Lezione 2 26/10/2023

giovedì 26 ottobre 2023 08:38

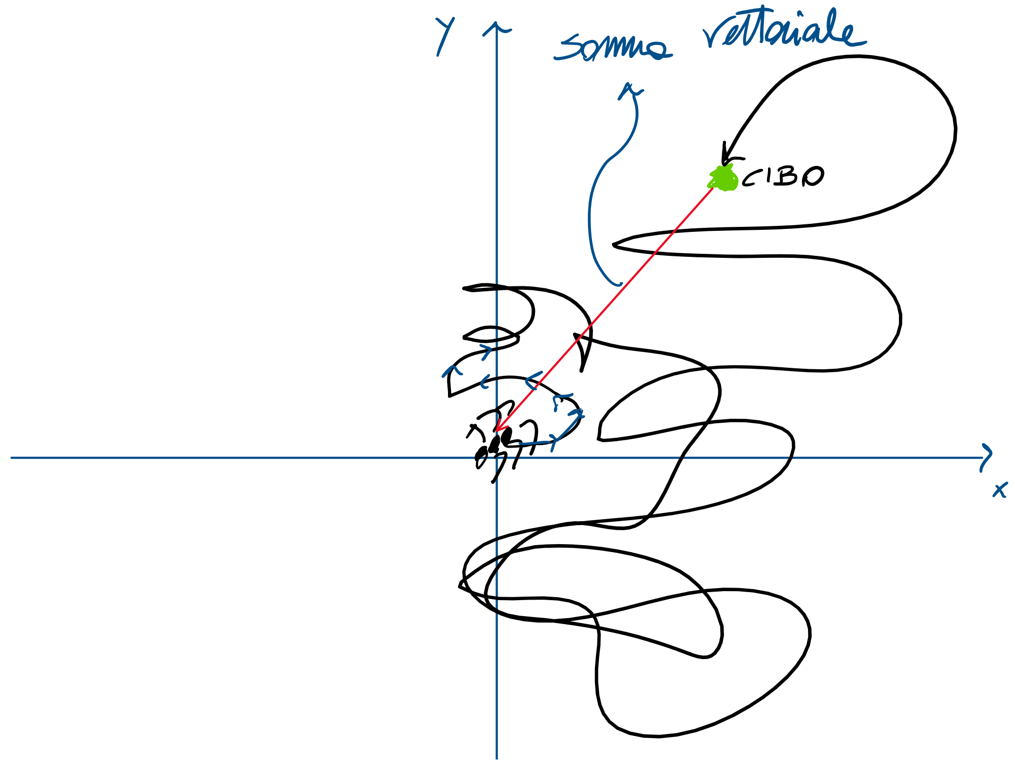
Lezione #2
26/10/2023

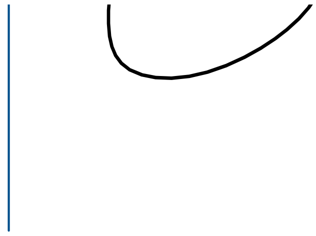
Puntate precedenti:

1) Grandezza fisica, misura, u.d.m.
   ↓
   SI $\begin{cases} m \\ k \\ s \end{cases}$

2) Controllo dimensionale
3) Errori e precisione c.s.
4) Vettori

Esercizio: Formica del deserto:



