

TECNICA DELLE COSTRUZIONI

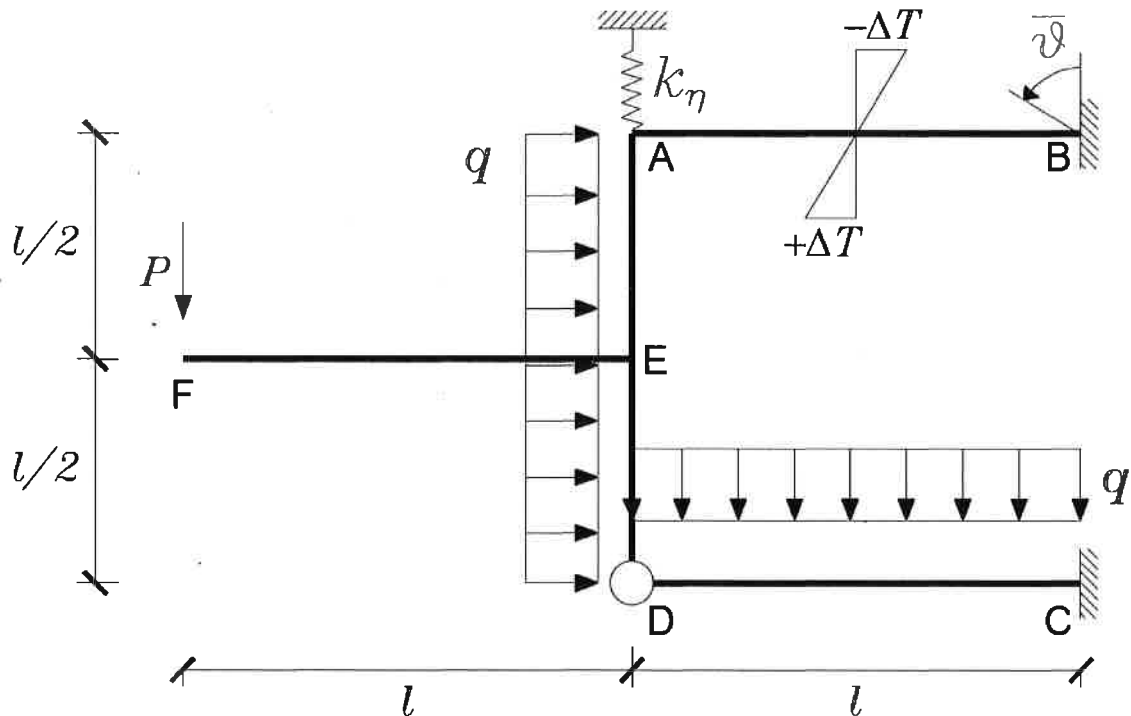
TEMA ESAME DEL 01 LUGLIO 2019

DOCENTI:

PROF. GIOVANNI A. PLIZZARI

DURATA: 2 ORE.

Esercizio



$$k_{\eta} = \frac{33 EJ}{8 l^3}$$

$$\frac{\alpha \Delta T}{h} = \frac{7 ql^2}{12 EJ}$$

$$P = ql$$

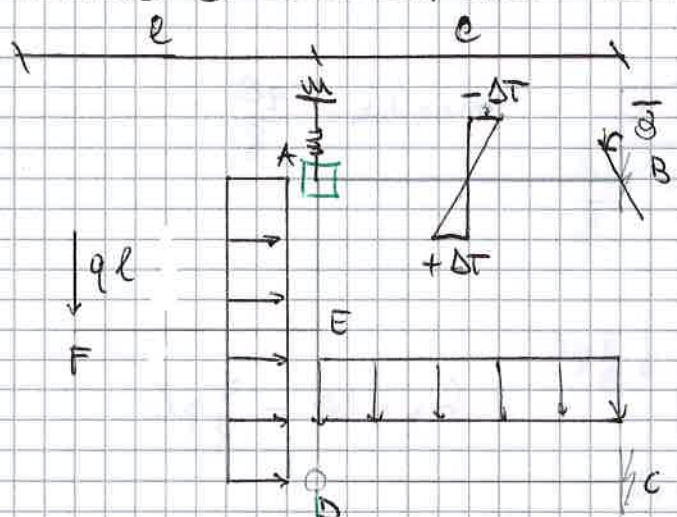
$$\bar{\vartheta} = \frac{ql^3}{EJ}$$

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.

