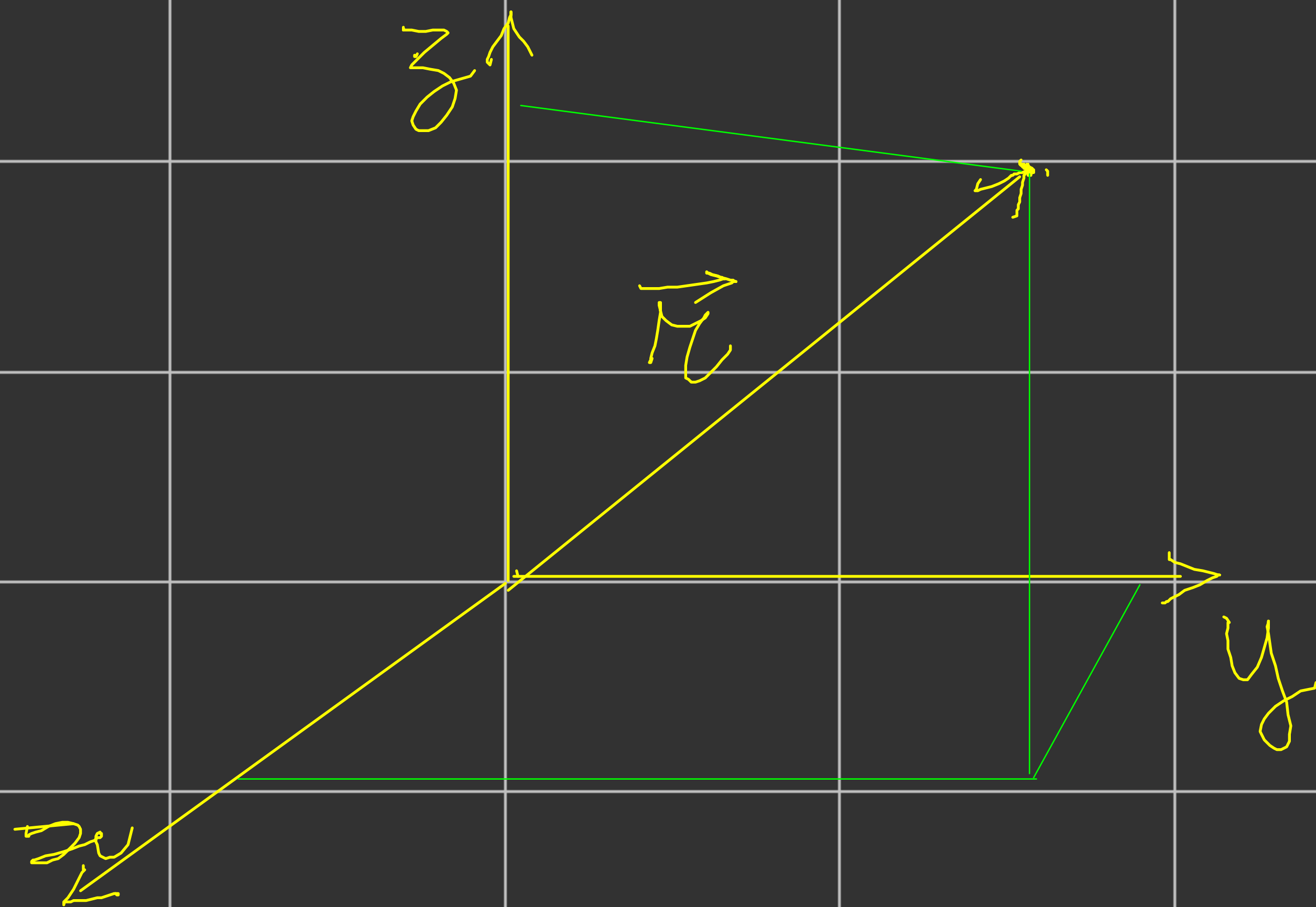


Sistemi di riferimento FISSO

osservatore in quiete rispetto



$$\vec{M} = x \hat{i} + y \hat{j} + z \hat{k}$$

$$\vec{M} = \vec{M}(t)$$

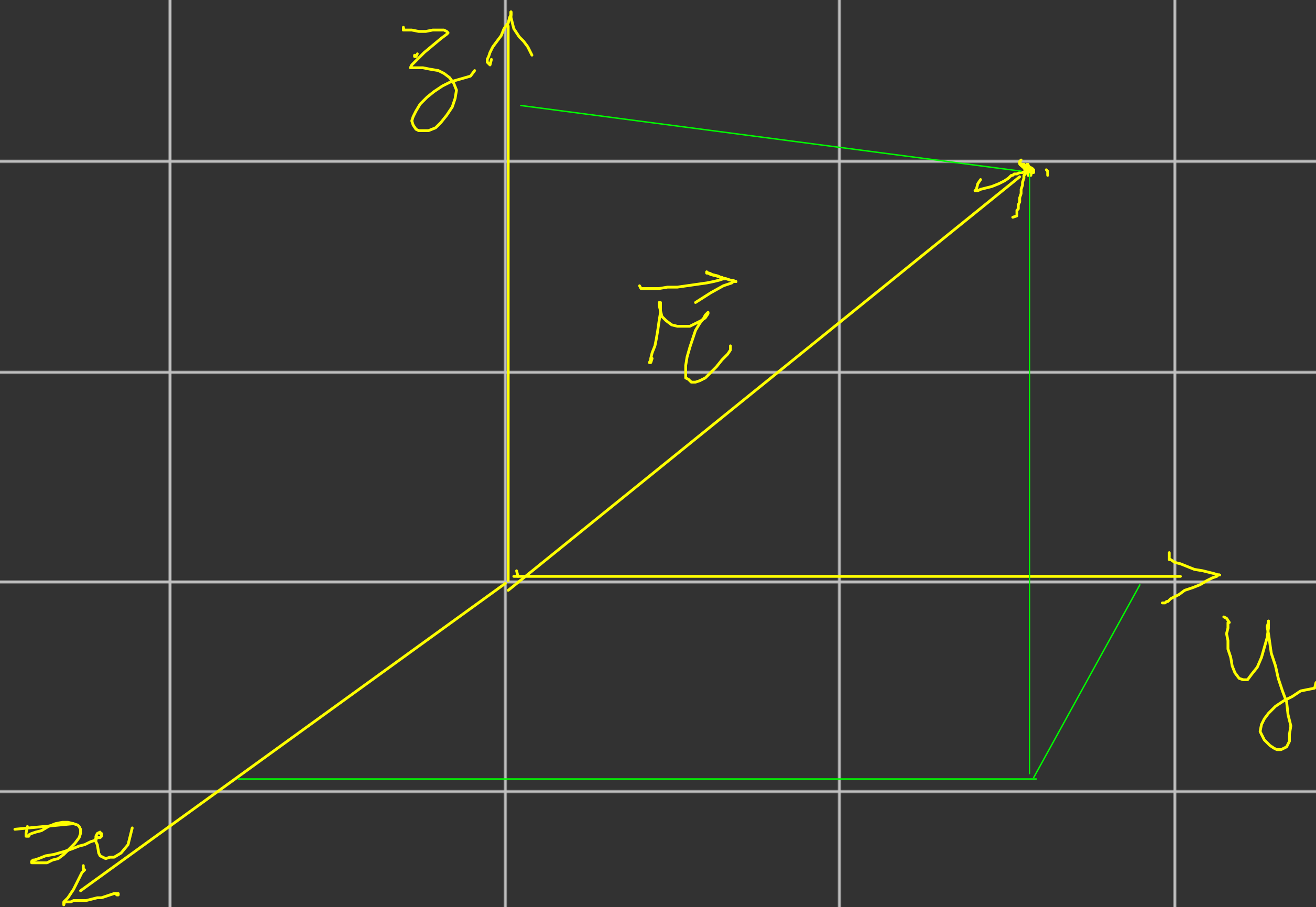
$$x(t)$$

$$y(t)$$

$$z(t)$$

Sistemi di riferimento FISSO

osservatore in quiete rispetto



$$\vec{M} = x \hat{i} + y \hat{j} + z \hat{k}$$

$$\vec{M} = \vec{M}(t)$$

$$x(t)$$

$$y(t)$$

$$z(t)$$

{ Motte unidimension. 1D
x

$$\vec{r} = x \hat{n}$$

$$\Delta \vec{r} = (x_f - x_i) \hat{n}$$

$$\begin{aligned} \vec{r}_i & \quad \vec{r}_f \\ \Delta \vec{r} &= \vec{r}_f - \vec{r}_i \\ &= (x_f - x_i) \hat{n} \\ & \quad + (y_f - y_i) \hat{j} \\ & \quad + (z_f - z_i) \hat{k} \end{aligned}$$

