TECNICA DELLE COSTRUZIONI

TEMA ESAME DEL 15 APRILE 2019

DOCENTI:
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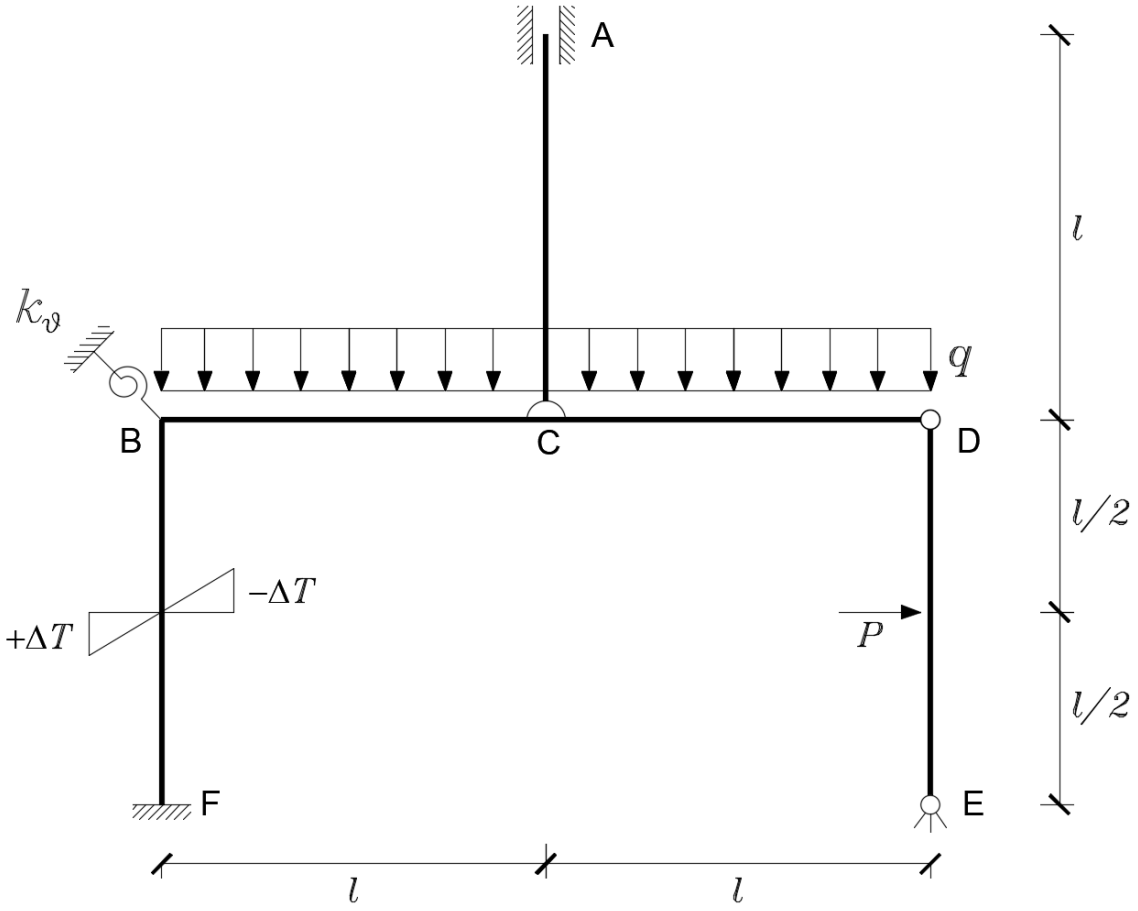
ESERCITATORI:
ING. FRANCESCA FEROLDI

DURATA: **2 ORE.**

Esercizio



$$k_\vartheta = \frac{1}{2}\frac{EJ}{l} \qquad \frac{\alpha \Delta T}{H} = \frac{1}{4}\frac{ql^2}{EJ}$$

