KINEMATICS

* [ ] DIMENSIONS → SI UNITS: [L] → m, [M] → kg, [T] → s

MATHEMATICAL REPRESENTATION

POSITION [L] $\equiv \vec{r} = \langle x, y, z \rangle$

DISPLACEMENT [L] $\equiv \vec{r}_f - \vec{r}_i = \langle x_f - x_i, y_f - y_i, z_f - z_i \rangle$

DISTANCE [L] $\equiv |\vec{r}| = \sqrt{x^2 + y^2 + z^2}$

VELOCITY $\frac{[L]}{[T]} \equiv \vec{v} = \langle v_x, v_y, v_z \rangle$

CHANGE IN VELOCITY $\frac{[L]}{[T]} \equiv \Delta\vec{v} = \vec{v}_f - \vec{v}_i = \langle v_{fx} - v_{ix}, v_{fy} - v_{iy}, v_{fz} - v_{iz} \rangle$

SPEED $\frac{[L]}{[T]} \equiv |\vec{v}| = \sqrt{v_x^2 + v_y^2 + v_z^2}$

$\vec{v}$ AVERAGE VELOCITY $\frac{[L]}{[T]} \equiv \frac{\Delta\vec{r}}{\Delta t} = \left\langle \frac{r_{fx} - r_{ix}}{\Delta t}, \frac{r_{fy} - r_{iy}}{\Delta t}, \frac{r_{fz} - r_{iz}}{\Delta t} \right\rangle$

ACCELERATION $\frac{[L]}{[T]^2} \equiv \vec{a} = \langle a_x, a_y, a_z \rangle$

MAGNITUDE OF ACCELERATION $\frac{[L]}{[T]^2} \equiv |\vec{a}| = \sqrt{a_x^2 + a_y^2 + a_z^2}$

$\vec{a}$ AVERAGE ACCELERATION $\frac{[L]}{[T]^2} \equiv \frac{\Delta\vec{v}}{\Delta t} = \left\langle \frac{v_{fx} - v_{ix}}{\Delta t}, \frac{v_{fy} - v_{iy}}{\Delta t}, \frac{v_{fz} - v_{iz}}{\Delta t} \right\rangle$

KINEMATIC EQUATIONS

*CONSTANT $\vec{a}$

$\vec{r}_f = \vec{r}_i + \vec{v}_i \Delta t + \frac{1}{2}\vec{a}\Delta t^2$

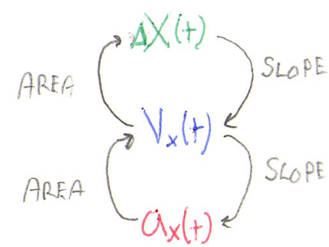
$\vec{v}_f = \vec{v}_i + \vec{a}\Delta t$

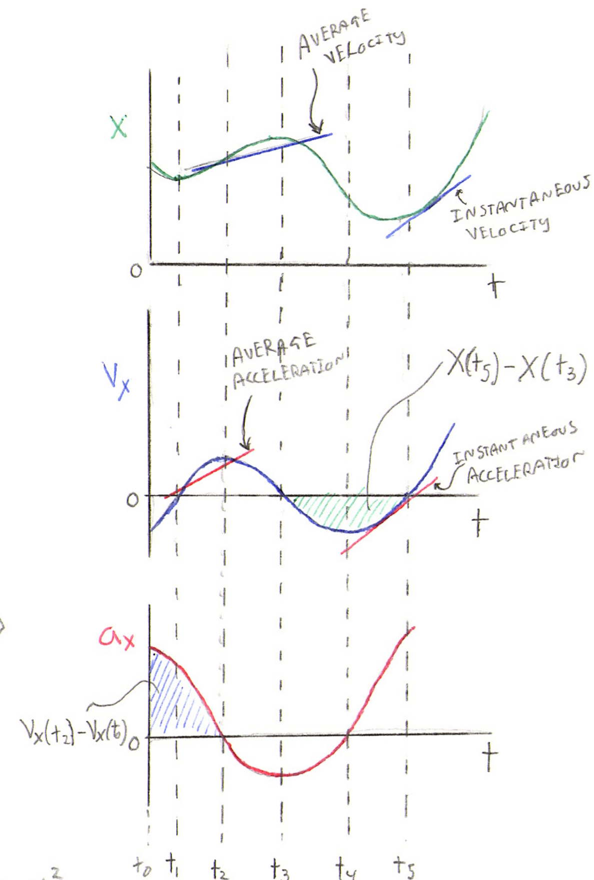
VECTOR FORM (3 EQUATIONS EACH)

Ex: $y_f = y_i + v_{iy}\Delta t + \frac{1}{2}a_y \Delta t^2$

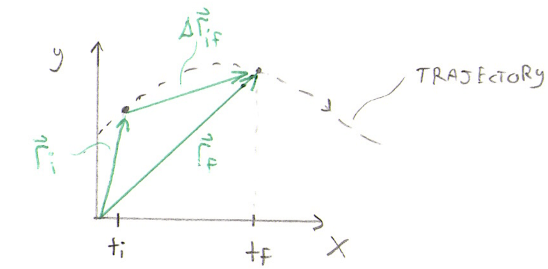
$v_{fx}^2 = v_{ix}^2 + 2a_x \Delta x$

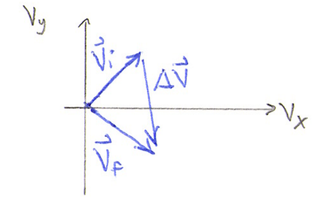
GRAPHICAL REPRESENTATION





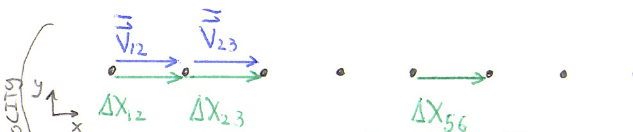
PHYSICAL REPRESENTATION





MOTION DIAGRAMS (EQUAL TIME INTERVALS)

CONSTANT VELOCITY

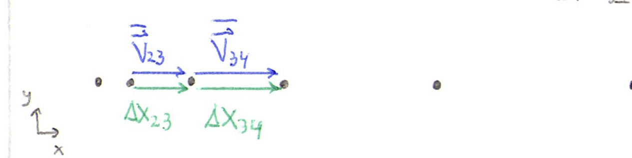


VECTOR OP.

$\vec{a} = \vec{0}$

$\vec{a}_{13} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_{23} - \vec{v}_{12}}{\left(\frac{\Delta t_{12} + \Delta t_{23}}{2}\right)}$

EQUAL TIME INTERVALS so $\bar{\Delta t} = \Delta t$



$\vec{a}_{24} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v}_{34} - \vec{v}_{23}}{\Delta t}$

VECTOR OP.