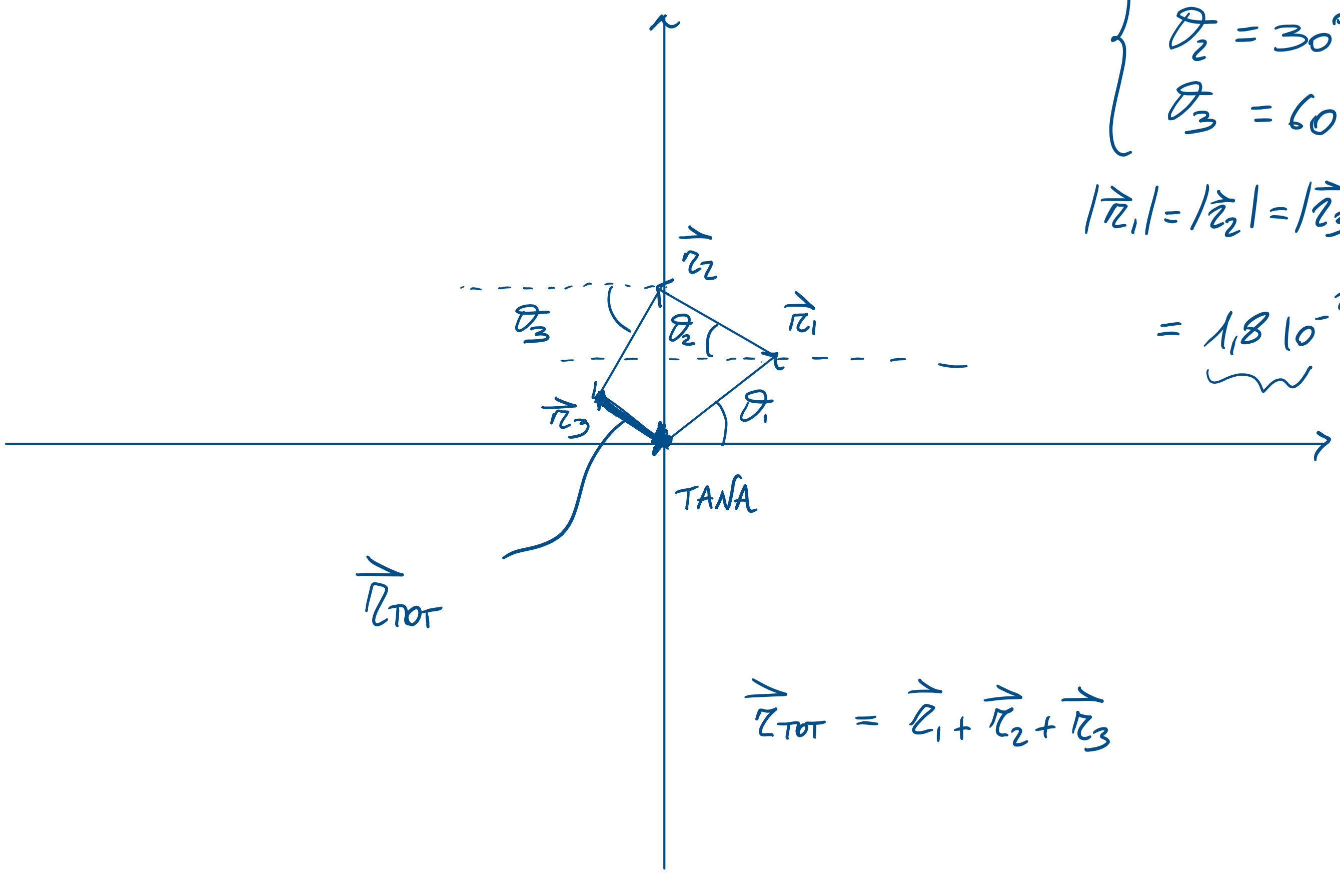


$$\begin{cases} \theta_1 = 45^\circ \\ \theta_2 = 30^\circ \\ \theta_3 = 60^\circ \end{cases}$$

$|\vec{r}_1| = |\vec{r}_2| = |\vec{r}_3| = 1{,}8\ cm$

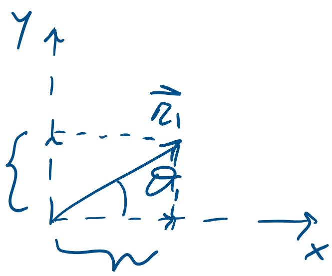
$= \underbrace{1{,}8}\ 10^{-2}\ m$

$0{,}018$



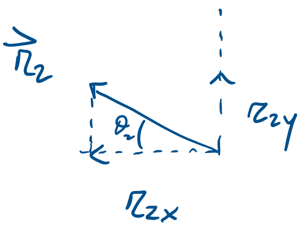
$\vec{r}_{TOT} = \vec{r}_1 + \vec{r}_2 + \vec{r}_3$

