Lezione 2 24/10/2024

giovedì 24 ottobre 2024 14:07

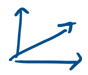
Lezione #2

24/10/2024

Misura di una grandezza fisica

↳ scalari

vs

vettoriali → 

SI $\begin{cases} l \\ m \\ t \end{cases}$

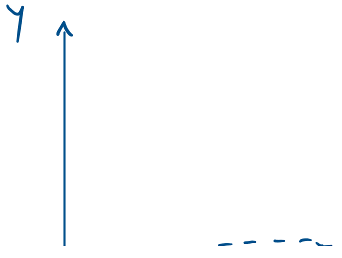
u.d.m.

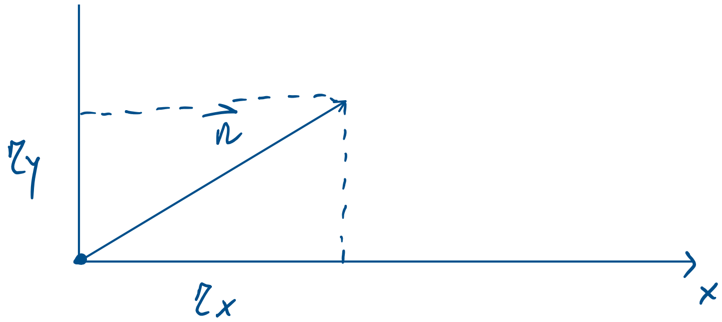
↳ check dimensionale

Precisione ⇒ cifre significative

Riepilogo su "vettori"

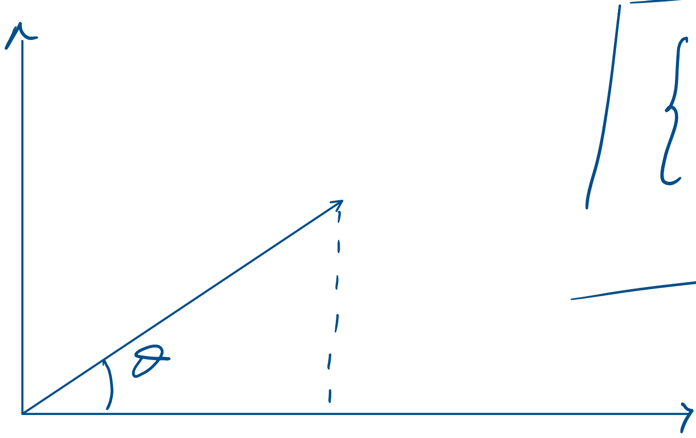
$$\vec{r} = (r_x ; r_y)$$





Modulo: $\boxed{|\vec{r}| = r = \sqrt{r_x^2 + r_y^2}}$

Come passare dal modulo alle componenti:



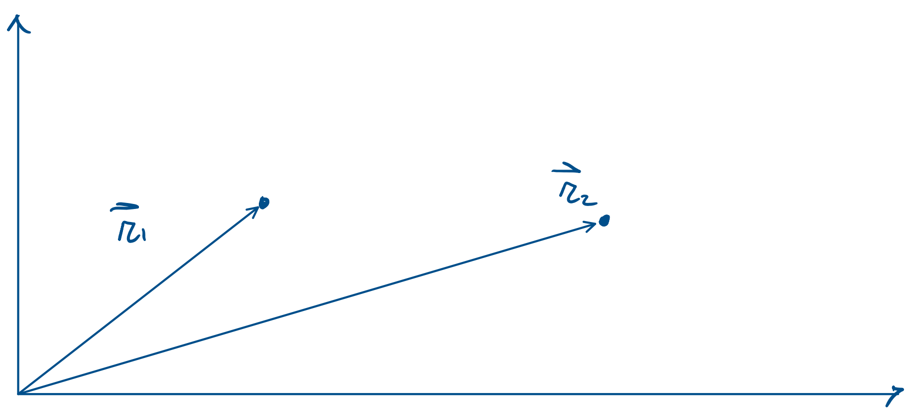
$$\boxed{\begin{cases} r_x = r\cos\theta \\ r_y = r\sin\theta \end{cases}}$$

