ES SUL CENTRO DI SIST. DI VETTORI // 7/03/24

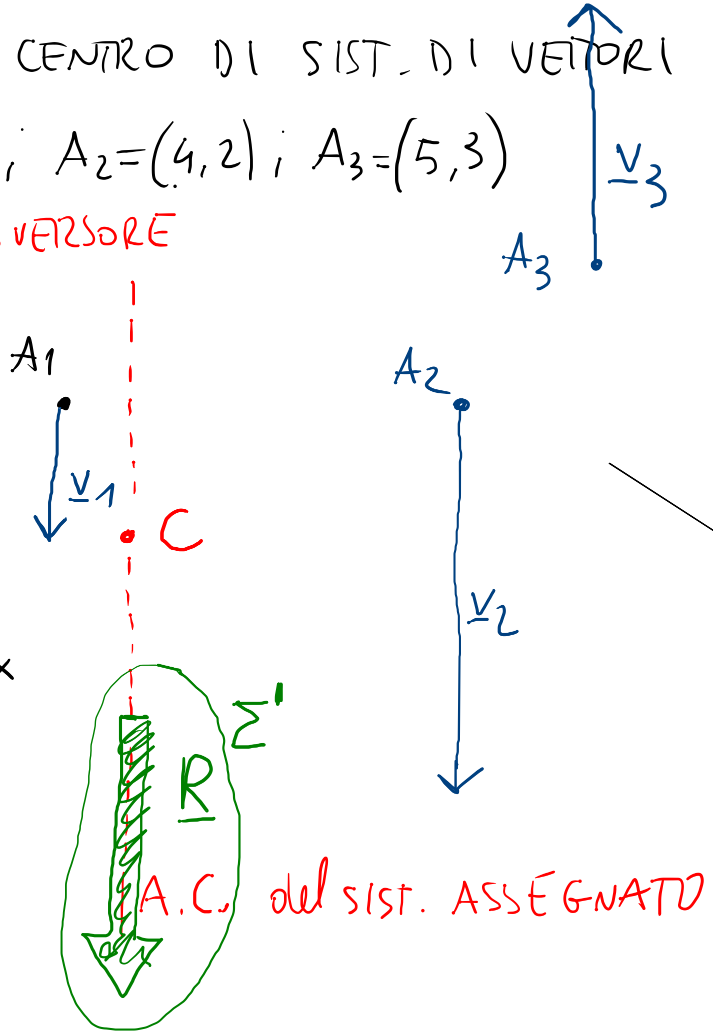
Σ:

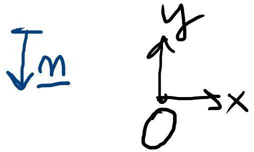
$A_1 = (1,2)$; $A_2 = (4,2)$; $A_3 = (5,3)$

$\underline{v}_1 = 1\,\underline{m}$ → VERSORE

$\underline{v}_2 = 3\,\underline{m}$

$\underline{v}_3 = -2\,\underline{m}$





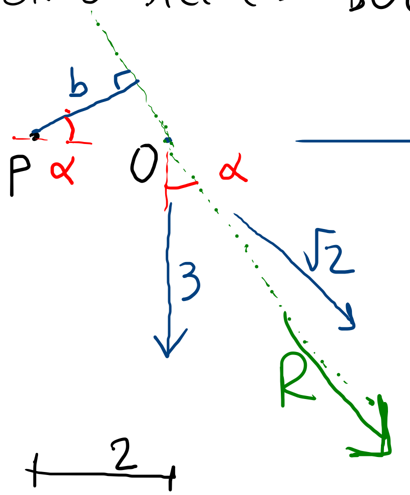
$R = |\underline{R}|$

$\underline{R} = 2\,\underline{m}$

$$x_c = \frac{\sum_{i=1}^{3} v_i x_i}{R} = \frac{1\cdot 1 + 3\cdot 4 + (-2)\cdot 5}{2} = +\frac{3}{2}$$

