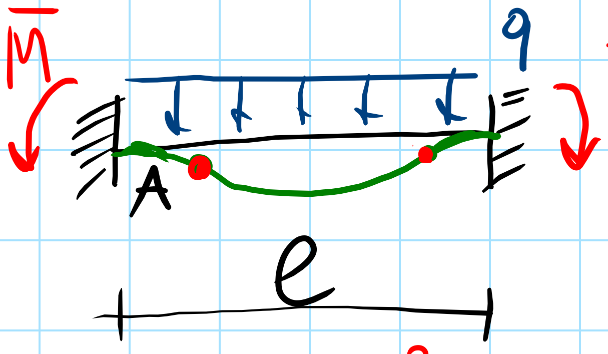
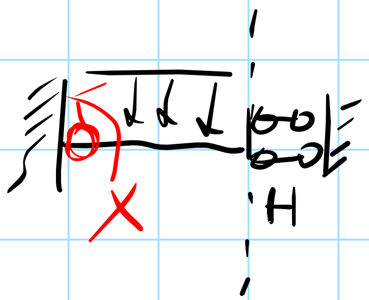
17/12/25

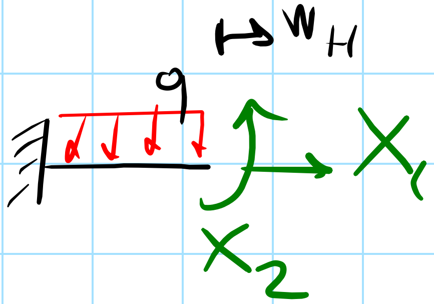
QUALCHE IPERST. UTILE PER LO SCHEMA I



$\bar{M}$: MOM DI INCASTRO PERFETTO



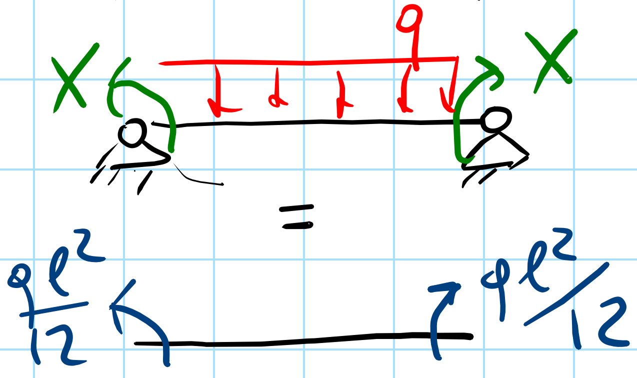
2V IPERST.



$w_H = 0\ ,\ \varphi_H = 0$

$w_H(X_1) = 0 \Rightarrow X_1 = 0$

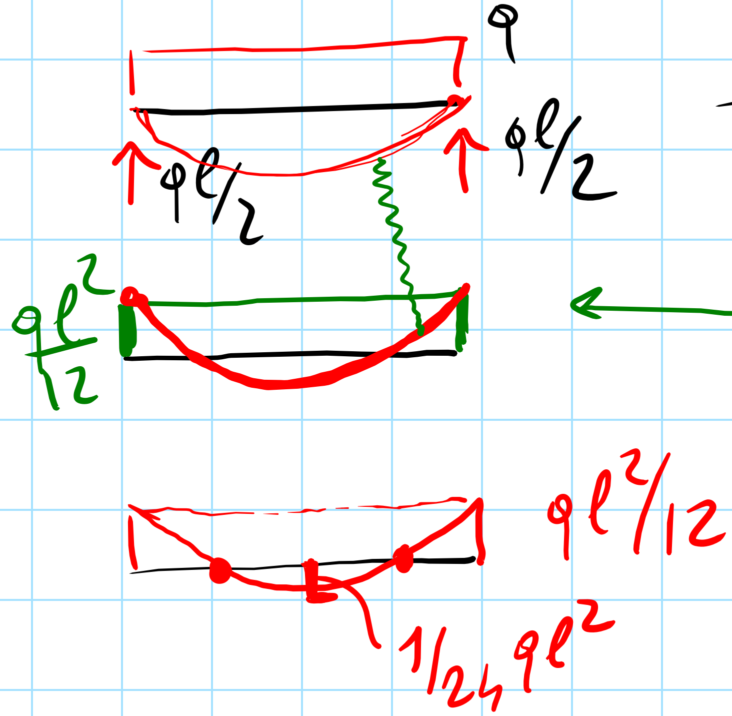
$\varphi_H(X_2, q, \cancel{X_1}) = 0\ ;\ X_2 = f(q)$



$$\varphi_A = 0 : \quad \frac{X\ell}{3EJ} + \frac{X\ell}{6EJ} - \frac{q\ell^3}{24EJ} = 0$$