$\vec{r}_1 : \left(r_{1x} ; r_{1y} \right)$



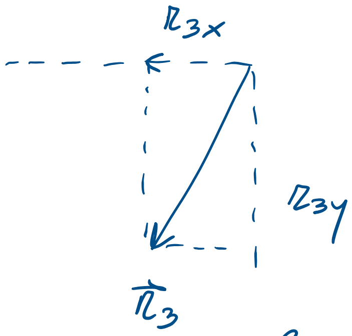
$$\begin{cases} r_{1x} = r_1 \cos(45^\circ) = + r_1 \dfrac{\sqrt{2}}{2} = r_1 \cdot 0{,}7071 \\ r_{1y} = r_1 \sin(45^\circ) = + r_1 \dfrac{\sqrt{2}}{2} = r_1 \cdot 0{,}7071 \end{cases}$$

$\vec{r}_2 :$



$$\begin{cases} r_{2x} = -r_2 \cos\theta_2 = -r_2 \dfrac{\sqrt{3}}{2} = -r_2 \cdot 0{,}8660 \\ r_{2y} = r_2 \sin\theta_2 = r_2 \dfrac{1}{2} = r_2 \cdot 0{,}5 \end{cases}$$

$\vec{r}_3$:



$$\begin{cases} r_{3x} = -r_3 \cos\theta_3 = -r_3 \dfrac{1}{2} \\ r_{3y} = -r_3 \sin\theta_3 = -r_3 \dfrac{\sqrt{3}}{2} \end{cases}$$

$$r_1 = r_2 = r_3 = r = 1{,}8\ cm = 1{,}8\,10^{-2}\ m$$

$$\begin{cases} r_{TOTx} = r_{1x} + r_{2x} + r_{3x} = r_1 \dfrac{\sqrt{2}}{2} - r_2 \dfrac{\sqrt{3}}{2} - r_3 \dfrac{1}{2} = \underset{0{,}018}{r} \underbrace{\left(\dfrac{\sqrt{2}}{2} - \dfrac{\sqrt{3}}{2} - \dfrac{1}{2}\right)}_{-0{,}6589} \\ r_{TOTy} = r_{1y} + r_{2y} + r_{3y} = \underset{0{,}018}{r} \underbrace{\left(\dfrac{\sqrt{2}}{2} + \dfrac{1}{2} - \dfrac{\sqrt{3}}{2}\right)}_{0{,}3411} \end{cases}$$

$$\begin{cases} r_{TOT,x} = -0{,}0119\ m \\ r_{TOT,y} = 0{,}0061\ m \end{cases}$$

$$|\vec{r}_{TOT}| = \sqrt{r_{TOT,x}^2 + r_{TOT,y}^2} = 0{,}0134\ m$$

$$|\vec{r}_{TOT}| \simeq 0{,}01\ m \qquad 1\ c.s.$$

Al ritorno, la formica ha percorso solo $\boxed{r_{TOT} = 0{,}01 m}$ mentre all'andata solo $r_{TOT} = 0{,}01\,m$ mentre all'andata

ha percorso $r_{ANDATA} = 3 \cdot 1{,}8 \cdot 10^{-2}\,m$

$$\boxed{r_{ANDATA} = 5{,}4 \; 10^{-2}\,m}$$

Quale percentuale ha risparmiato:

$$\frac{r_{TOT}}{r_{ANDATA}} = \frac{0{,}01}{5{,}4 \; 10^{-2}} = \frac{10^{-2}}{5{,}4\,10^{-2}} = 0{,}1852$$