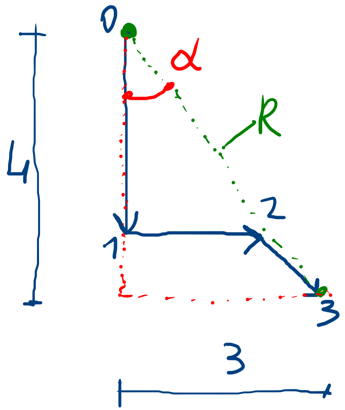
$$y_c = \frac{\sum_{i=1}^{3} v_i y_i}{R} = \frac{1\cdot 2 + 3\cdot 2 + (-2)\cdot 3}{2} = \frac{2}{2} = 1$$

RITORNO ALL'ES SUL TM. DI VARIGNON



ORA CALCOLO PRIMA LA RISULTANTE, POI CALCOLO M_P

$\underline{R} = 03$; $R = \sqrt{4^2+3^2} = \sqrt{16+9} = \sqrt{25} = 5$



$\cos\alpha = \frac{4}{5}$

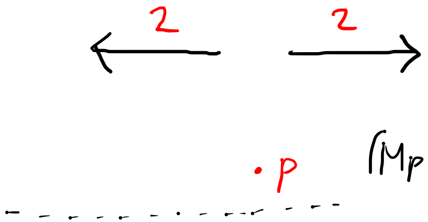
$b = 2\cos\alpha = 2\cdot\frac{4}{5} = \frac{8}{5} = 1.6$

$$\overset{+}{\curvearrowleft} M_P = \underbrace{\cancel{5}\cdot\frac{8}{\cancel{5}}}_{R\cdot b} = 8$$

SISTEMA DI VETTORI NULLO o EQUILIBRATO

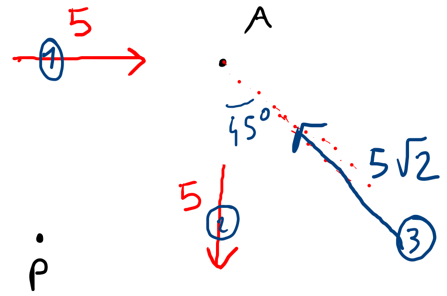
Σ è un sistema NULLO o EQUILIBRATO $\iff$ $\boxed{\underline{R}=\underline{0} \quad \text{e} \quad \underline{M}_P=\underline{0}, \forall P}$

ES DI SISTEMI EQUILIBRATI.



COPPIA DI BRACCIO NULLO.