Come calcolare θ ?

$$\frac{r_y}{r_x} = \frac{\cancel{r}\sin\theta}{\cancel{r}\cos\theta} = tg\theta$$

$$\boxed{\theta = arctg\left(r_y/r_x\right)}$$

Somma/Differenza vettoriale:



$\vec{r}_{TOT} = \vec{r}_1 + \vec{r}_2$ se $\begin{cases} \vec{r}_1 = (r_{1x} \,;\, r_{1y}) \\ \vec{r}_2 = (r_{2x} \,;\, r_{2y}) \end{cases}$

$$\vec{r}_{TOT} = \begin{cases} r_{TOT,x} = r_{1x} + r_{2x} \\ r_{TOT,y} = r_{1y} + r_{2y} \end{cases}$$

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

FORMICA DEL DESERTO

"Cataglyphis"

Ha un tempo di sopravvivenza di $\simeq$ 10 min a 70°

$v_M = 0,85$ m/s. Esercizio:

Supponiamo che una formica del deserto esca dalla tana in cerca di cibo.

Ogni passo della formica ha il modulo pari a 1,8 cm, sapendo che compie tre passi $\vec{r}_1$, $\vec{r}_2$ ed $\vec{r}_3$ con

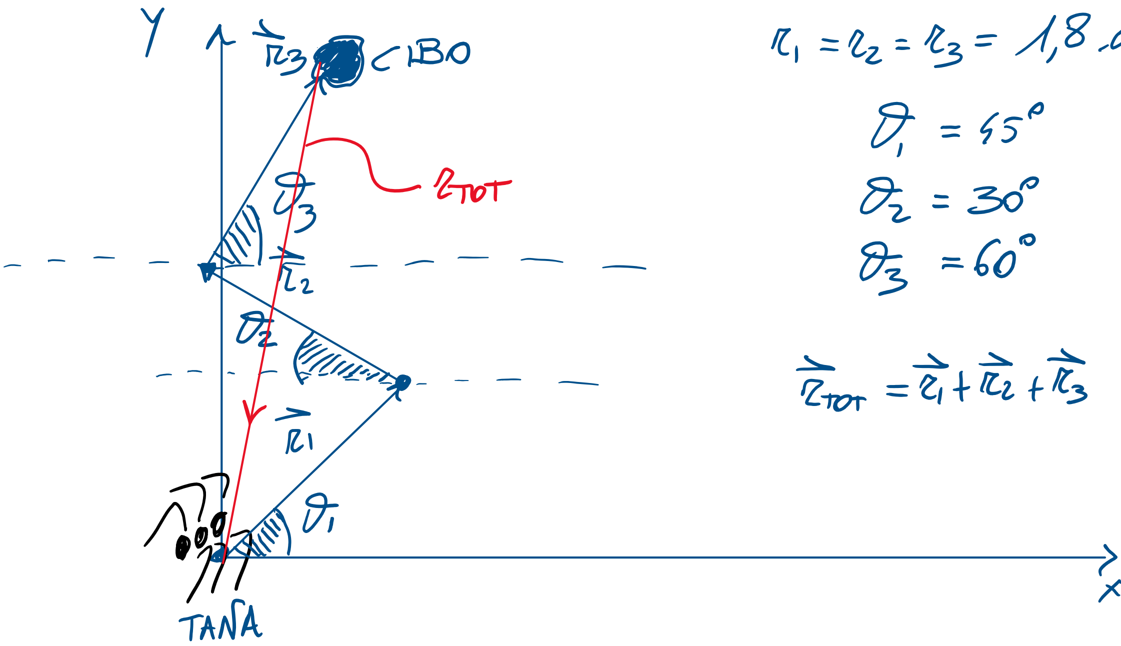
$\theta_1 = 45°$, $\theta_2 = 30°$ e $\theta_3 = 60°$.