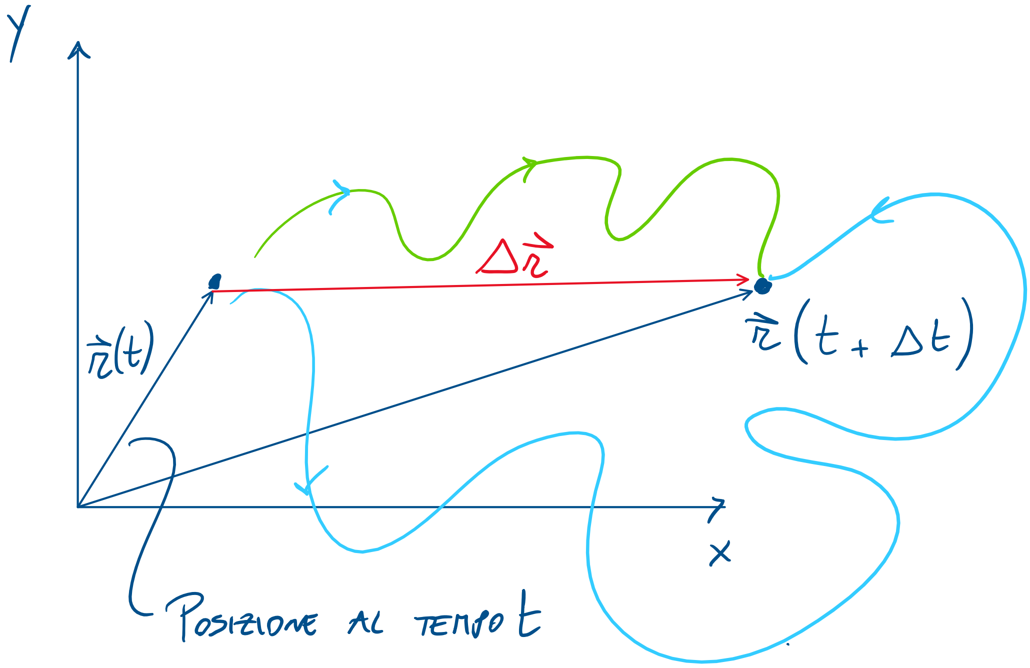
Al ritorno ha percorso solamente il 18% del cammino dell'andata.

CINEMATICA

Descrizione di un moto senza indagarne le cause

Ipotesi:
1) Punto materiale ($S = V = 0$; $m \neq 0$)
2) $v << c$
3) $d >> d_{ATOMICHE}$

Spostamento:



$\Delta\vec{r}$ = vettore spostamento = $\vec{r}(t+\Delta t) - \vec{r}(t)$

Non dipende dalla traiettoria ma solo dalla posizione iniz. e finale

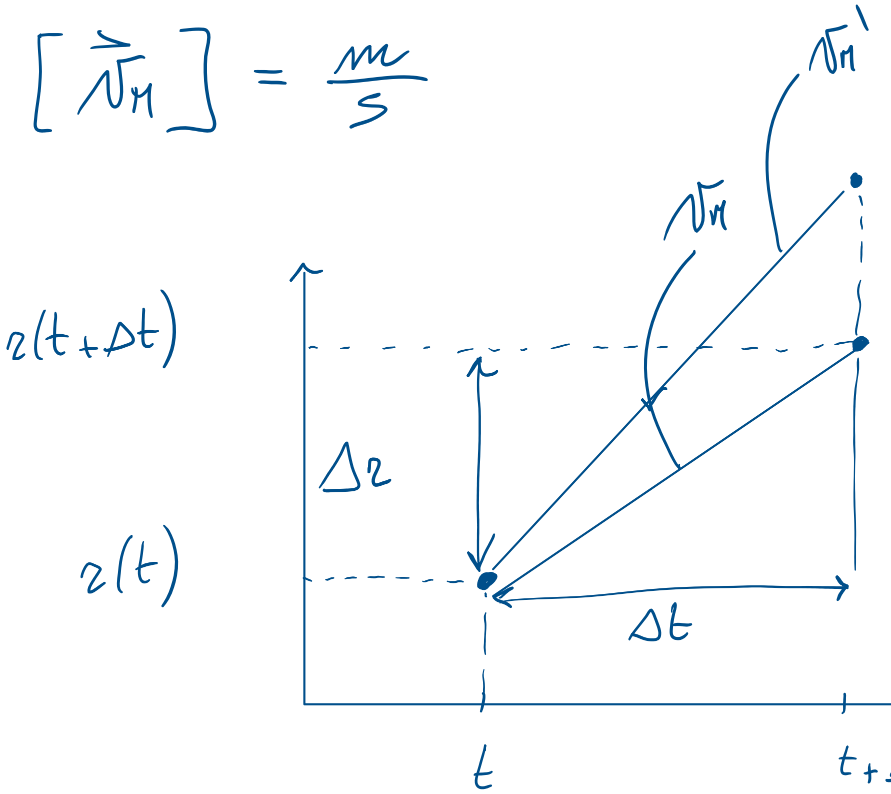
$[\Delta\vec{r}] = m$

$[\Delta t] = s$

$$\vec{v}_M = \frac{\Delta\vec{r}}{\Delta t} = \frac{\vec{r}(t+\Delta t) - \vec{r}(t)}{\quad} =$$

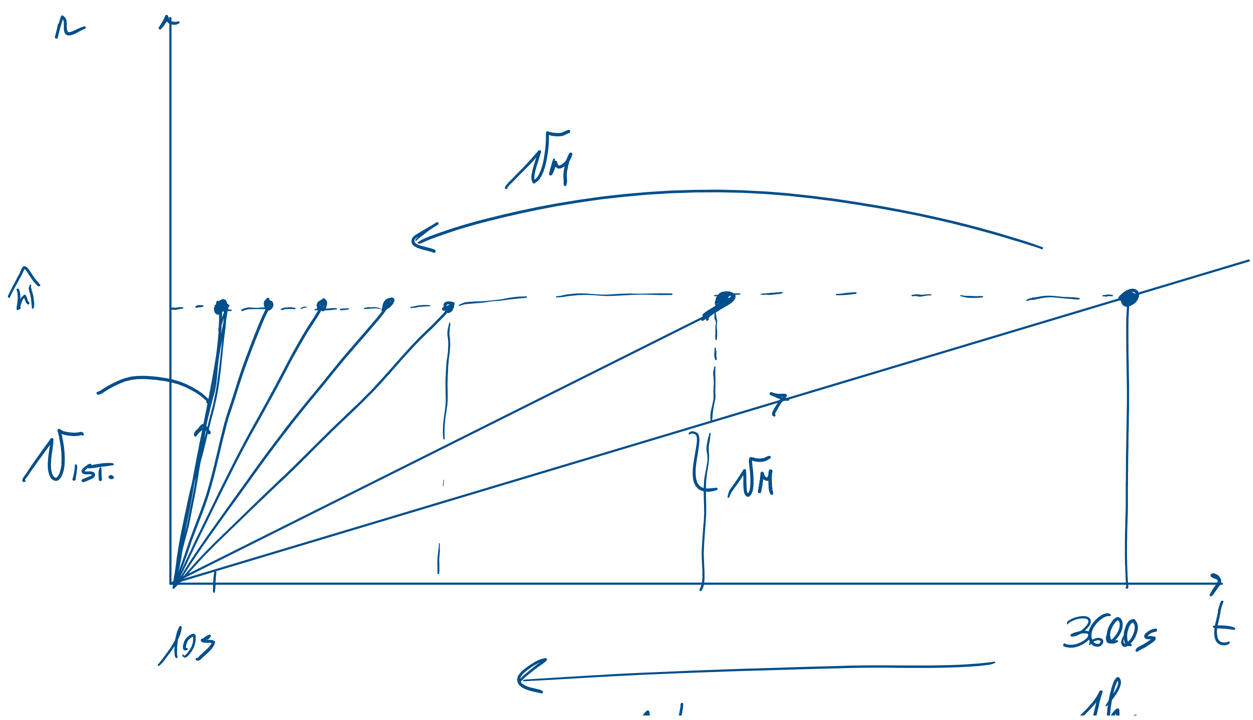
$$v_M = \frac{\Delta r}{\Delta t} = \frac{\qquad}{\Delta t} =$$