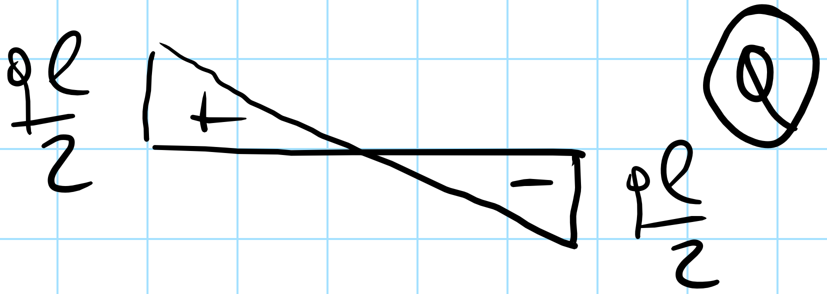
$\boxed{q=0}$

$$\frac{3}{6}X = \frac{q\ell^2}{24}\ ;\ \boxed{X = \frac{q\ell^2}{12}}$$

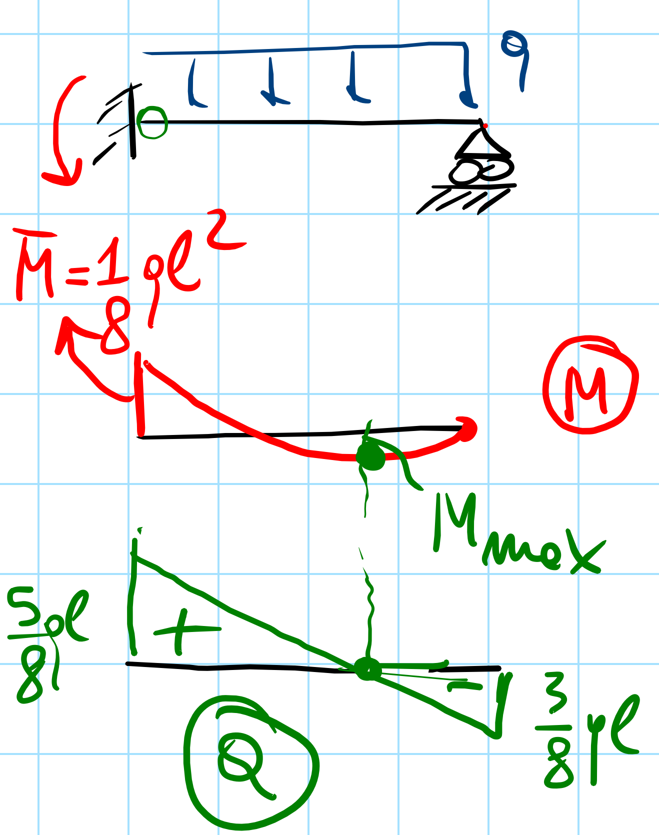


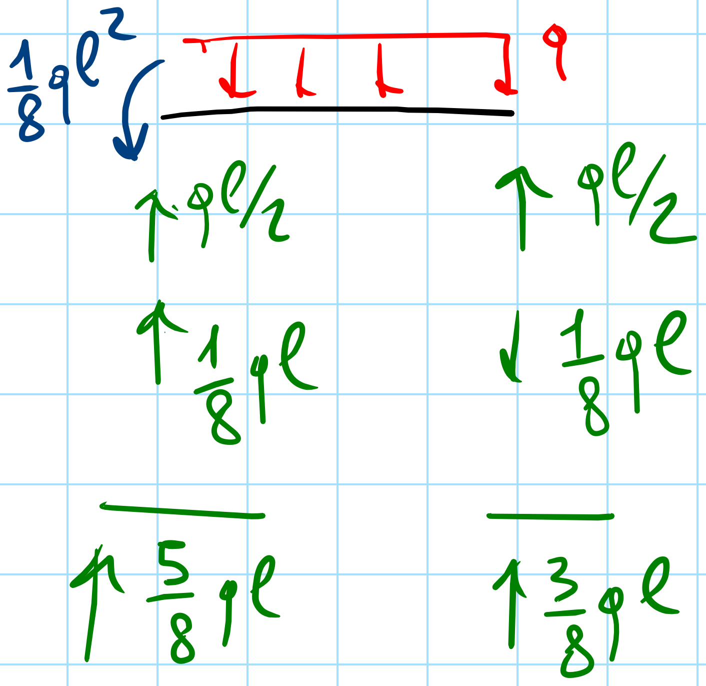
M

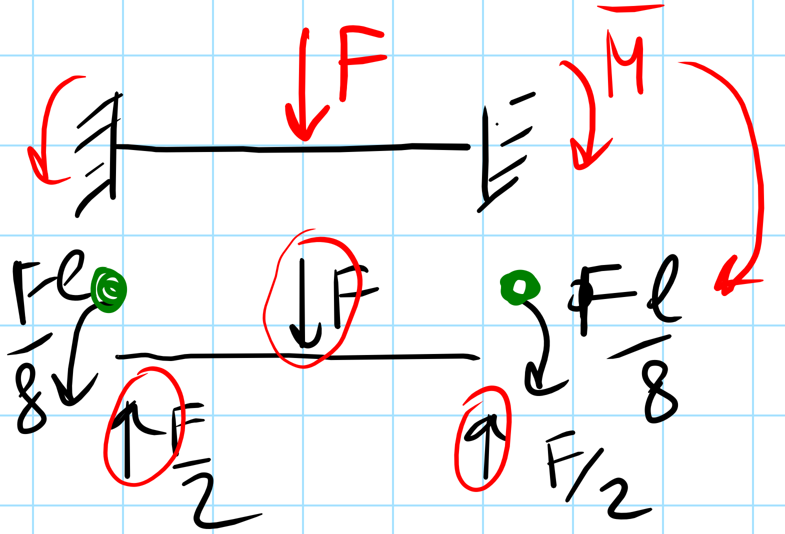
$\frac{q\ell^2}{8}$

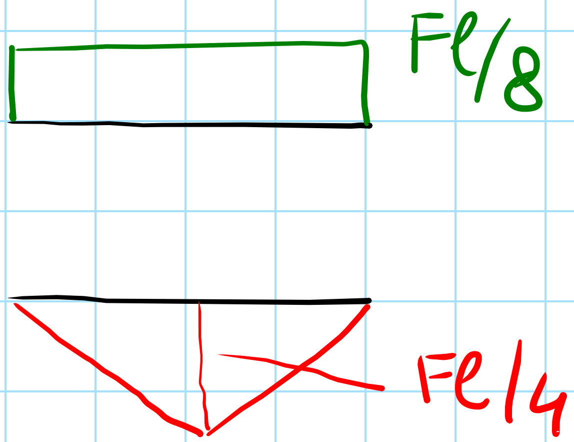


Q

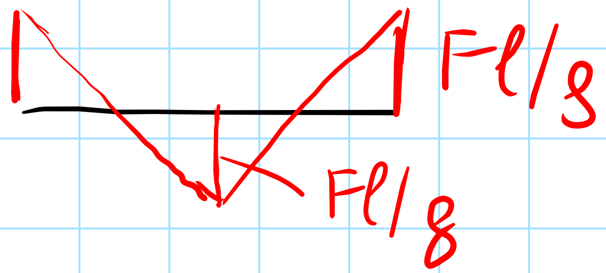

q
$\bar{M} = \frac{1}{8} q l^2$
M
M_{max}
$\frac{5}{8} q l$
+
−
$\frac{3}{8} q l$
Q

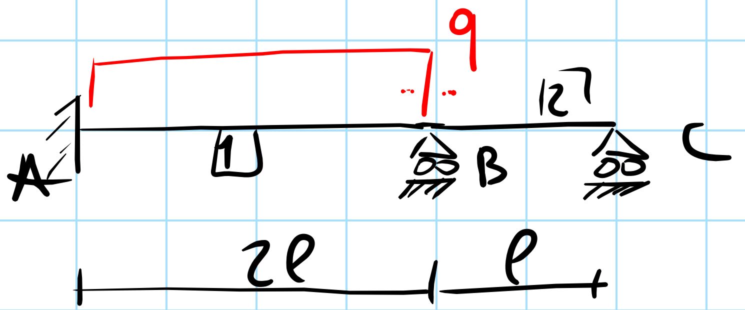

$\frac{1}{8} q l^2$
q
$q l/2$
$q l/2$
$\frac{1}{8} q l$
$\frac{1}{8} q l$
$\frac{5}{8} q l$
$\frac{3}{8} q l$