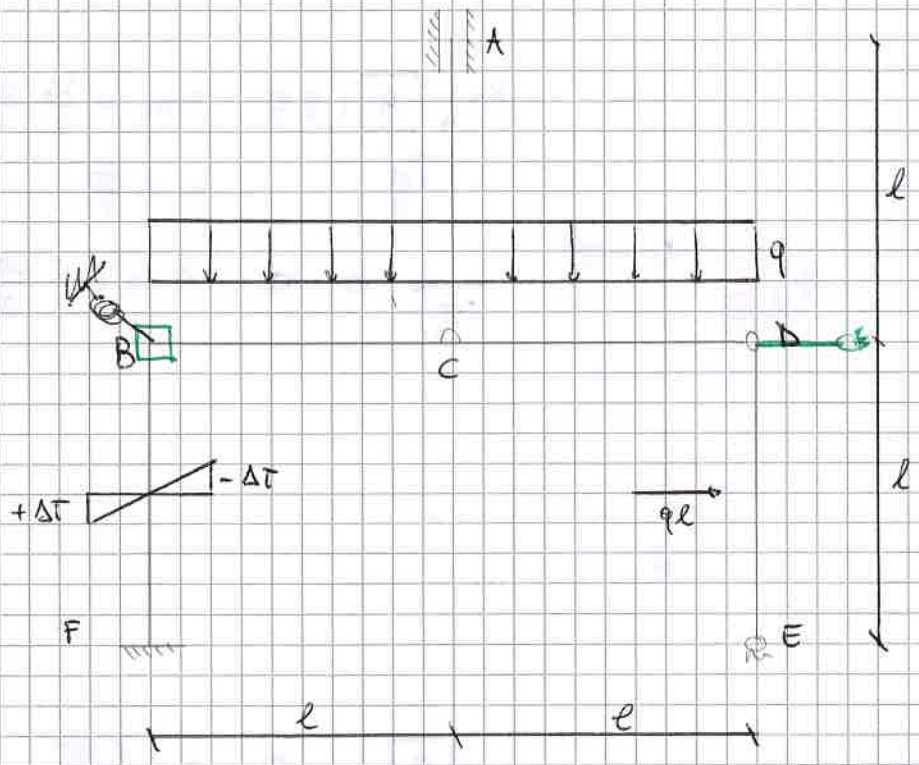
$$P = ql$$

Dato il telaio in figura, **si richiedono i grafici di:**

1. Momento flettente (con il valore e la posizione dei massimi);
2. Taglio;
3. Azione assiale;
4. Deformata qualitativa con posizione dei flessi.

I grafici possono essere realizzati in matita, mentre i calcoli necessari per lo sviluppo del tema devono essere in tratto non cancellabile. Il tutto deve essere riportato chiaramente.

TELAIO TECNICA DELLE COSTRUZIONI 15/04/2019



$$k_\vartheta = \frac{1}{2}\,\frac{EJ}{\ell}$$

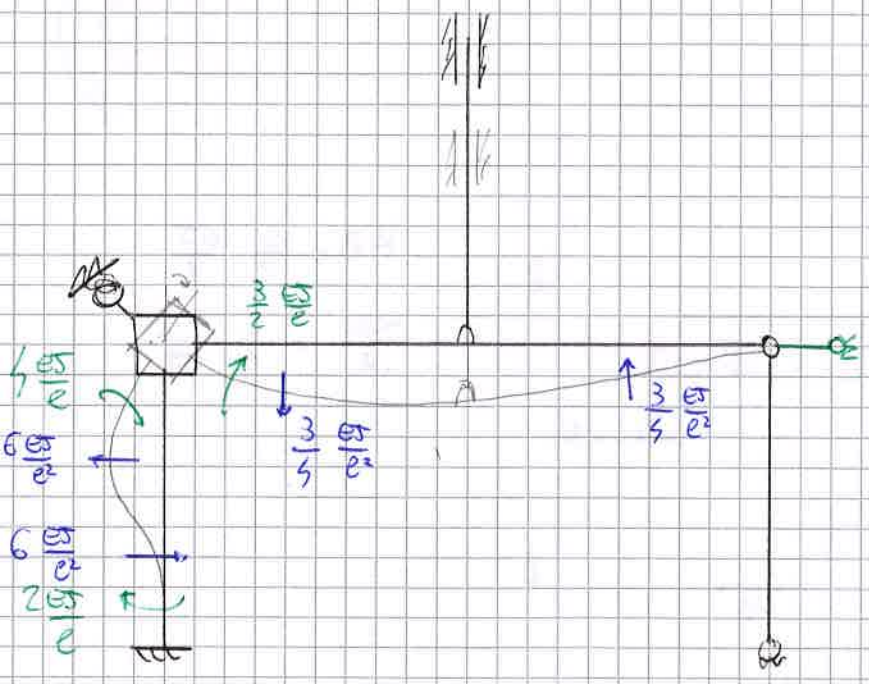
$$\frac{2\Delta T}{t} = \frac{1}{3}\,\frac{q\ell^2}{EJ}$$