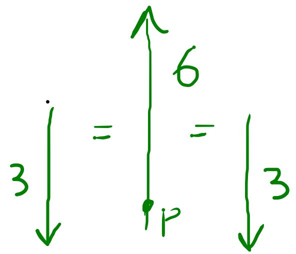
$(M_P=0)$



$\underline{R}=\underline{0}$

$\underline{M}_A=\underline{0}$

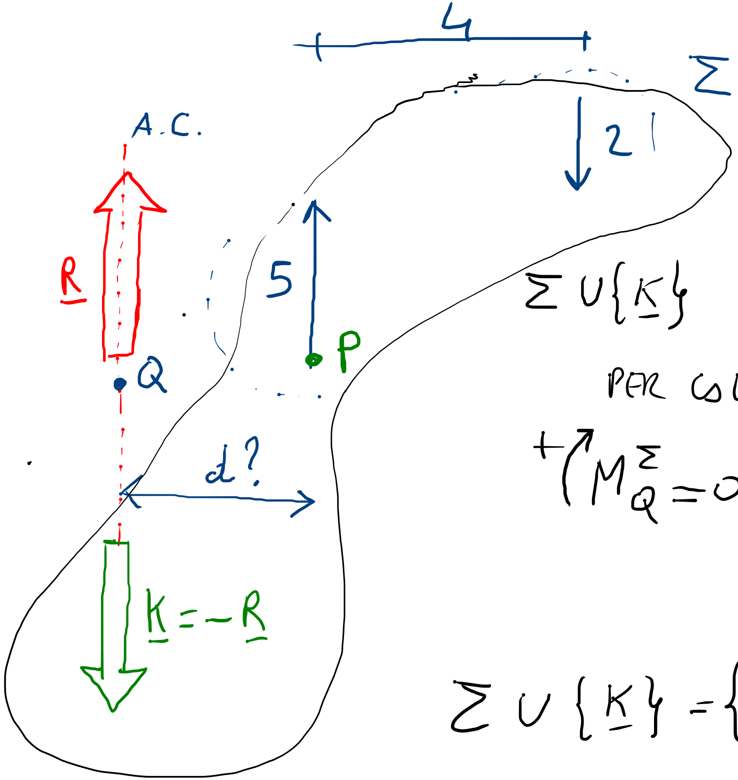
$(M_P=\underline{0})\ \forall P$



$\underline{R}=\underline{0}$

$\underline{M}_P=\underline{0}$

ES Σ è un sist. generico. Determinare un vettore $\underline{K}$ che rende il nuovo sistema $\Sigma \cup \{\underline{K}\}$ equilibrato



$|\underline{R}^{\Sigma}| = 3$

$|\underline{K}| = 3$

Calcolo $\underline{R}$ e l'A.C. (d?)
poi individuo $\underline{K}$ come l'opposto di $\underline{R}$ applicato all'A.C.

$\Sigma \cup \{\underline{K}\}$

$$\boxed{\overset{+}{\circlearrowright} M_P(\Sigma \cup \{\underline{K}\}) = +2\cdot 4 - \cancel{3}\cdot \frac{8}{\cancel{3}} = 0}$$

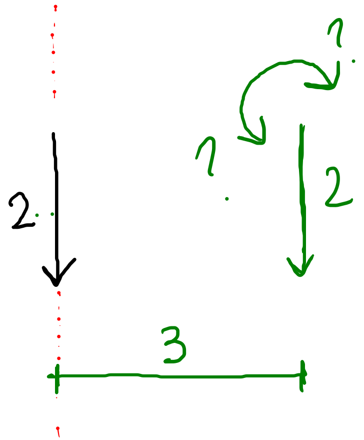
Per calcolare d:

$$\overset{+}{\circlearrowright} M_Q^{\Sigma} = 0 \ : \ -5\cdot d + 2(4+d) = 0 \ ; \ -3d = -8$$

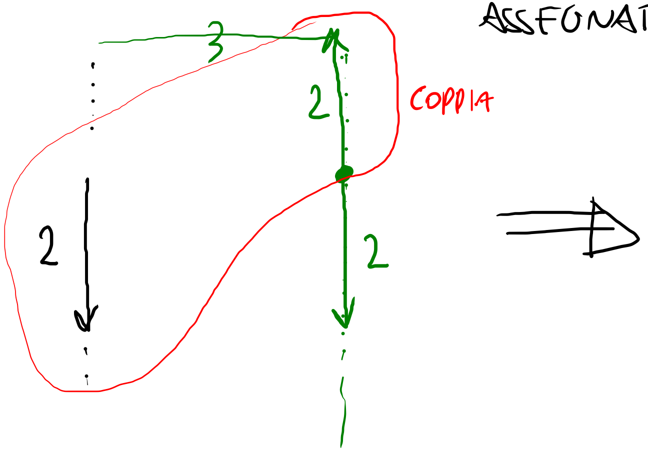
$$d = \frac{8}{3}$$

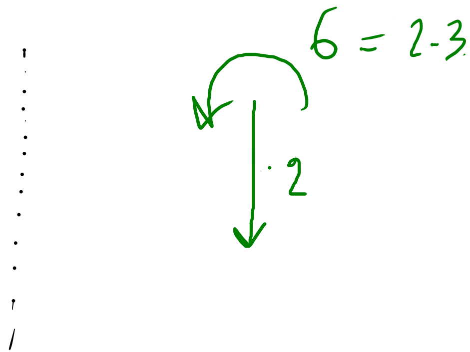
$\Sigma \cup \{\underline{K}\} = \{"5", "2", \underline{K}\}$ è **equilibrato**