F
$\bar{M}$
$Fl/8$
F
$Fl/8$
$F/2$
$F/2$


$Fl/8$
$Fl/4$

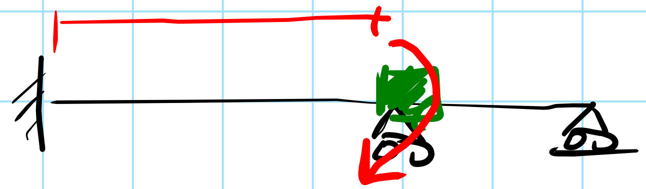
=


$Fl/8$
$Fl/8$

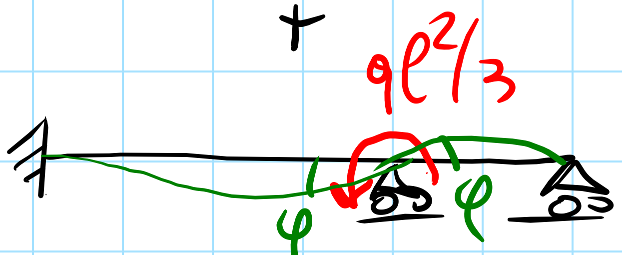


EJ : cost

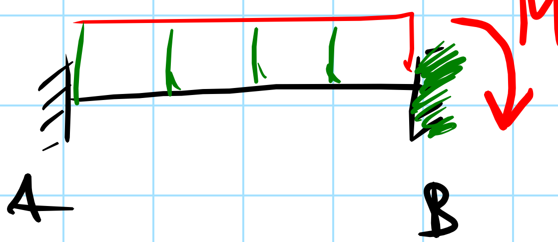
=



+



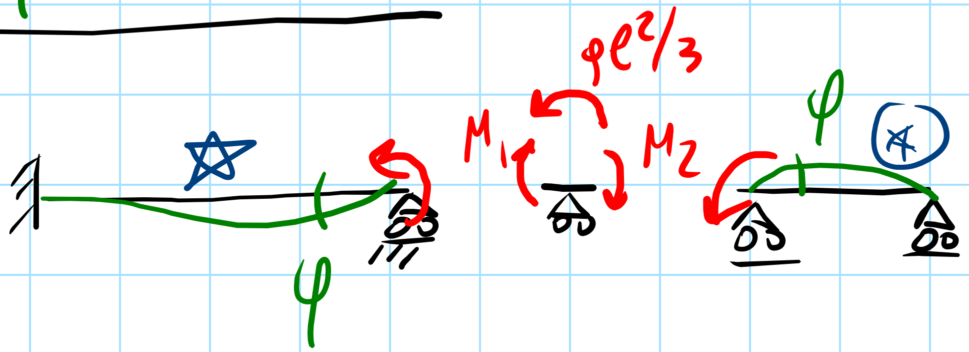
SCH I



$$\overline{M} = \frac{q(2\ell)^2}{12} = \frac{q\ell^2}{3}$$

SCH II

SCH II



$$M_1 = 4\frac{EJ}{2\ell}\varphi = 2R\varphi$$

$$M_2 = 3\frac{EJ}{\ell}\varphi = 3R\varphi$$

$$\varphi = \frac{q\ell^2/3}{5R}$$

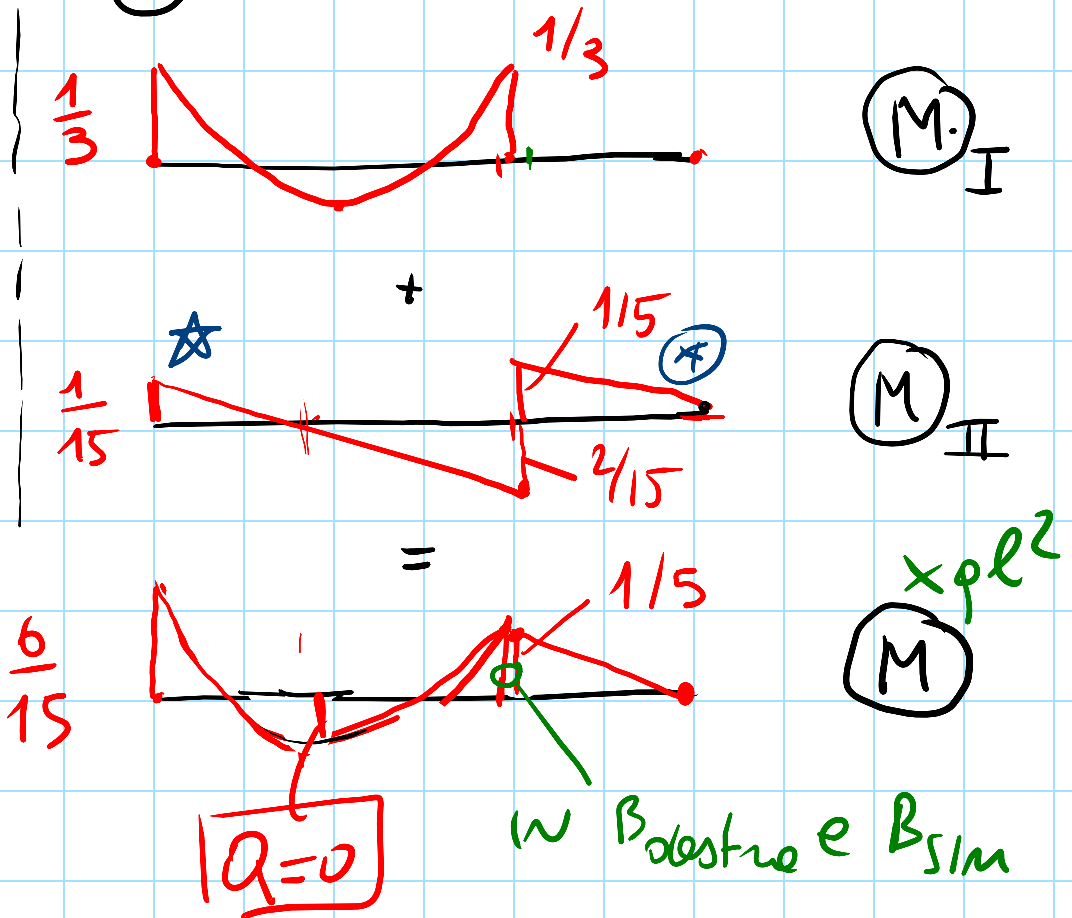
$$= \frac{2\cancel{R}}{5\cancel{R}}\frac{q\ell^2}{3} = \frac{2}{15}q\ell^2$$