$$[\vec{v}_M] = \frac{m}{s}$$



$$v_M = \frac{\Delta r}{\Delta t}$$

Esercizio / Vecchietta al volante:



10 s $\longleftarrow$ 3600 s t

Δt 1h

$$\vec{v}_{IST.} = \lim_{\Delta t \to 0} \frac{\Delta \vec{r}}{\Delta t} = \frac{d\vec{r}}{dt}$$

La velocità è una grandezza vettoriale per cui non appena cambia anche solo <u>una</u> delle sue proprietà (modulo, direz. e verso) essa non è più costante.

$$\vec{a}_M = \frac{\Delta \vec{v}}{\Delta t}$$

accelerazione

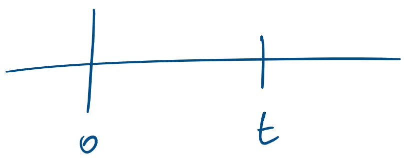
quanto rapidamente varia la velocità in un intervallo di tempo Δt

$$[\vec{a}_M] = \frac{[\Delta \vec{v}]}{[\Delta t]} = \frac{m}{s}\,\frac{1}{s} = m/s^2$$

$$\vec{a}_{IST} = \lim_{\Delta t \to 0} \frac{\Delta \vec{v}}{\Delta t} = \frac{d\vec{v}}{dt}$$

MOTO UNIFORMEMENTE ACCELERATO IN DUE DIMENSIONI

$$\begin{cases} t_{IN} = 0 \\ t_{FIN} = t \end{cases}$$



$$\begin{cases} \vec{r}_{IN} = (x_0 ; y_0) = \vec{r}_0 \\ \vec{r}_{FIN} = (x ; y) = \vec{r} \end{cases}$$

$$\begin{cases} \vec{v}_{IN} = \vec{v}_0 \\ \vec{v}_{FIN} = \vec{v} \end{cases}$$

Accelerazione è costante!!!

Non dipende dal Tempo

$$\vec{a}_0 = \vec{a}_{FIN} = \vec{a}$$

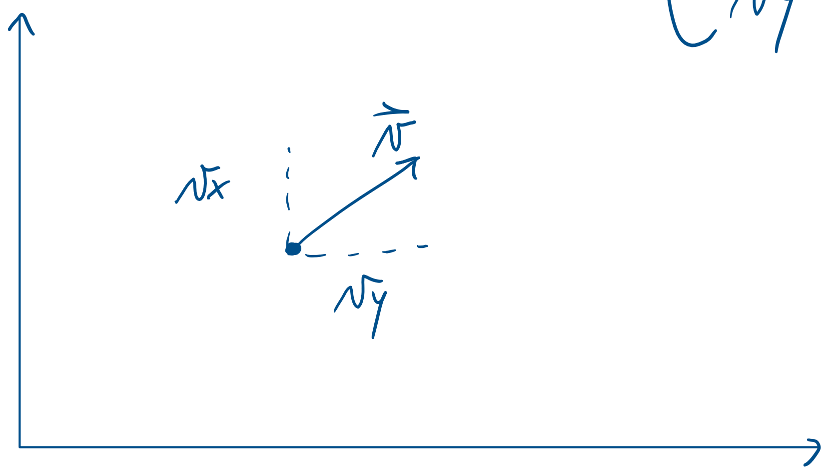
$$\vec{a}_{IST} = \vec{a}_M = \vec{a}$$

$$\vec{a} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v} - \vec{v}_0}{t - 0} = \frac{\vec{v} - \vec{v}_0}{t}$$