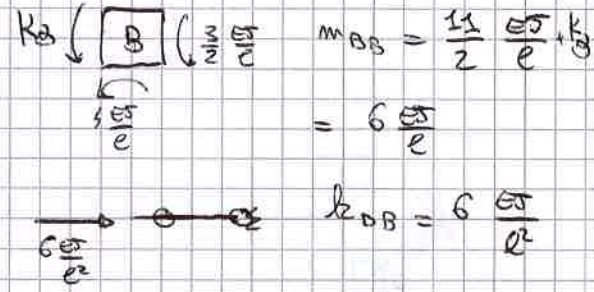
Convenzioni di segno

Telaio a nodi spostabili: biella fittizia in D e nodo in B.
Sistema risolvente

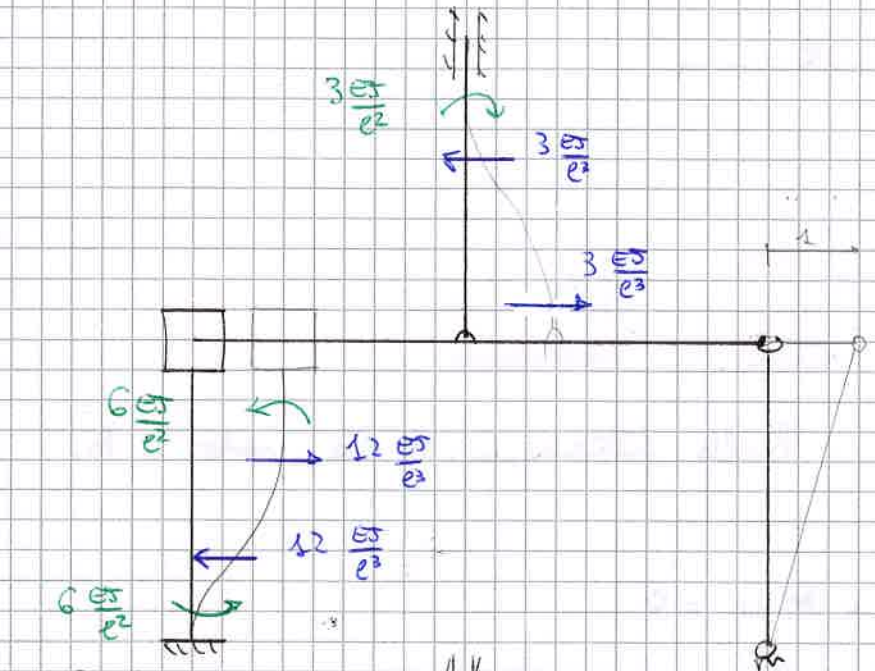
$$\begin{cases} m_{BB}\,\ell_B + m_{B\Delta}\,\mathcal{M}_\Delta + m_{B0} = 0 \\ k_{\Delta B}\,\ell_B + k_{\Delta\Delta}\,\mathcal{M}_\Delta + k_{\Delta 0} = 0 \end{cases}$$

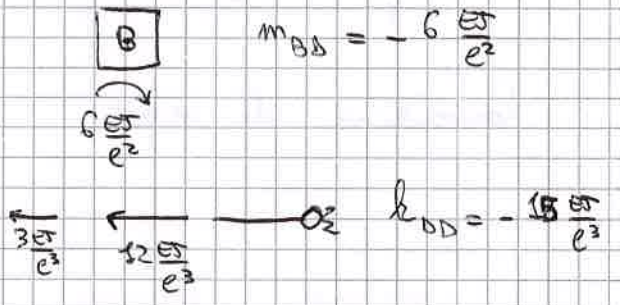
- rotazione $\varphi_B = 1$, resto $= 0$