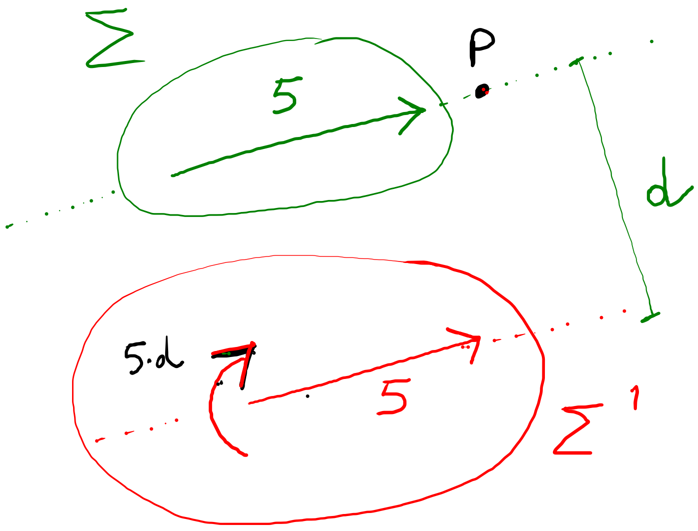
TRASLAZIONE "TRASVERSALE" DI UN VETTORE (TRASVERSALE RISPETTO ALLA RETTA D'AZIONE)



AGGIUNGERE UN MOMENTO CONCENTRATO PER FAR SÌ CHE IL SISTEMA COLORATO IN VERDE SIA $\doteq$ AL VETTORE ASSEGNATO (IN NERO)