$$\vec{v} - \vec{v}_0 = \vec{a}\, t$$

$$\boxed{\vec{v} = \vec{v}_0 + \vec{a}\, t}$$

$$\begin{cases} v_x = v_{0x} + a_x t \\ v_y = v_{0y} + a t \end{cases}$$



$$\vec{v}_m = \frac{\Delta \vec{r}}{\Delta t} = \frac{\vec{r} - \vec{r}_0}{t}$$

$$\left[\ \vec{v} = \vec{v}_0 + \vec{a}\, t\ \right]$$

$$\vec{r} - \vec{r}_0 = \vec{v}_m t \qquad \vec{r} = \vec{r}_0 + \vec{v}_m t$$

$$v_m = \frac{v + v_0}{2}$$

$$\vec{r} = \vec{r}_0 + \underbrace{\left(\frac{1}{2} v + \frac{1}{2} v_0\right)} t$$

$$\left[\ \vec{v} = \vec{v}_0 + \vec{a}\, t\ \right]$$

$$\vec{r} = \vec{r}_0 + \overbrace{\left(\underbrace{\frac{1}{2}\vec{v}_0 + \frac{1}{2}\vec{a}t}_{v} + \frac{1}{2}\vec{v}_0 \right)}^{v_M} t$$

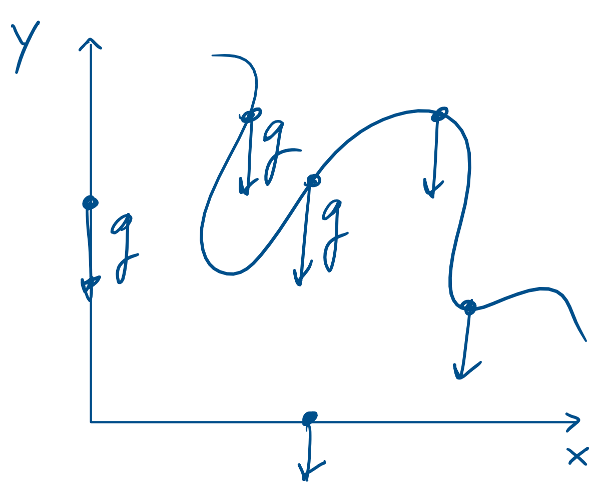
$$\boxed{\vec{r} = \vec{r}_0 + \vec{v}_0 t + \frac{1}{2}\vec{a}\,t^2}$$

MOTO UNIF. ACCELERATO IN DUE DIMENSIONI

$$\begin{cases} x = x_0 + v_{0x}t + \frac{1}{2}a_x t^2 \\ y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2 \end{cases} \qquad \begin{cases} v_x = v_{0x} + a_x t \\ v_y = v_{0y} + a_y t \end{cases}$$

Nel caso della gravità

$$\vec{a} = (\underset{a_x}{0} \,;\, \underset{a_y}{-g})$$



$$\begin{cases} x = x_0 + v_{0x}t + \cancel{\frac{1}{2}a_x t^2} = x_0 + v_{0x}t \\ y = y_0 + v_{0y}t - \frac{1}{2}g t^2 = y_0 + v_{0y}t - \frac{1}{2}g t^2 \end{cases}$$

$$\begin{cases} y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2 = y_0 + v_{0y} t - \frac{1}{2} g t^2 \end{cases}$$

$$\begin{cases} v_x = v_{0x} + \cancel{a_x t} = v_{0x} \\ v_y = v_{0y} t + a_y t = v_{0y} t - g t \end{cases}$$

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= PROSSIMA LEZIONE LUNEDÌ 30/10/2023

ore 14:00 AULA 14