Si assuma $EA \rightarrow \infty$, $EJ = \text{costante}$.

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.



$$\frac{\Delta \Delta T}{k} = \frac{7}{12} \frac{ql^2}{EI}$$

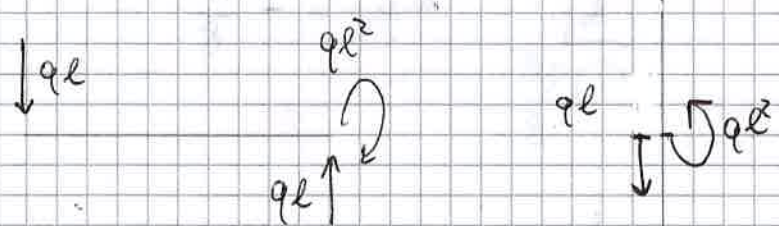
$$\theta = \frac{ql^2}{EI}$$

$$k_c = \frac{33}{8} \frac{EI}{e^3}$$

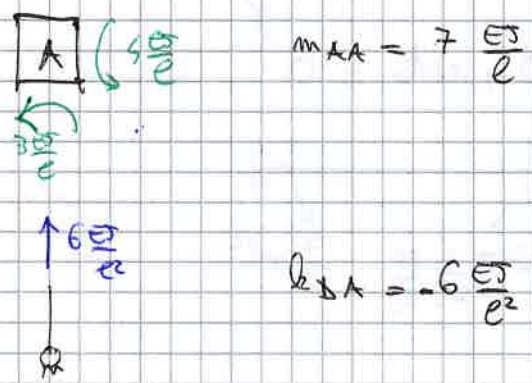
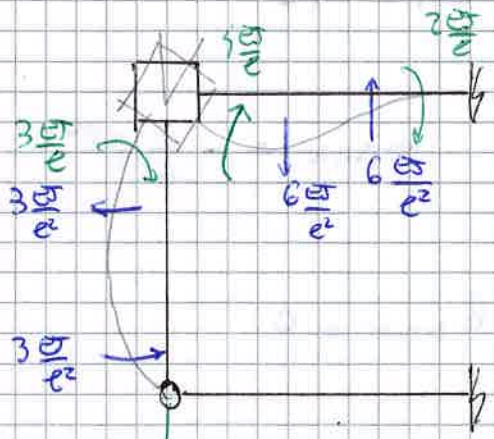


Struttura a nodi spostabili (in verticale). Rotazione in A e biella fittizia in D.

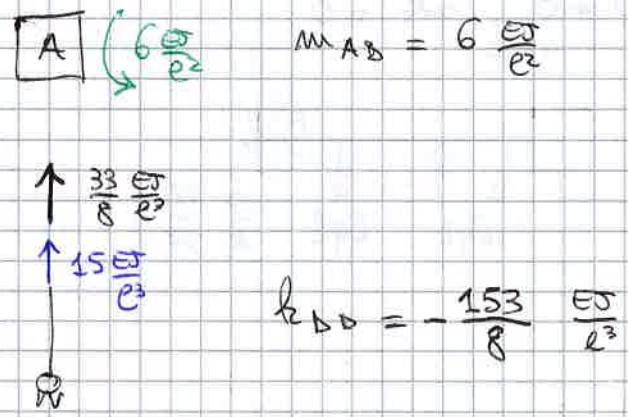
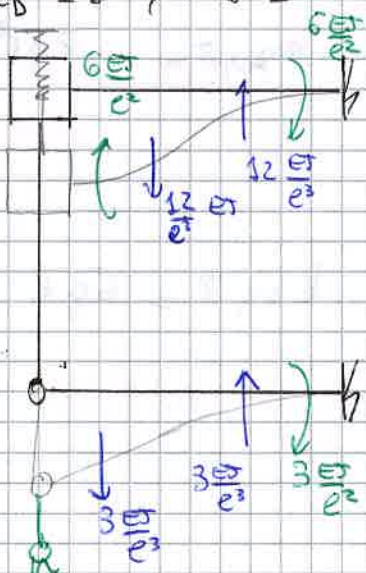
L'asta FE è un'appendice rotazionale

$$\begin{cases} m_{AA} \varphi_A + m_{AD} \theta_D + m_{AO} = 0 \\ k_{DA} \varphi_A + k_{DD} \theta_D + k_{DO} = 0 \end{cases}$$