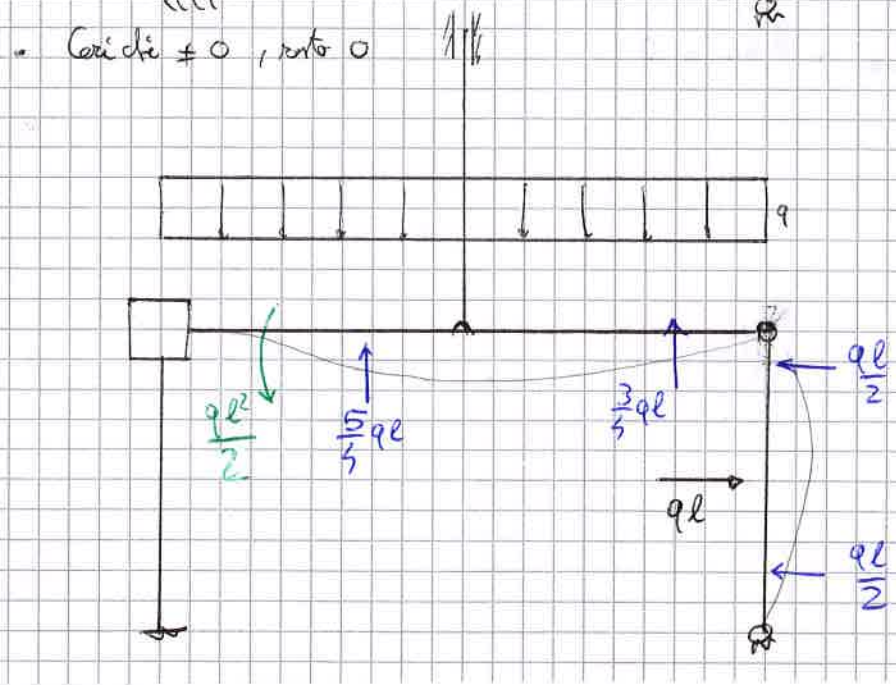


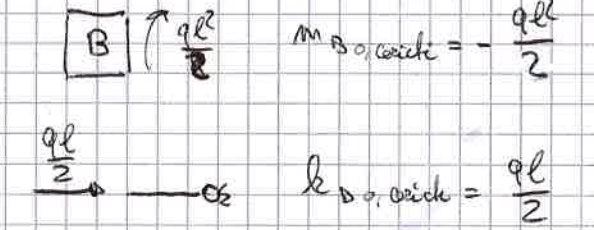
- $M_D = 1$, resto $= 0$



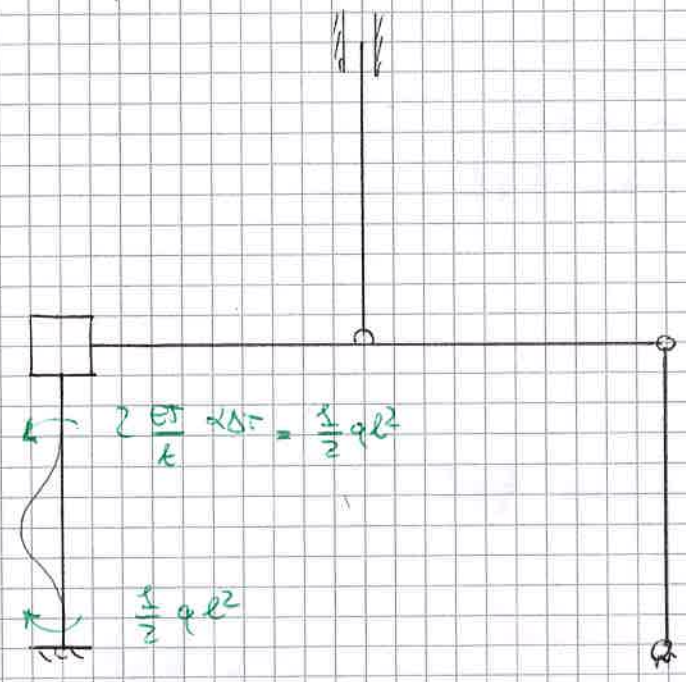


- Carichi $\neq 0$, resto 0





- $\Delta T \neq 0$, reste $= 0$



$$\textcircled{1}\ 6\frac{EJ}{\ell}\varphi_B - 6\frac{EJ}{\ell^2}M_D - \frac{q\ell^2}{2} - \frac{q\ell^2}{2} = 0$$