$$= \frac{3}{5}\frac{q\ell^2}{3} = \frac{q\ell^2}{5}$$

$$\frac{1}{3}q\ell^2$$

subito posso disegnare

M TOTALE

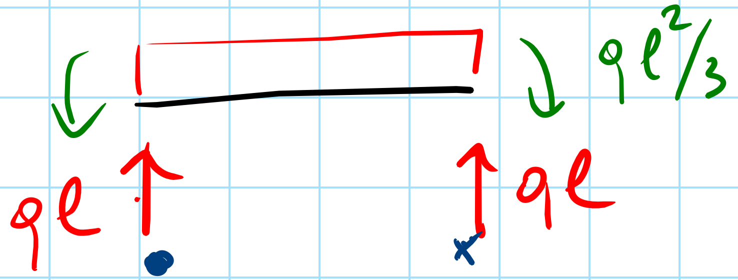


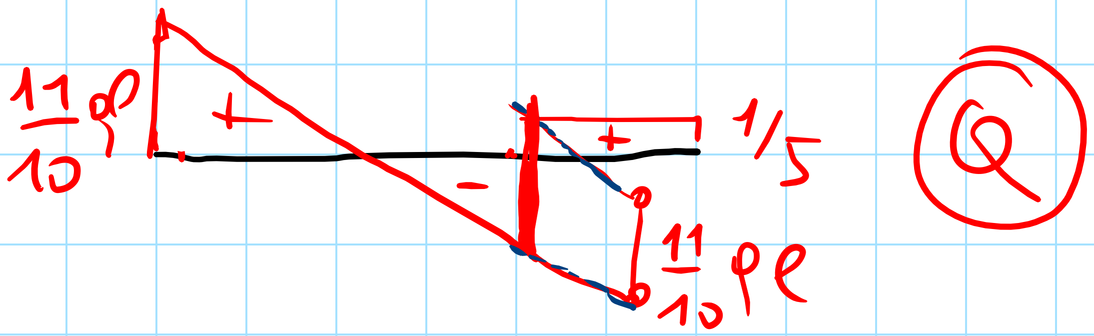
in B_{destra} e B_{SIN}

IL M è continuo

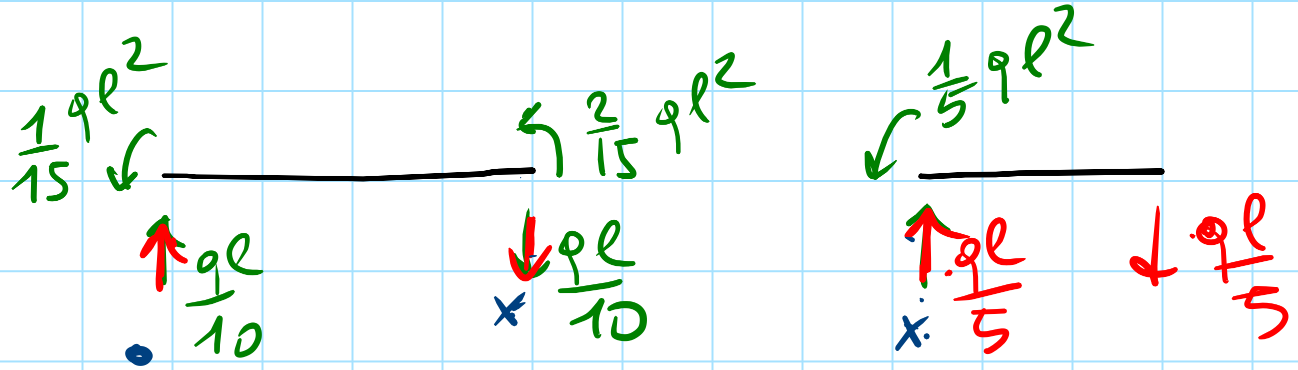
$$M_B = \frac{1}{5}q\ell^2$$

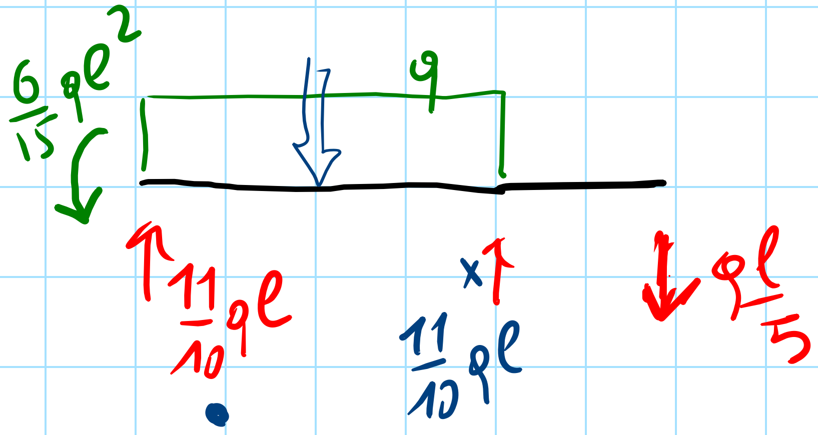
SCH I





SCH II





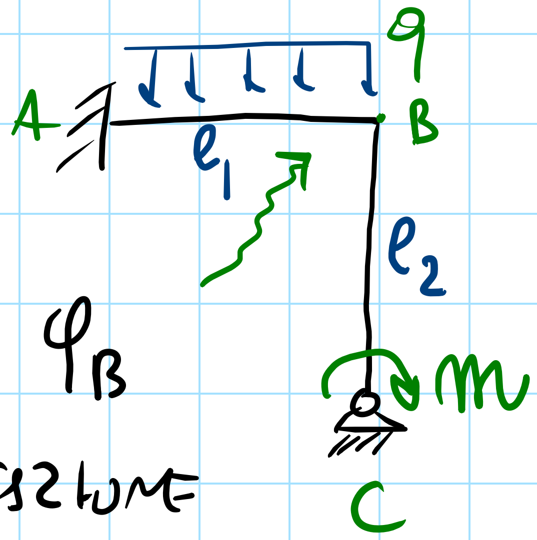
S.C.L. EQUIL

BILANCIO $\uparrow +$: $\Downarrow 2q\ell + \uparrow \underbrace{\frac{11}{10}q\ell \times 2}_{} - \frac{1}{5}q\ell$