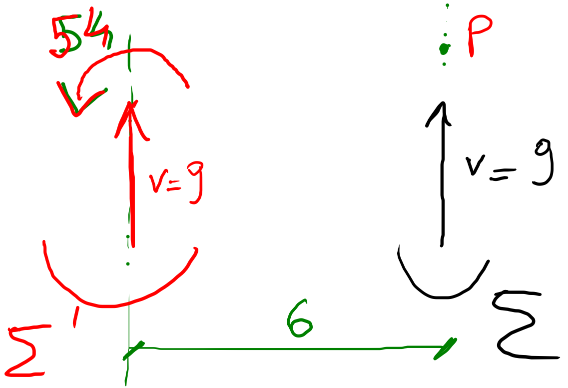






$\Sigma \doteq \Sigma'$

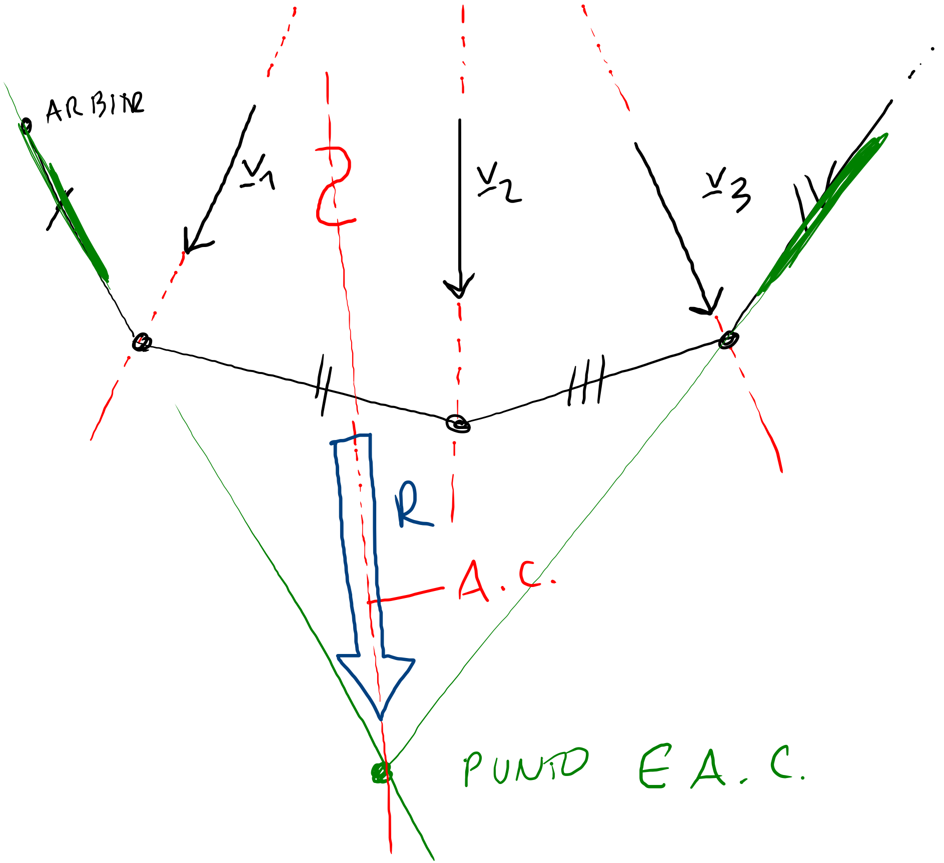
IL MOMENTO CONCENTRATO DI INTENSITA' $5 \cdot d$ ANNULLA IL MOMENTO DEL VETTORE di Σ' IN MODO CHE $M_P^{\Sigma'} = 0$



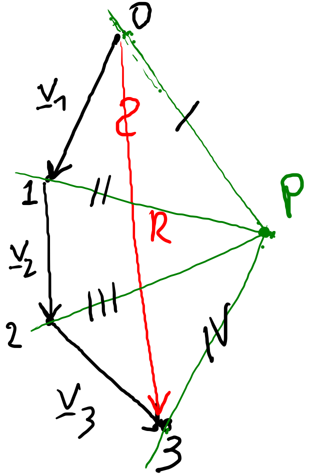
$\Sigma \doteq \Sigma'$

POLIGONO FUNICOLARE (COSTR. GRAFICA NOTEVOLE)

ASSEGNATO UN SIST. DI VETTORI NEL PIANO, IL POLIGONO FUNICOLARE PERMETTE DI DETERMINARE GRAFICAMENTE L'A.C.



POLIGONO DEI VETTORI

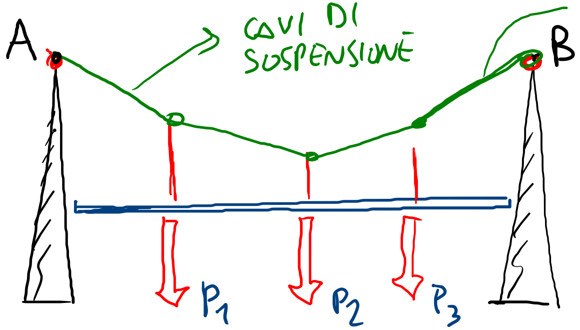


$\underline{R} = \underline{v}_1 + \underline{v}_2 + \underline{v}_3$

$\underline{01} + \underline{12} + \underline{23}$

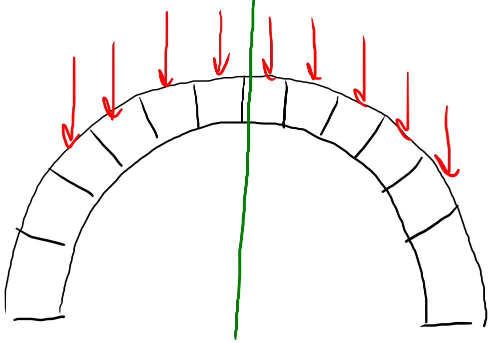
$\underline{R} = \underline{OP} + \underline{P3}$