$$\textcircled{2}\ 6\frac{EJ}{\ell^2}\varphi_B - 15\frac{EJ}{\ell^3}M_D + \frac{q\ell}{2} = 0$$

$$\textcircled{1}\quad \varphi_B = \frac{\ell}{6EJ}\left[6\frac{EJ}{\ell^2}M_D + q\ell^2\right]$$

$$\textcircled{2}\quad 6\frac{EJ}{\ell^2}\cdot\frac{\ell}{6EJ}\left[6\frac{EJ}{\ell^2}M_D + q\ell^2\right] - 15\frac{EJ}{\ell^3}M_D + \frac{q\ell}{2} = 0$$

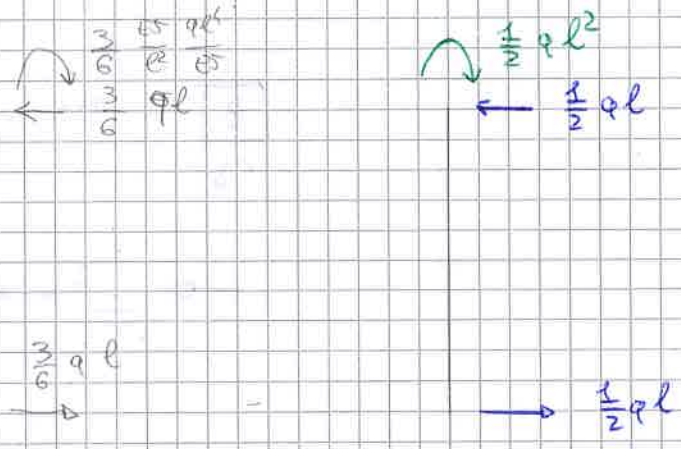
$$6\frac{EJ}{\ell^3}M_D + q\ell - 15\frac{EJ}{\ell^3}M_D + \frac{q\ell}{2} = 0$$

$$9\frac{EJ}{\ell^3}M_D = \frac{3}{2}q\ell \qquad \boxed{M_D = \frac{1}{6}\frac{q\ell^4}{EJ}}$$

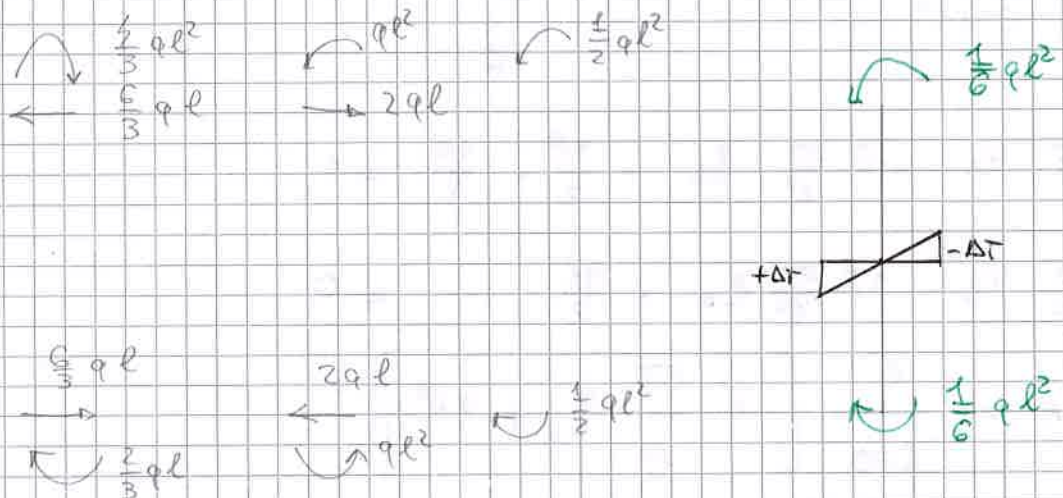
$$\textcircled{1}\quad \varphi_B = \frac{\ell}{6EJ}\left[6\frac{EJ}{\ell^2}\cdot\frac{1}{6}\frac{q\ell^4}{EJ} + q\ell^2\right] = \frac{1}{3}\frac{q\ell^3}{EJ}$$