$\downarrow \frac{20}{10} \quad \uparrow \frac{22}{10} \quad \downarrow \frac{2}{10}$ OK

BILANCIO $\overset{\curvearrowleft +}{M} = 0$? DA VERIFICARE

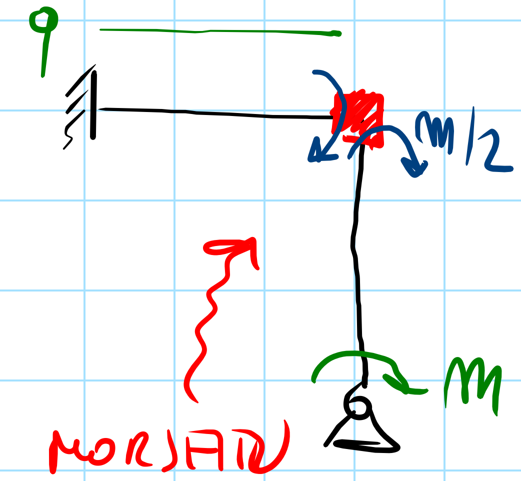
ES



METODO SPOST φ_B

È LA ROTAZIONE INCOGNITA

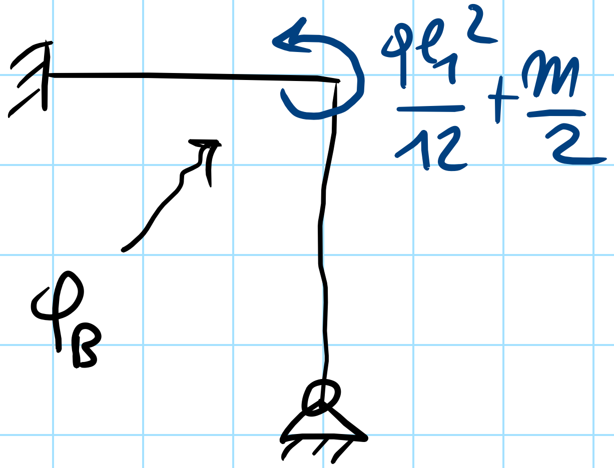
=



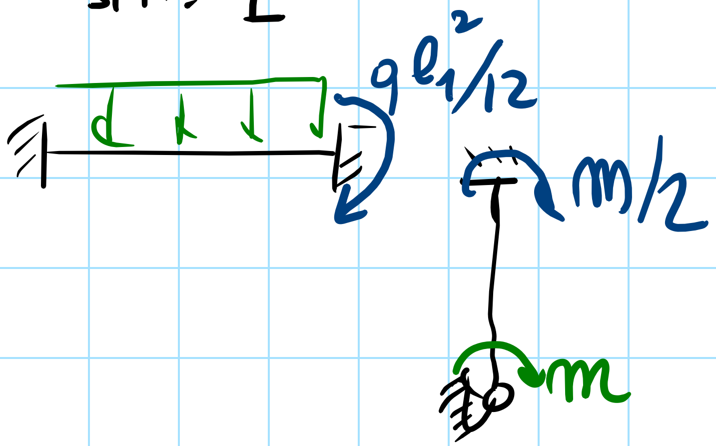
SCH. I

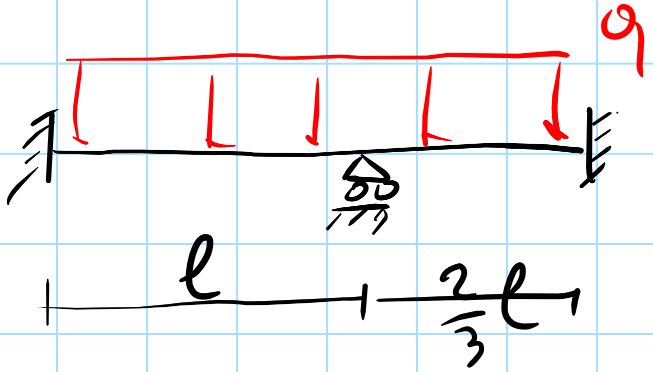
$\frac{q l_1^2}{12} + \frac{m}{2}$

+



SCH. II





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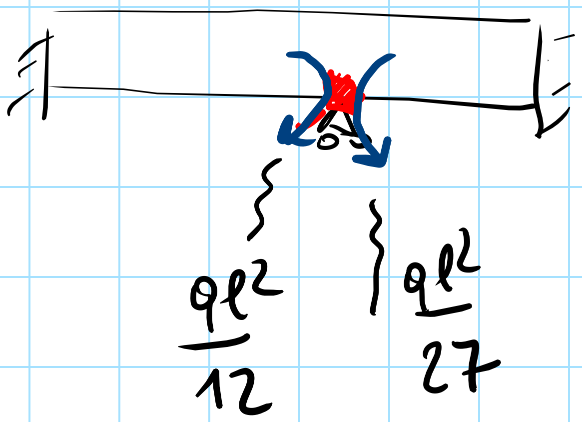
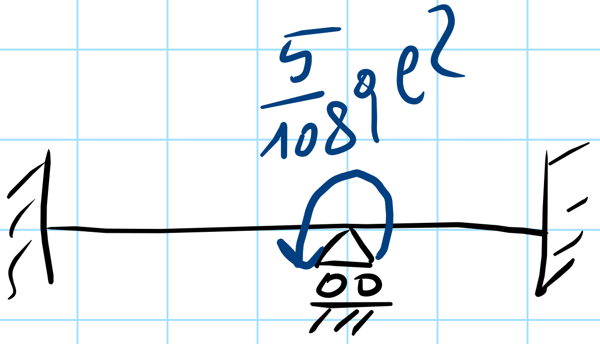