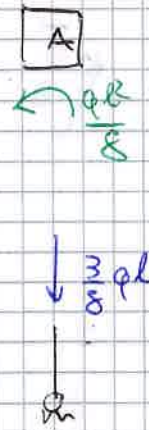
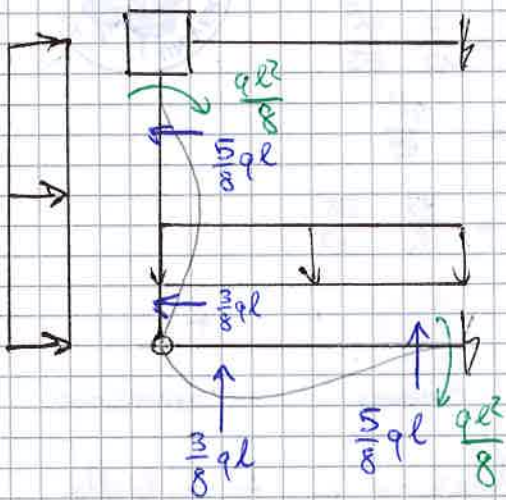
$\varphi_A = 1, \text{ resto} = 0$



$\theta_D = 1, \text{ resto} = 0$



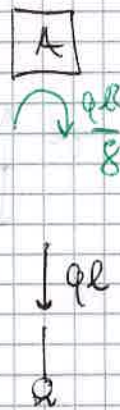
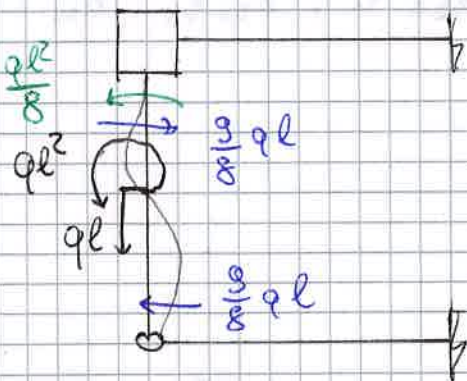
• Carichi distribuiti $\neq 0$, resto = 0



$$m_{A,0,distr} = \frac{ql^2}{8}$$

$$k_{D,0,distr} = \frac{3}{8} ql$$

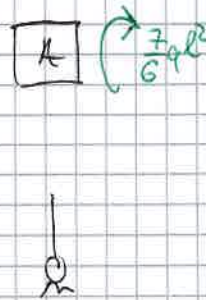
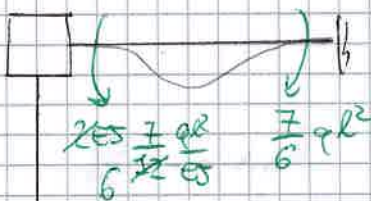
• Carichi concentrati $\neq 0$, resto = 0



$$m_{A,0,P} = -\frac{ql^2}{8}$$

$$k_{D,0,P} = ql$$

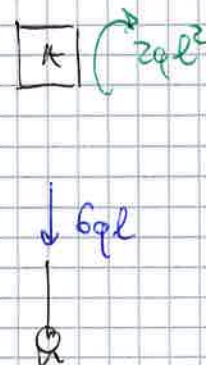
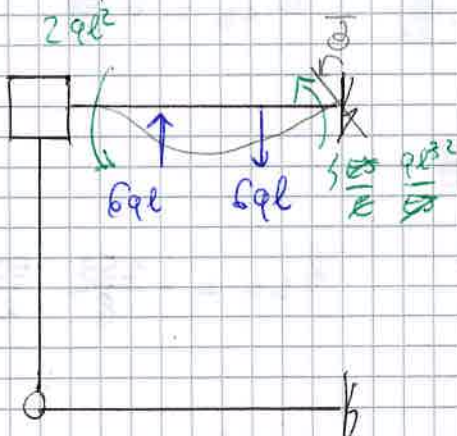
• $\Delta T \neq 0$, resto = 0



$$m_{A,0,\Delta T} = -\frac{7}{6} ql^2$$

$$k_{D,0,\Delta T} = 0$$

• $\bar{\delta} \neq 0$, resto = 0



$$m_{A,0,\bar{\delta}} = -2ql^2$$

$$k_{D,0,\bar{\delta}} = 6ql$$

$$\int 7 \frac{ES}{e} \varphi_A + 6 \frac{ES}{e} M_D + \frac{ql^2}{8} - \frac{ql^2}{8} - \frac{7}{6} ql^2 - 2 ql^2 = 0$$