$$\boxed{\varphi_B = \frac{1}{3}\frac{q\ell^3}{EJ}}$$

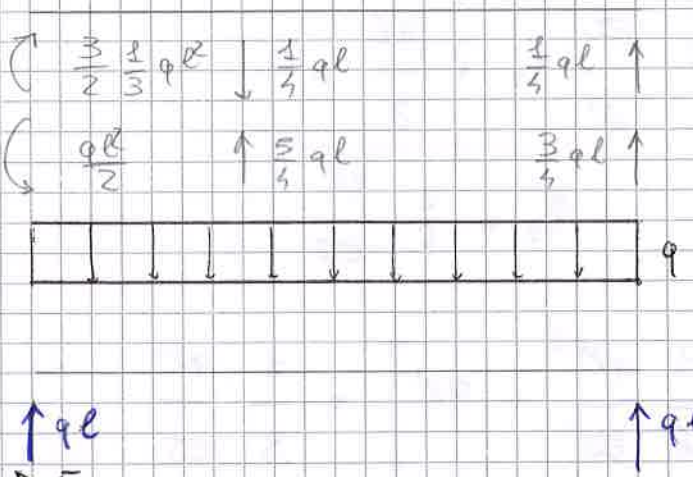
Asta AD



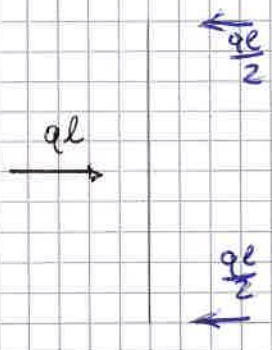
Asta BF

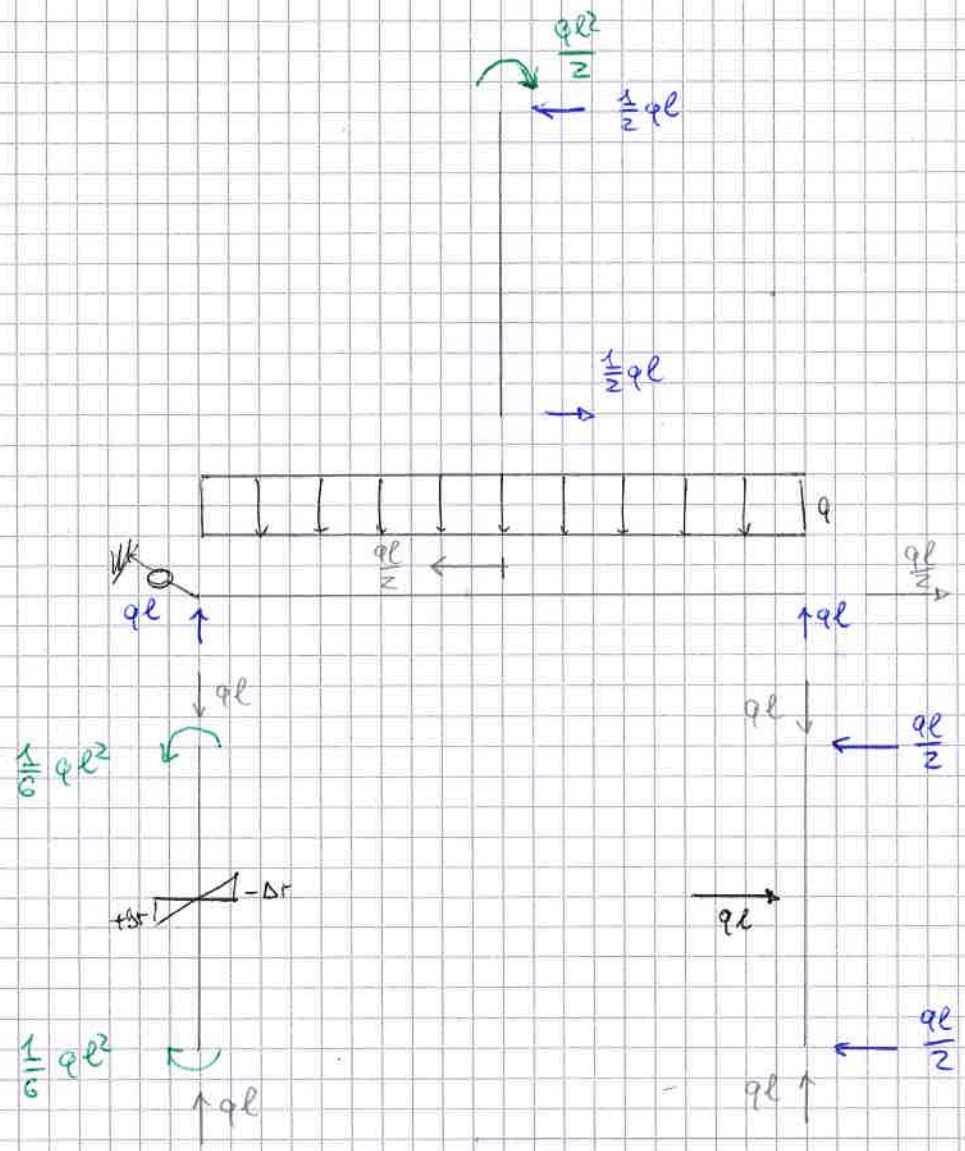