P: POLO (ARBITRARIO)

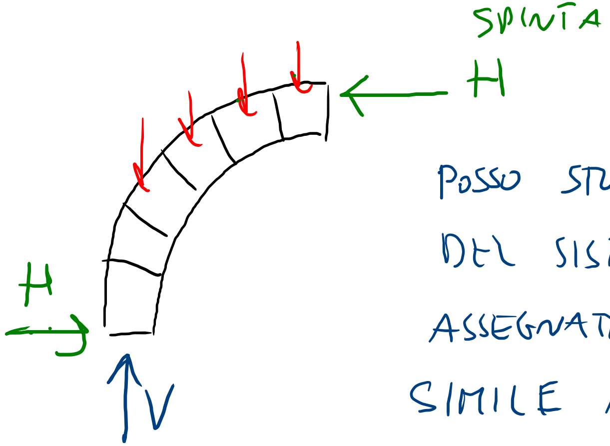


"FORMA" DEI CAVI → POLIGONO FUNICOLARE DEI PESI P_1, P_2, P_3

PONTE SOSPESO

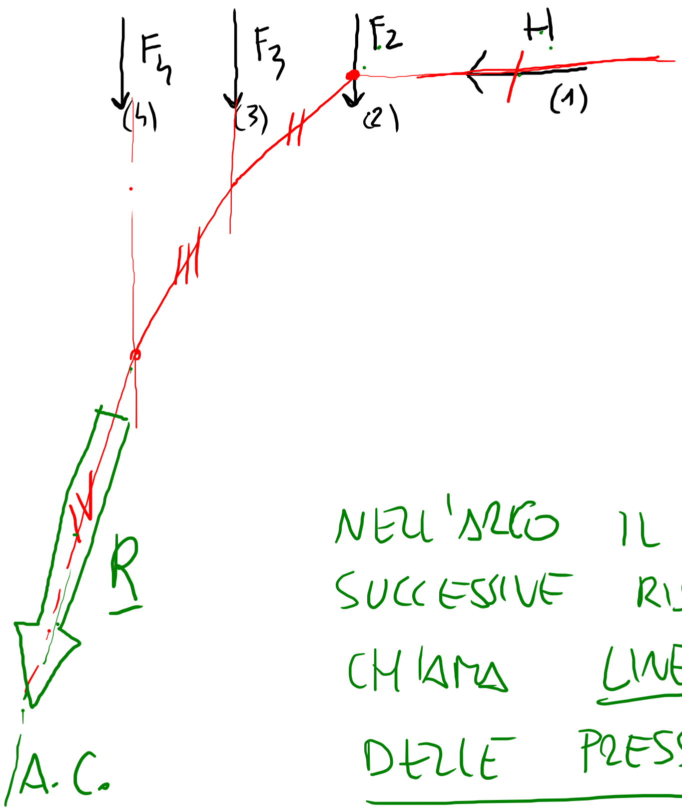


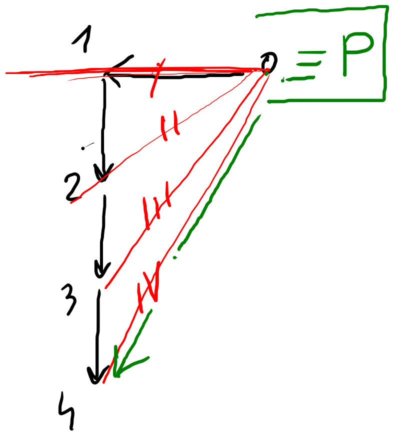
ARCO A CONCI



POSSO STUDIARE L'EQUILIBRIO DEL SISTEMA DI VETTORI ASSEGNATO CON UNO STRUMENTO SIMILE AL POLIGONO FUNICOLARE?

