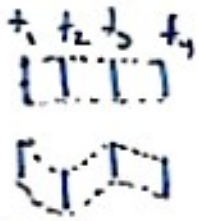
Kinematics : The study of motion without concern of forces causing motion.

$\Sigma F = ma$

Kinetics Kinematics

Types Motion

1. Linear

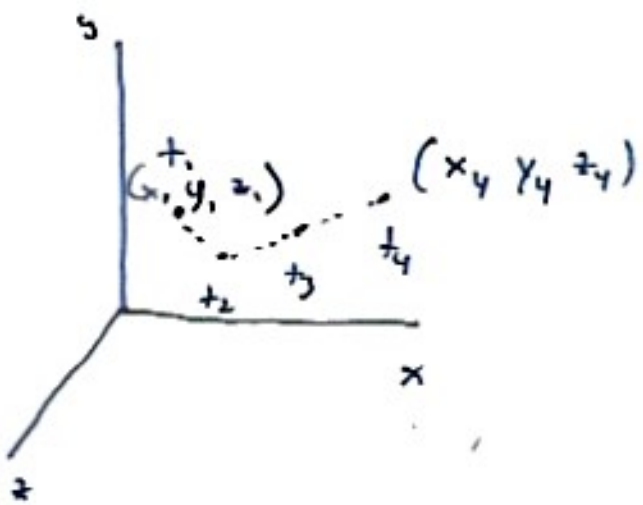


- rectilinear
- curvilinear

2. Rotational

3. General

Linear + Rotational



Linear

Angular

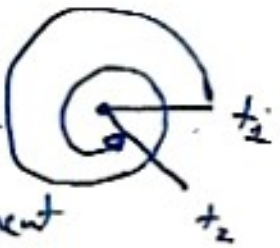
Position

Distance

Displacement

$\Delta s = s_f - s_i$

units: length



Angular distance

Angular displacement

$\Delta\theta = \theta_f - \theta_i$

units: degrees, radians, rev.

Velocity

$v = \frac{\Delta s}{\Delta t} = \frac{s_f - s_i}{t_f - t_i}$

units: $\frac{\text{length}}{\text{time}}$

Speed

Angular velocity

$\omega = \frac{\Delta\theta}{\Delta t} = \frac{\theta_f - \theta_i}{t_f - t_i}$

units: e.g. °/s rad/s ...

Angular speed

Acceleration

$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{t_f - t_i}$

units: $\frac{m/s}{s} = m/s^2$

Angular deceleration

$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{\omega_f - \omega_i}{t_f - t_i}$

units: e.g. $\frac{°/s}{s} = °/s^2$

Math

$v_i = 3\ m/s$

$v_f = 0\ m/s$

$\Delta t = 6\ s$

$a = ?$

$$\frac{\frac{m}{s}}{\frac{s}{1}} = \frac{m}{s} \cdot \frac{1}{s} = \frac{m}{s^2}$$

?

$$a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{(t_f - t_i)}$$

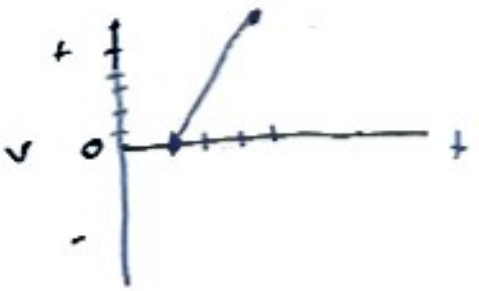
$$a = \frac{0\ m/s - 3\ m/s}{6s} = \frac{-3\ m/s}{6\ s} = -\frac{1}{2}\ \frac{m/s}{s} = \boxed{-\frac{1}{2}\ m/s^2}$$

$a = 2\ m/s^2$

$v_f = 6\ m/s$

$\Delta t = 3\ s$

$v_i = ?$



Δt $a = \frac{\Delta v}{\Delta t} = \frac{v_f - v_i}{(t_f - t_i)} \cdot \Delta t$

$+v_i$ $a(\Delta t) = (v_f - v_i) + v_i$

$-a\Delta t$ $v_i + a\Delta t = v_f$ $- a\Delta t$

$\frac{m}{s^2} \cdot s$

$$v_i = v_f - a\Delta t$$

$$v_i = 6\ m/s - (2\ m/s^2 \cdot 3\ s)$$

$$v_i = 6\ m/s - (6\ m/s)$$

$$\boxed{v_i = 0\ m/s}$$

$$\omega = \frac{\Delta\theta}{\Delta t} = \frac{\theta_f - \theta_i}{t_f - t_i}$$

$\theta_f = ?$

$$\omega (t_f - t_i) = (\theta_f - \theta_i)$$

$$\omega(t_f - t_i) + \theta_i = \theta_f$$

$$\theta_f = \omega(t_f - t_i) + \theta_i$$

$$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{\omega_f - \omega_i}{t_f - t_i}$$