I

+

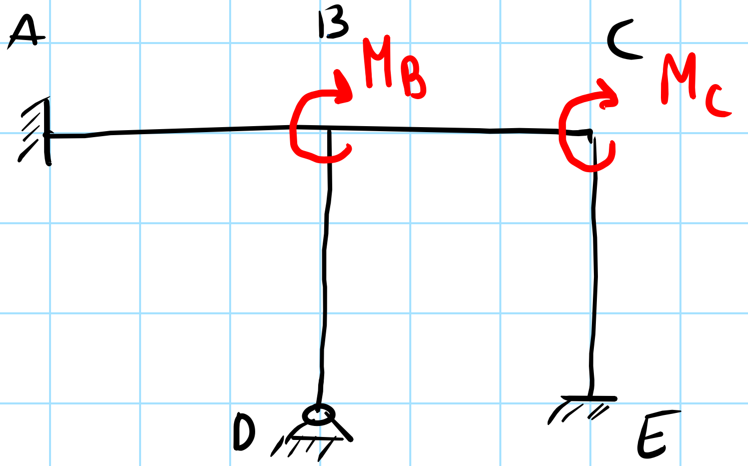


II

$\frac{4}{9} l^2 \frac{1}{12} q$

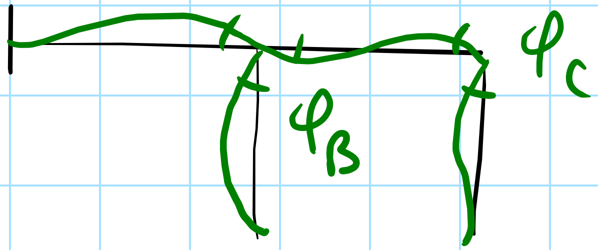
$\frac{1}{12} - \frac{1}{27} = \frac{9-4}{108} = \frac{5}{108} q l^2$

RIPARTIZ. DI MOMENTI NODALI IN TELAI A NODI FISSI (2 o PIÙ GDL)