Calcolare:

1) la distanza finale a cui trova la preda

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

2) Quanto risparmia in lunghezza al ritorno



$r_1 = r_2 = r_3 = 1{,}8$ cm

$\theta_1 = 45°$

$\theta_2 = 30°$

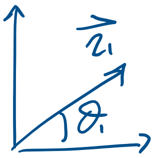
$\theta_3 = 60°$

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

Soluzione:

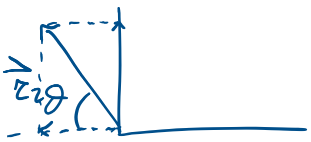
Scomponiamo $\vec{r}_1$, $\vec{r}_2$ e $\vec{r}_3$ $\qquad r_1 = r_2 = r_3 = 1{,}8\,10^{-2}$ m

$r_{1x} = r_1 \cos\theta_1 = 0{,}018 \cos(45°) = 0{,}0127$



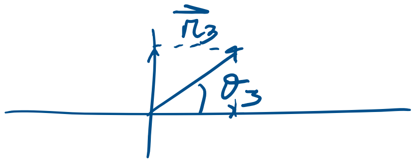
$$\begin{cases} r_{1x} = r_1 \cos\theta_1 = 0{,}018 \cos(45°) = 0{,}0127 \\ r_{1y} = r_1 \sin\theta_1 = 0{,}018 \sin(45°) = 0{,}0127 \end{cases}$$

$\vec{r}_2$



$$\begin{cases} r_{2x} = -r_2 \cos\theta_2 = -0{,}018 \cos(30°) = -0{,}0156 \\ r_{2y} = r_2 \sin\theta_2 = 0{,}018 \sin(30°) = 0{,}0090 \end{cases}$$

$\vec{r}_3$:



$$\begin{cases} r_{3x} = r_3 \cos\theta_3 = 0{,}018 \cos(60°) = 0{,}0090 \\ r_{3y} = r_3 \sin\theta_3 = 0{,}018 \sin(60°) = 0{,}0156 \end{cases}$$

$$\vec{r}_{TOT} = (r_{TOT,x}\ ;\ r_{TOT,y})$$

$$\begin{cases} r_{TOT,x} = r_{1x} + r_{2x} + r_{3x} = 0{,}0127 - 0{,}0156 + 0{,}0090 = 0{,}0061 \\ r_{TOT,y} = r_{1y} + r_{2y} + r_{3y} = 0{,}0127 + 0{,}0090 + 0{,}0156 = 0{,}0373 \end{cases}$$

$$|\vec{r}_{TOT}| = \sqrt{0{,}0061^2 + 0{,}0373^2} = 0{,}0378\ m$$

$$\boxed{|\vec{r}_{TOT}| = 0{,}0378\ m \simeq 0{,}038\ m}$$

2) All'andata $r_{AND} = 3 \cdot 1{,}8\ 10^{-2}$

2) All'andata $z_{AND} = 3 \cdot 1{,}8\ 10$

$= 0{,}0540\ m$

Al ritorno $z_{RIT} = 0{,}038$

$$\Delta z = 0{,}054 - 0{,}038 = 0{,}0160\ m$$

$$\frac{\Delta z}{z} = \frac{0{,}016}{0{,}054} \simeq 29\ \%$$

CINEMATICA

Descrizione moto trascurandone le cause:

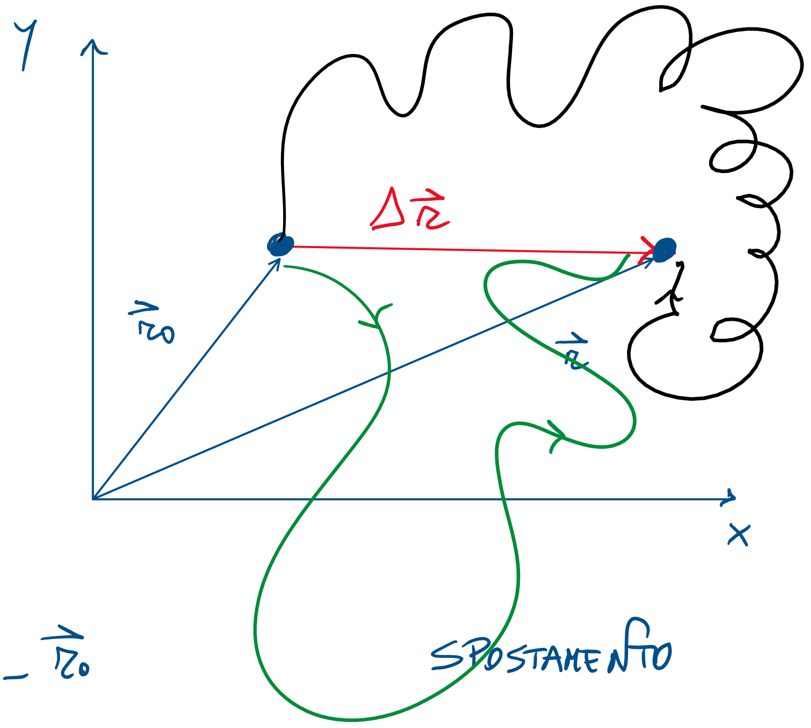
HP: Punto materiale
$$\begin{cases} \bullet\ S = V = 0 \\ m \neq 0 \\ \downarrow \\ \text{massa} \end{cases}$$