$$\hookrightarrow -6 \frac{ES}{e^2} \varphi_A - \frac{153}{8} \frac{ES}{e^3} M_D + \frac{3}{8} ql + ql + 6ql = 0$$

$$\textcircled{1} \begin{cases} 7 \frac{ES}{e} \varphi_A + 6 \frac{ES}{e} M_D - \frac{19}{6} ql^2 = 0 \\ \textcircled{2} -6 \frac{ES}{e^2} \varphi_A - \frac{153}{8} \frac{ES}{e^3} M_D + \frac{53}{8} ql = 0 \end{cases}$$

$$\textcircled{2} \varphi_A = \frac{e^2}{6ES} \left[-\frac{153}{8} \frac{ES}{e^3} M_D + \frac{53}{8} ql \right]$$

$$\textcircled{1} 7 \frac{ES}{e} \frac{e^2}{6ES} \left[-\frac{153}{8} \frac{ES}{e^3} M_D + \frac{53}{8} ql \right] + 6 \frac{ES}{e} M_D - \frac{19}{6} ql^2 = 0$$

$$- \frac{357}{16} \frac{ES}{e^2} M_D + \frac{413}{58} ql^2 + 6 \frac{ES}{e} M_D - \frac{19}{6} ql^2 = 0$$

$$+ \frac{261}{16} \frac{ES}{e^2} M_D = \frac{87}{16} ql^2 \Rightarrow M_D = \frac{1}{3} \cdot \frac{ql^2}{ES}$$

$$\textcircled{2} \varphi_A = \frac{e^2}{6ES} \left[-\frac{153}{8} \frac{ES}{e^3} \frac{1}{3} \frac{ql^2}{ES} + \frac{53}{8} ql \right] = \frac{1}{6} \frac{ql^3}{ES}$$

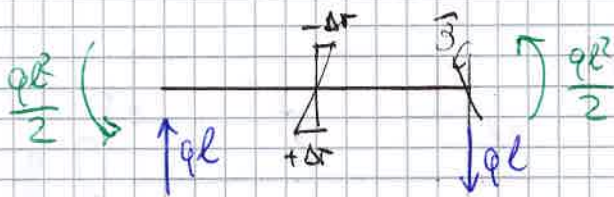
Quota AB

$$\left(\frac{1}{6} \frac{ql^2}{ES} \right) \downarrow ql \quad ql \uparrow \quad \left(\frac{2}{6} ql^2 \right)$$

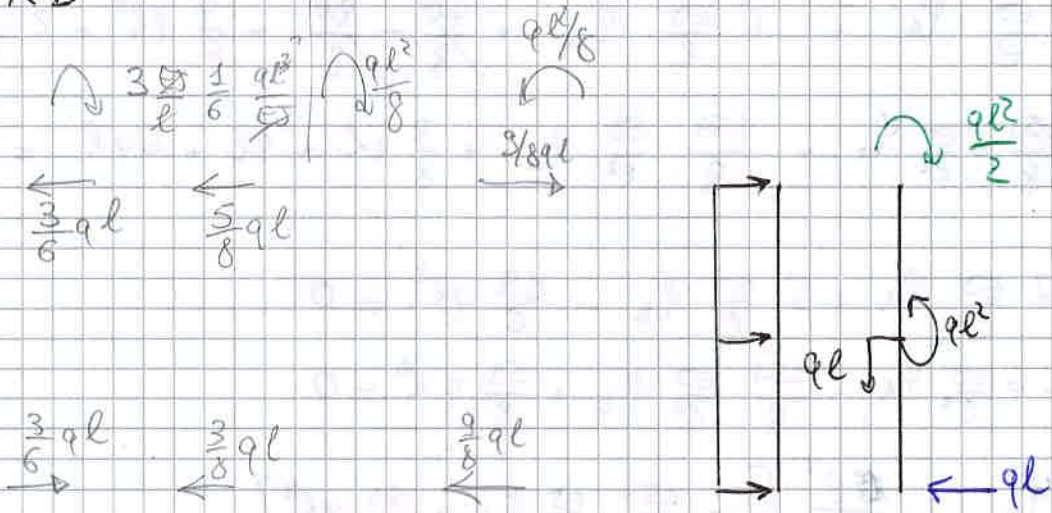
$$\left(\frac{6}{e^2} \frac{1}{3} \frac{ql^2}{ES} \right) \downarrow \frac{12}{3} ql \quad \frac{12}{3} ql \uparrow \quad \left(\frac{6}{3} ql^2 \right)$$