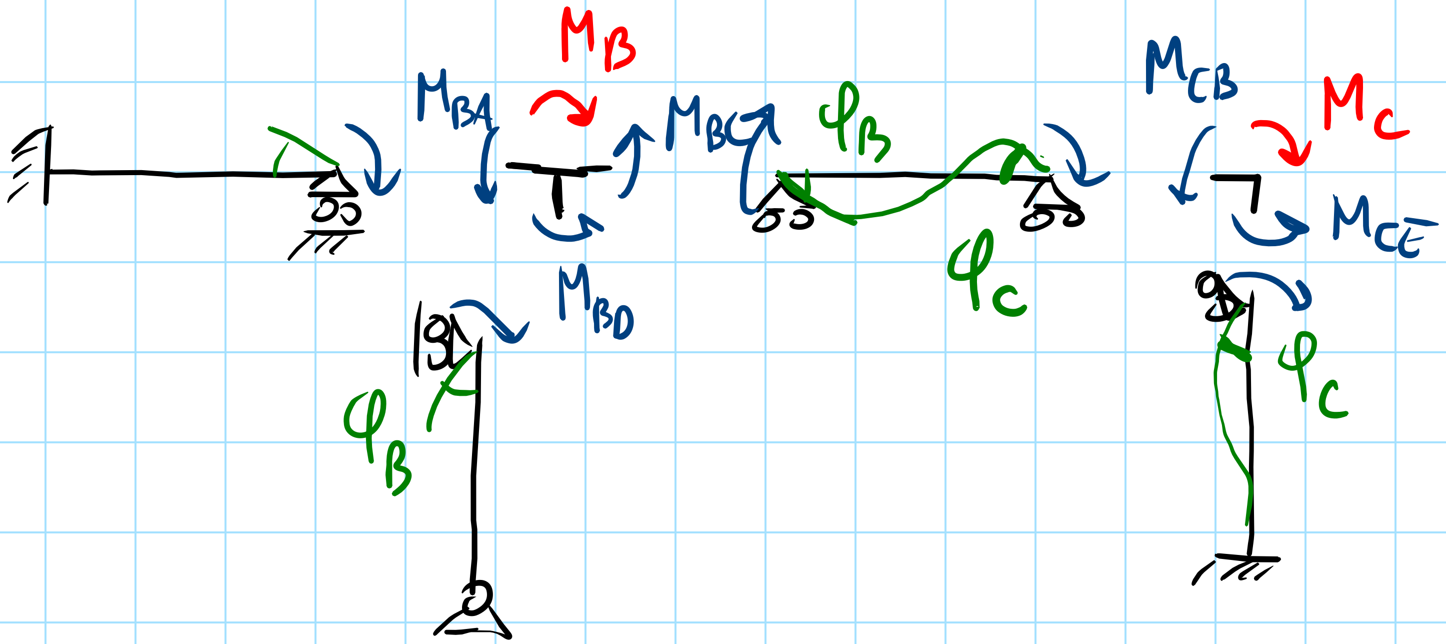


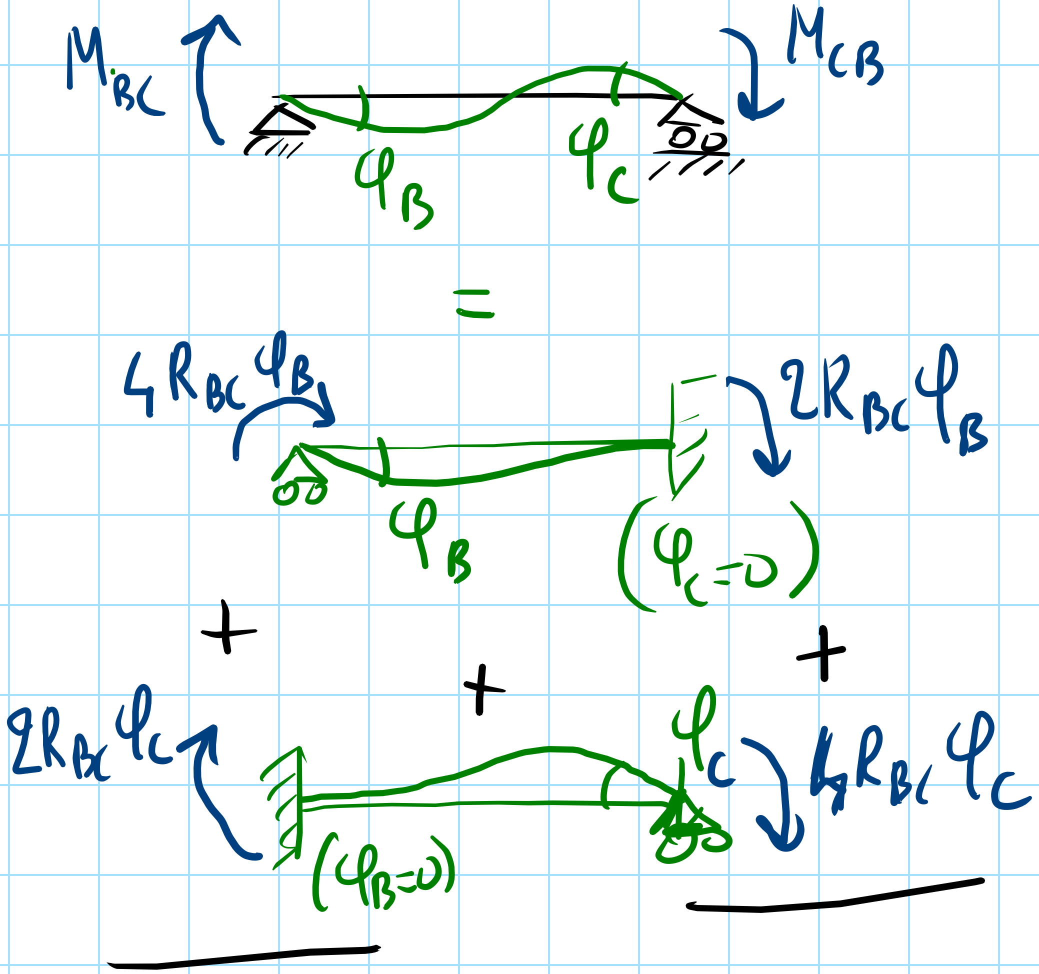
B, C: NODI FISSI, GDL φ_B, φ_C ↻+

INCOGNITE (2)



2 EQ DI EQUIL.
$$\begin{cases} M_B - M_{BA} - M_{BD} - M_{BC} = 0 \\ M_C - M_{CB} - M_{CE} = 0 \end{cases}$$





IMPONGO φ_B CON $\varphi_C = 0$

$M_{BA} = 4R_{BA}\varphi_B$

$M_{BD} = 3R_{BD}\varphi_B$

$M_{CE} = 4R_{CE}\varphi_C$

$M_{BC} = 4R_{BC}\varphi_B + 2R_{BC}\varphi_C$

$M_{CB} = 2R_{BC}\varphi_B + 4R_{BC}\varphi_C$

(*)

$$\begin{cases} M_B = 4R_{AB}\varphi_B + 4R_{BC}\varphi_B + \underbrace{2R_{BC}}\varphi_C + 3R_{BD}\varphi_B \\ M_C = 4R_{BC}\varphi_C + \underbrace{2R_{BC}}\varphi_B + 4R_{CE}\varphi_C \end{cases}$$

$$\begin{cases} M_B = \overbrace{(4R_{AB}+4R_{BC}+3R_{BD})}^{K_{BB}}\varphi_B + \overbrace{2R_{BC}}^{K_{BC}}\varphi_C \\ M_C = \underbrace{2R_{BC}}_{K_{CB}}\varphi_B + \underbrace{(4R_{BC}+4R_{CE})}_{K_{CC}}\varphi_C \end{cases}$$

NOTI

INCOGNITE

$$\begin{bmatrix} K_{BB} & K_{BC} \\ K_{CB} & K_{CC} \end{bmatrix} \begin{bmatrix} \varphi_B \\ \varphi_C \end{bmatrix} = \begin{bmatrix} M_B \\ M_C \end{bmatrix} \longrightarrow \begin{bmatrix} \varphi_B \\ \varphi_C \end{bmatrix} = [K]^{-1} \begin{bmatrix} M_B \\ M_C \end{bmatrix}$$

SOLUZ. UNICA

$[K]$: MATRICE DI RIGIDEZZA

TERMINI NOTI

PROPRIETA' MATRICE DI RIGIDEZZA:

- QUADRATA (ORDINE n: n° DI GDL)
- SIMMETRICA (SI DIMOSTRA INVOCANDO L'ESIST. DI ENERGIA ELASTICA)
- DEFINITA POSITIVA (e QUINDI $\exists$ L'INVERSA)

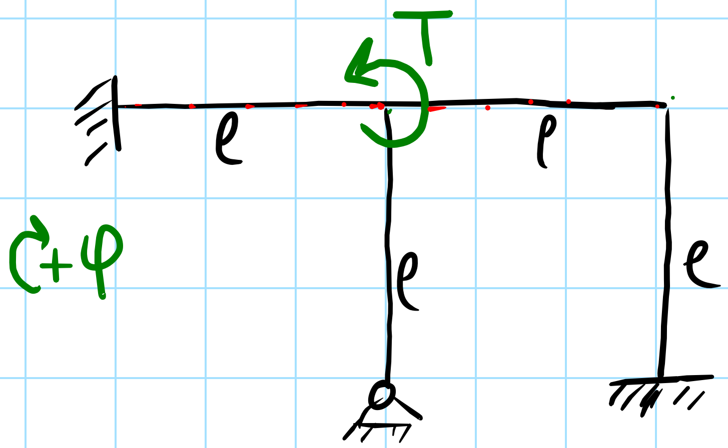
$\underset{\sim}{A}$ è DEF. POSITIVO:

$\underset{\sim}{A}\,\underline{v}\cdot\underline{v} > 0$ se $\underline{v} \neq \underline{0}$

$\underset{\sim}{A}\,\underline{v}\cdot\underline{v} = 0$ SSE $\underline{v} = \underline{0}$

$[K]$ è L'INV. DELLA MATRICE $[H]$ (DELLE CEDEVOLEZZE) DEL METODO DELLE FORZE

DOPO AVER TROVATO LA SOLUZ. φ_B, φ_C, TORNO ALLE EQ (*) E CALCOLO I MOMENTI NELLE VARIE TRAVI ⟶ DIAGRAMMI, S.C.L. EQUIL. ECC.