Velocità $\rightarrow$ $\vec{v} \ll \vec{c}$

$\hookrightarrow$ v. della luce

$d \gg d_{ATOMICHE}$

– Velocità –



$t_{IN} \to t_0 = 0\,s$, $\vec{r}_0$

$t_{FIN} \to t$, $\vec{r}$

$$\Delta\vec{r} = \vec{r} - \vec{r}_0$$

Il vettore spostamento dipende **solo** dalla pos. iniziale e finale e non dalla traiettoria | percorso seguito

$$\vec{v}_{MEDIA} = \vec{v}_M = \frac{\Delta\vec{r} \to \text{SPAZIO PERCORSO}}{\Delta t \to \text{TEMPO IMP.}}$$

$$= \frac{\vec{r} - \vec{r}_0}{(t - t_0)} = \frac{\vec{r} - \vec{r}_0}{t}$$

$$[v_m] = \frac{m}{s}$$

$\vec{v}$ = un vettore !!!

$\vec{v}_m$ è un vettore !!!

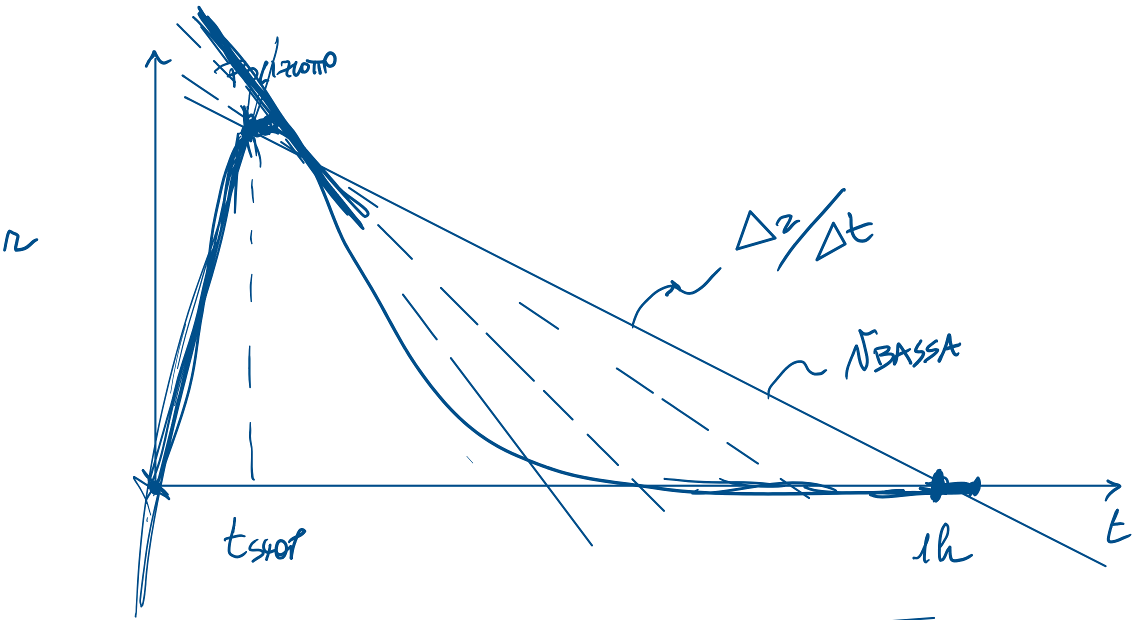
$\Downarrow$

Possiamo dire che la $\vec{v} = \text{cost.}$

se e solo se $\begin{cases} \text{Modulo} = \text{cost} \\ \text{Direzione} = \text{"} \\ \text{Verso} = \text{cost} \end{cases}$