velocităi medie

t_i t_f

$$\Delta t = t_f - t_i$$

$$\langle \vec{v} \rangle =$$

$$\frac{\vec{v}_f - \vec{v}_i}{t_f - t_i} = \frac{\Delta \vec{v}}{\Delta t}$$

$$t_f - t_i$$

$$\Delta t$$

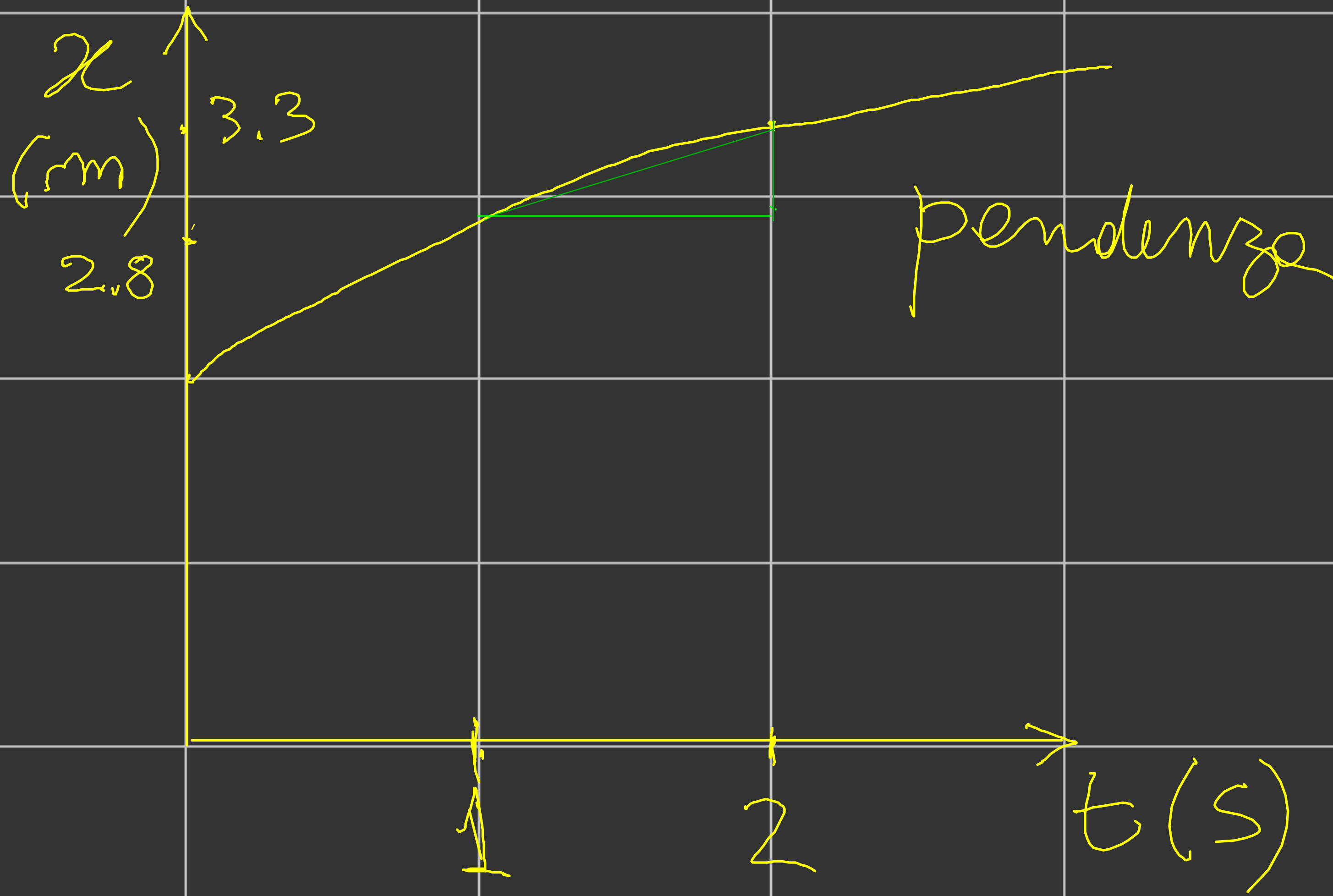
1D

$$\langle \vec{v} \rangle =$$

$$\left(\frac{x_f - x_i}{t_f - t_i} \right) \hat{i}$$

$$= \frac{\Delta x}{\Delta t} \hat{i}$$

$$= \langle v_x \rangle \hat{i}$$



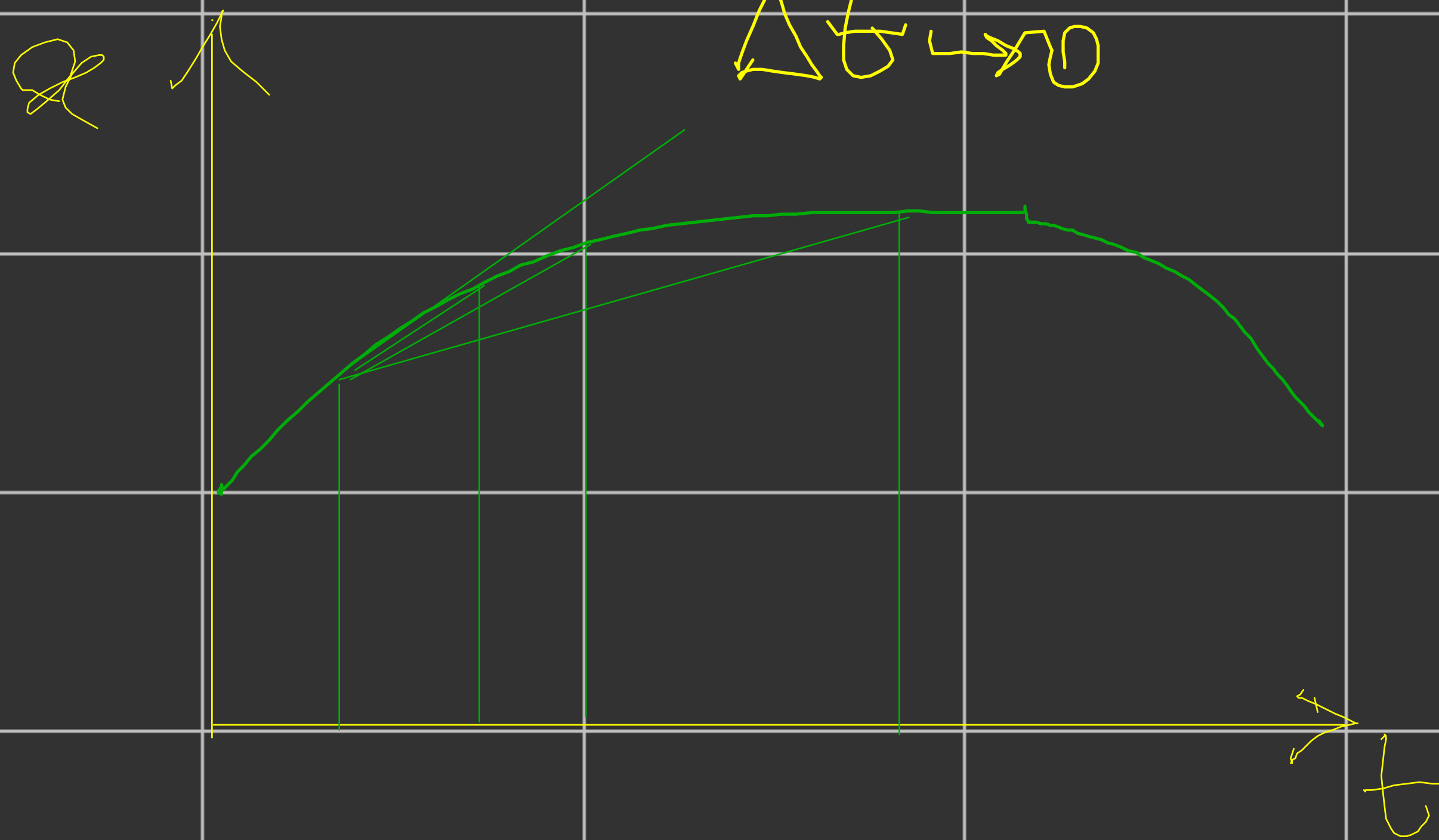
$$\langle v_x \rangle = \frac{0,5 \text{ m}}{1,5} = 0,5 \frac{\text{m}}{\text{s}}$$

velocitate instantanee

$$v_x = \lim_{\Delta t \rightarrow 0} \langle v_x \rangle$$

$$= \lim_{\Delta t \rightarrow 0} \frac{\Delta x}{\Delta t}$$

$$= \frac{dx}{dt}$$



3D

$$\vec{v} = \lim_{\Delta t \rightarrow 0} \langle \vec{v} \rangle = \lim_{\Delta t \rightarrow 0} \frac{\Delta \vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$$

$$\vec{v} = \frac{d\vec{r}}{dt} = \frac{dx}{dt} \hat{i} + \frac{dy}{dt} \hat{j} + \frac{dz}{dt} \hat{k}$$

$$v = |\vec{v}| = \left| \frac{d\vec{r}}{dt} \right| = \sqrt{\left(\frac{dx}{dt} \right)^2 + \left(\frac{dy}{dt} \right)^2 + \left(\frac{dz}{dt} \right)^2}$$

$v = |\vec{v}| \geq 0$