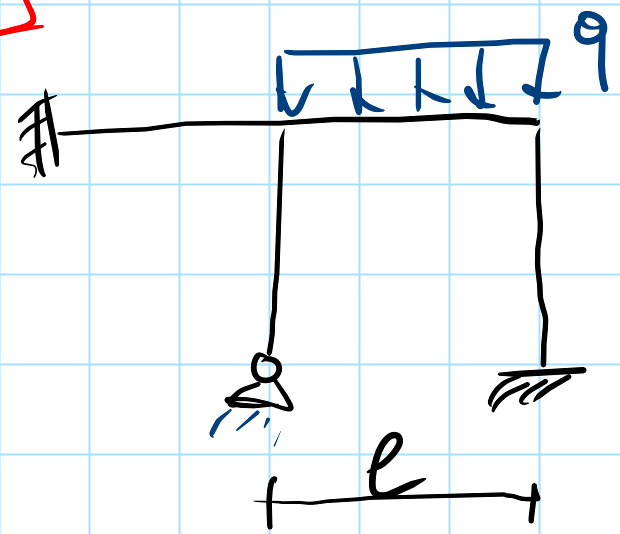
$\frac{EJ}{\ell} = R$: cost

$$[K] \begin{bmatrix} \varphi_B \\ \varphi_C \end{bmatrix} = \begin{bmatrix} -T \\ 0 \end{bmatrix}$$

[K] è INDIP. DAL VETTORE DEI TERMINI NOTI

$$[K] = \begin{bmatrix} 11R & 2R \\ 2R & 8R \end{bmatrix}$$

ES



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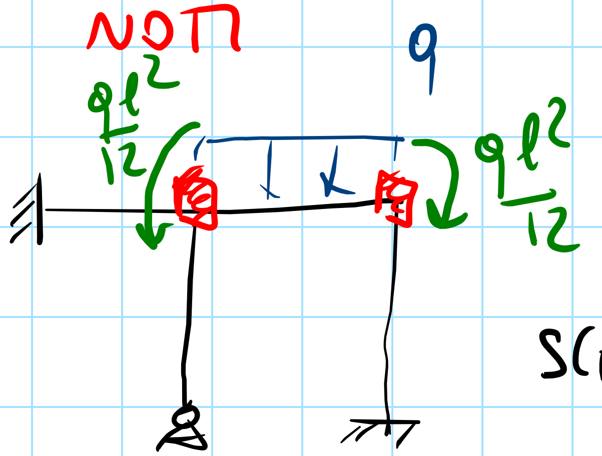

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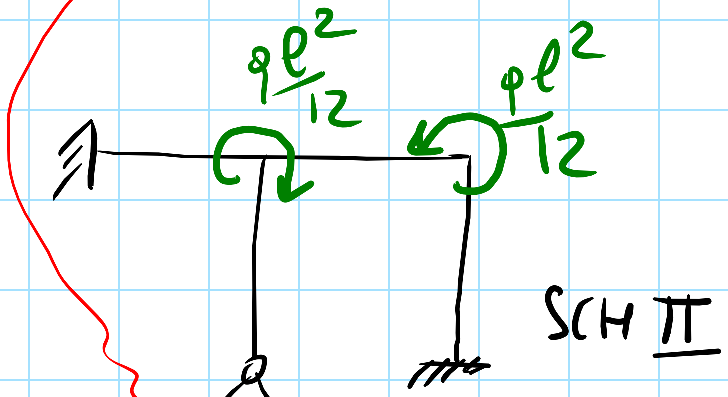
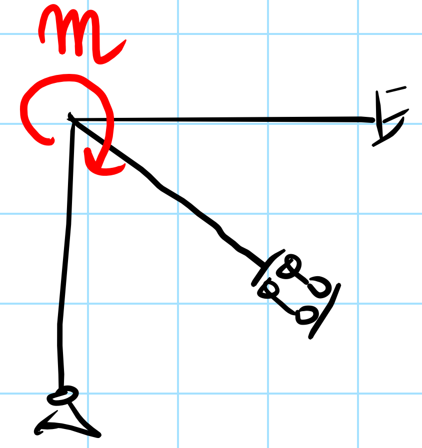
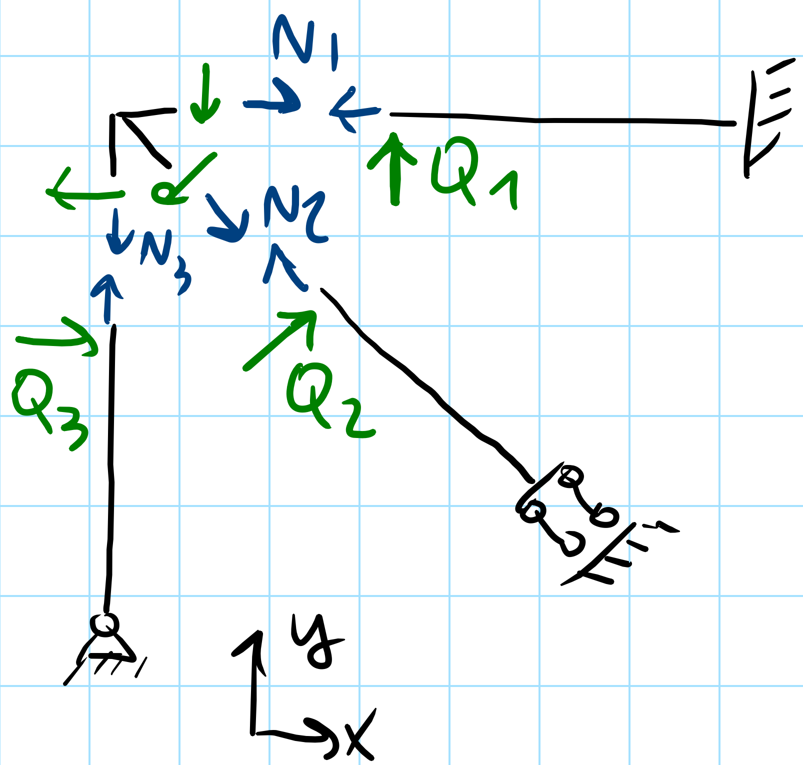


$$[K] \begin{bmatrix} \varphi_B \\ \varphi_C \end{bmatrix} = \begin{bmatrix} +q\ell^2/12 \\ -q\ell^2/12 \end{bmatrix}$$

NOTA SUL BILANCIO DELLE FORZE NEI NODI DI UN TELAIO





DOPO AVER RIPARTITO $\mathcal{M}$ NELLE VARIE TRAVI, È NECESSARIO CALCOLARE N e Q DELLE STESSE.

I TAGLI NELLE TRAVI LI POSSO CALCOLARE (Q_i)

APPLICATI AL NODO, I TAGLI Q_i SONO BILANCIATI DALLE FORZE NORMALI N_i

$$\begin{cases} \sum_i Q_{ix} + \sum_i N_{ix} = 0 \\ \sum_i Q_{iy} + \sum_i N_{iy} = 0 \end{cases}$$

2 EQ DI BILANCIO

SIST. PER N_i