Asta BD



Asta DE





Cantello

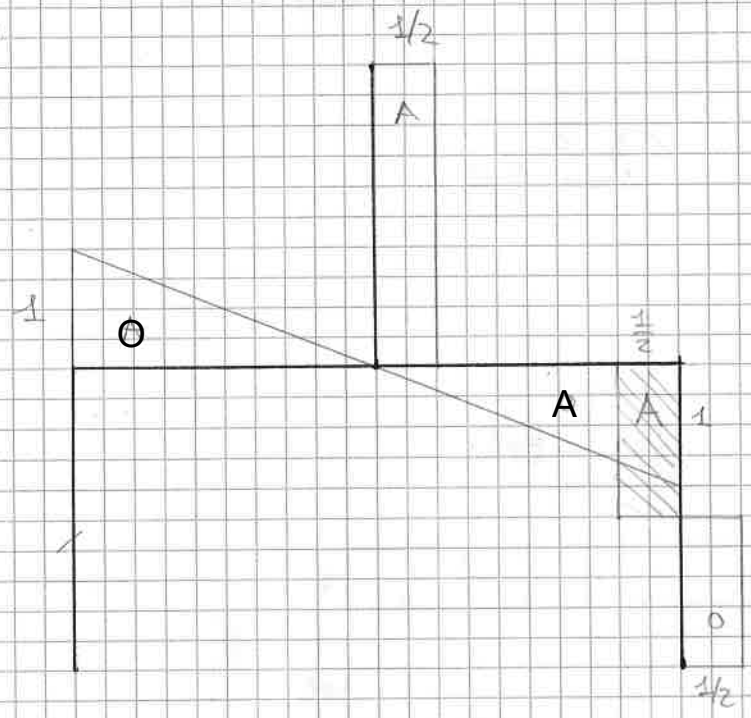
$\Sigma_V = 0 \qquad ql + ql - 2ql = 0 \qquad$ OK!

$\Sigma_H = 0 \qquad \frac{ql}{2} + \frac{ql}{2} - ql = 0 \qquad$ OK!

