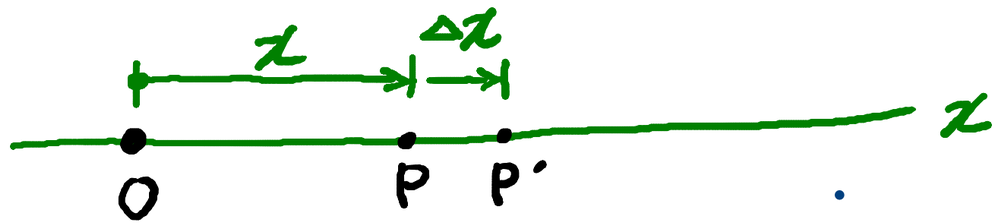
Rectilinear motion of a particle

Kinematics

Kinetics



x : position variable

t : time

a : acceleration $\quad a = \frac{dv}{dt}$

Δx : displacement

$v = \frac{dx}{dt} = \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$ velocity

$j = \frac{da}{dt}$ jerk

If the <u>acceleration is constant</u>, we can let $a = a_c$ = const.

$a_c = \frac{dv}{dt} \qquad \int_0^t a_c \, dt = \int_{v_0}^{v} dv \qquad a_c t \Big|_0^t = v \Big|_{v_0}^{v} \qquad a_c(t-0) = v - v_0$

$$\boxed{v = v_0 + a_c t}$$

$\frac{dx}{dt} = v = v_0 + a_c t \qquad dx = (v_0 + a_c t)\,dt$

$\int_{x_0}^{x} dx = \int_0^t (v_0 + a_c t)\,dt \qquad x \Big|_{x_0}^{x} = v_0 t + \frac{1}{2} a_c t^2 \Big|_0^t$

$x - x_0 = v_0 t + \frac{1}{2} a_c t^2 \qquad \boxed{x = x_0 + v_0 t + \frac{1}{2} a_c t^2}$