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

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

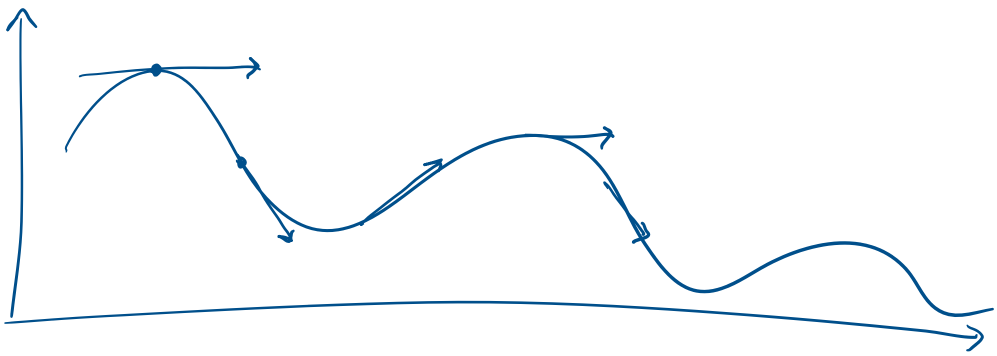


$\longleftarrow$

$\Delta t \to 0$

$\vec{v} \nearrow$

$\vec{v} \nearrow$



La velocità graficamente è rappresentata dalla pendenza di $\vec{r}(t)$

- Accelerazione -

$$\begin{cases} \vec{a}_m = \dfrac{\Delta \vec{v}}{\Delta t} \\ \vec{a}_{IST} = \dfrac{d\vec{v}}{dt} \end{cases}$$

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

MOTO UNIFORMEMENTE ACCELERATO

$v_{FIN} = v$

$v_{IN} = v_0$

$\vec{a}$ = COSTANTE

$v_{FIN} = v$

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

$$\vec{a}_M = \frac{\Delta \vec{v}}{\Delta t} = \frac{v_{FIN} - v_0}{t - 0} = \frac{v - v_0}{t}$$

$$\vec{a}_M = \vec{a}_i$$

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

$$v = (v_x ; v_y)$$

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

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

$$\vec{r} = \vec{r}_0 + \vec{v}_M\, t$$

$$v_M = v.\ media = \frac{v_0 + v}{2}$$

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

$$\left[\, \underline{v} = v_0 + at \,\right]$$

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

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

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

$$\vec{r} = (x, y)$$

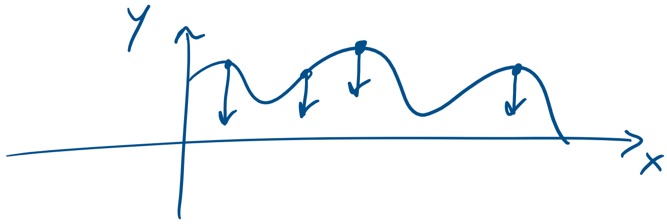
$$\vec{r}: \begin{cases} x = x_0 + v_{0x} t + \frac{1}{2} a_x t^2 \\ y = y_0 + v_{0y} t + \frac{1}{2} a_y t^2 \end{cases}$$

$$\vec{v}: \begin{cases} v_x = v_{0x} + a_x t \\ v_y = v_{0y} + a_y t \end{cases}$$

Moto uniformemente accelerato in 2D !!!!

Nel caso dell'accelerazione di gravità:

$$\vec{a} = (0; -g)$$



$$\begin{cases} x = x_0 + v_{0x} t \\ \ldots \end{cases} \qquad \begin{cases} v_x = v_{0x} \\ \ldots \end{cases}$$

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

Eq^{ni} moto caduta libera in 2D

Moto parabolico