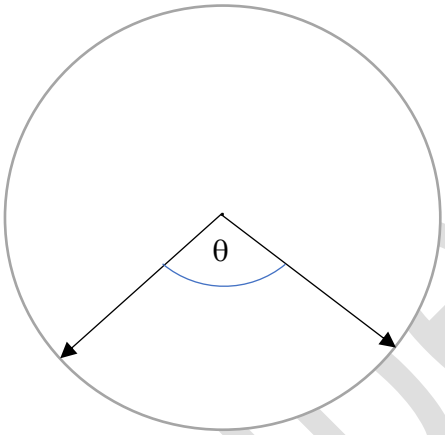
Rotational Motion

- **Relation between Linear Motion and Rotational Motion.**



- $S = r\theta$
- $V = r\omega$
- $a = r\alpha$

- You should use θ in radians.

- **Angular Velocity**

$$\boldsymbol{\omega}\ (ang.\ velocity) = \frac{\boldsymbol{\theta}\ (ang.\ displacement)}{\boldsymbol{t}}$$

- **Angular Acceleration**

  $\boldsymbol{\alpha}$ *(ang. acc.)* $= \frac{\boldsymbol{\omega}\ (\boldsymbol{ang.\ velocity})}{\boldsymbol{t}}$

- **Periodic Time**

  - Simply, Periodic time (T) means the time takes to complete a circle.

    One circle means 360°. It means 2π radians in Ts.

    So,

    Ang. displacement in T = 2π

    Ang. displacement in 1s $= \frac{2\pi}{T} = \omega$

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

- **Frequency**

  - Briefly, circles per second.

So,

$T = \frac{1}{f}$

- Let's add this to last formula.

$\omega = 2\pi f$

- **Centripetal Acceleration**

  - An object is moving in a circular path. Then, an acceleration vector will be pointed **towards the center** of the path. That acceleration is called as Centripetal Acceleration ($\mathbf{a_r}$).

$a_r = v\omega$

$a_r = r\omega^2$

$a_r = v^2/r$

  - You can get the centripetal force by multiplying the $\mathbf{a_r}$ from mass.

$F_r = ma_r$

- **<u>Rotational Inertia</u>**

  - Factors affecting rotational inertia(**I**),

    1. The mass of the object
    2. Mass distribution

- As the mass of an object increases, the inertial friction increases and as the distance of the mass distribution from the axis of rotation increases, the inertial friction increases.

$$I=mr^2$$

❖ **<u>Direction →</u>**

Please go to the Easy patterns in Mechanics site to see other formulas. It is containing an easy method to memorize rotational motion formulas alongside linear motion formulas.