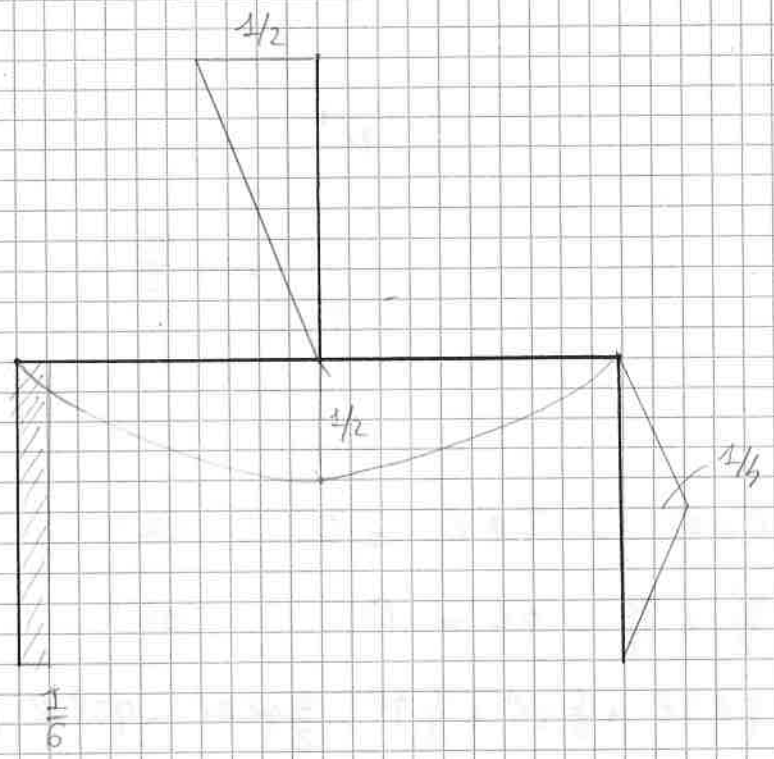
$\Sigma_{H(E)} = 0 \qquad ql\,2l + \frac{1}{6}ql^2 + \frac{1}{2}ql^2 - \frac{1}{2}ql\,2l - q2l\,l + ql\frac{l}{2} - \frac{1}{2}\frac{EJ}{l}\frac{1}{3}\frac{ql^3}{EJ} =$

$= 0$

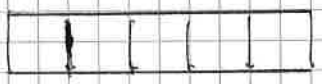
V [ql]



M [ql²]

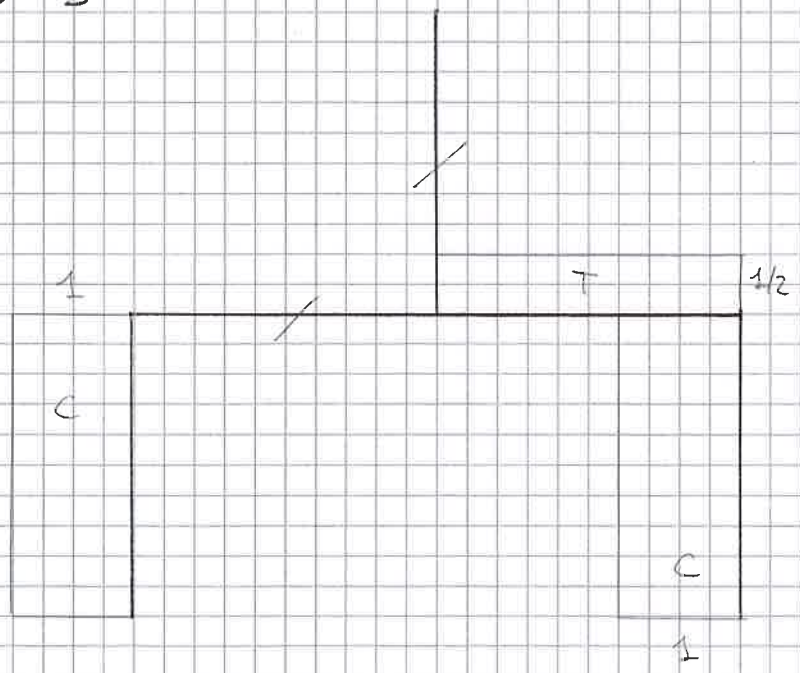


Osta BC

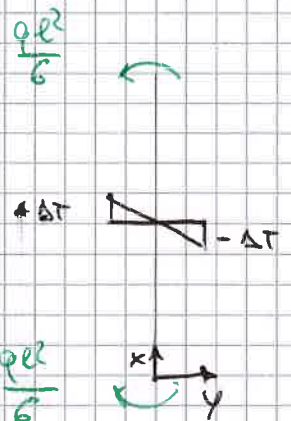


$M_{max} = qll - ql\frac{l}{2} = \frac{1}{2}ql^2$

N [ql]



Stadio deformato Termica



$$v'' = -\frac{N(x)}{EA} + 2\frac{\alpha\Delta T}{h} =$$

$$= -\frac{ql}{6} + 2\frac{1}{4}ql^2 =$$

$$= \frac{1}{3} \geq 0 \quad \forall x$$

DEFORMATA