POLIGONO DELLE SUCCESSIVE RISULTANTI (È UNO SPECIALE POLIGONO FUNICOLARE)





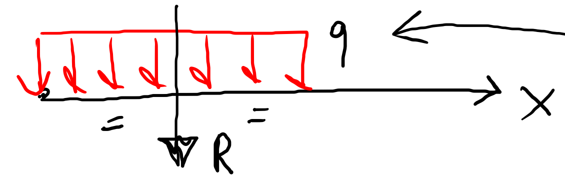
$R = \overline{O4}$

$\overline{P4}$

NELL'ARCO IL POLIGONO DELLE SUCCESSIVE RISULTANTI SI CHIAMA LINEA (O CURVA) DELLE PRESSIONI

(EQUILIBRIO DELL'ARCO: L.D.P. ALL'INTERNO DELLO SPESSORE IN OGNI PUNTO)

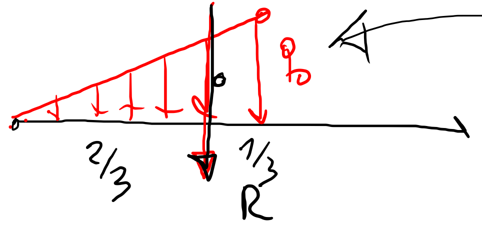
CARICHI (o FORZE) DISTRIBUITI SU UNA LINEA



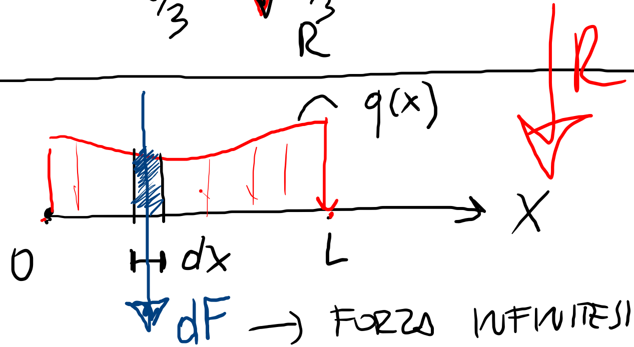
$$[q]=[F/L]$$

$$R=\int_{\cancel{0}}^{\cancel{L}} dF=\int_0^L q(x)\,dx$$

$q(x)=\text{cost}=q$



$q(x)$: lineare $=\alpha x$



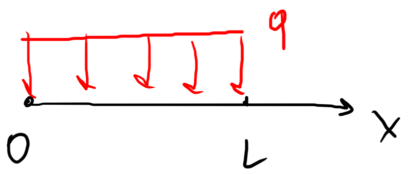
$q(x)$: FUNZIONE CARICO DISTRIBUITO

$$[q]=[F/L]$$

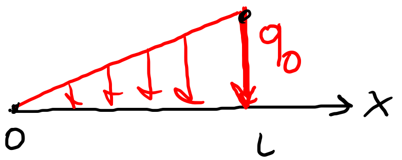
$\frac{N}{m}$ (u.d.m.)

dF → FORZA INFINITESIMA CHE INSISTE SUL TRATTO dx

$$dF=q(x)\,dx$$



$q = \text{cost}$ $\quad$ $R\,?$ $\quad$ $R = \int_0^L q(x)\,dx = q\int_0^L dx = qL$



$q(L) = q_0 \; ; \; q(0) = 0$

$q(x) = \alpha x = \frac{q_0}{L} x$

$\alpha\,?$

$q(x) = \frac{q_0}{L} x$

$$\boxed{R} = \int_0^L \frac{q_0}{L} x\,dx = \frac{q_0}{L}\int_0^L x\,dx$$

$$= \frac{q_0}{L}\left[\frac{x^2}{2}\right]_0^L = \frac{q_0}{L}\left(\frac{L^2}{2} - 0\right)$$

$$= \boxed{\frac{q_0 L}{2}}$$