$$\left(\frac{7}{6} ql^2 \right) \quad \left(\frac{7}{6} ql^2 \right)$$

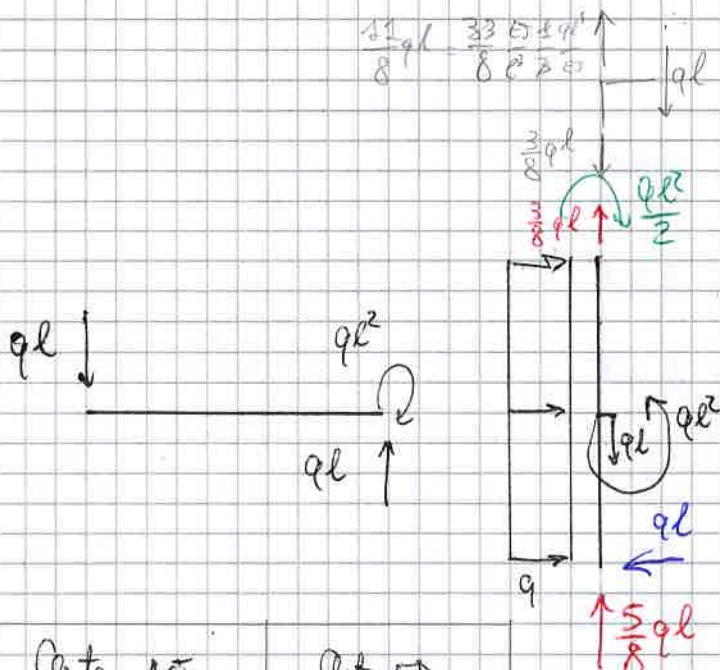
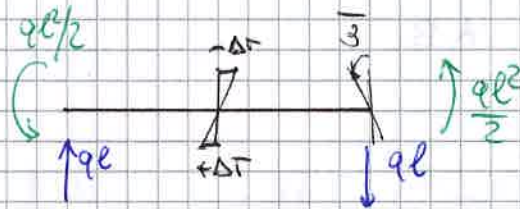
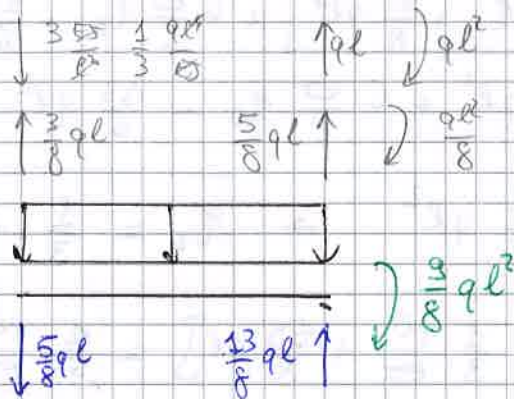
$$\left(2ql^2 \right) \uparrow 6ql \quad 6ql \downarrow \quad \left(4ql^2 \right)$$



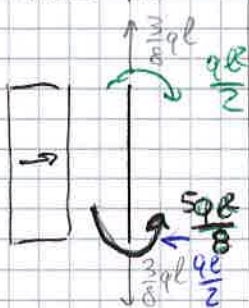
Arta AD



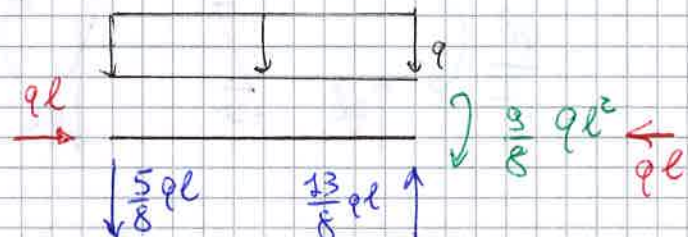
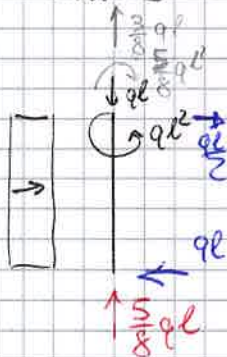
Arta DC



Arta AE



Arta ED

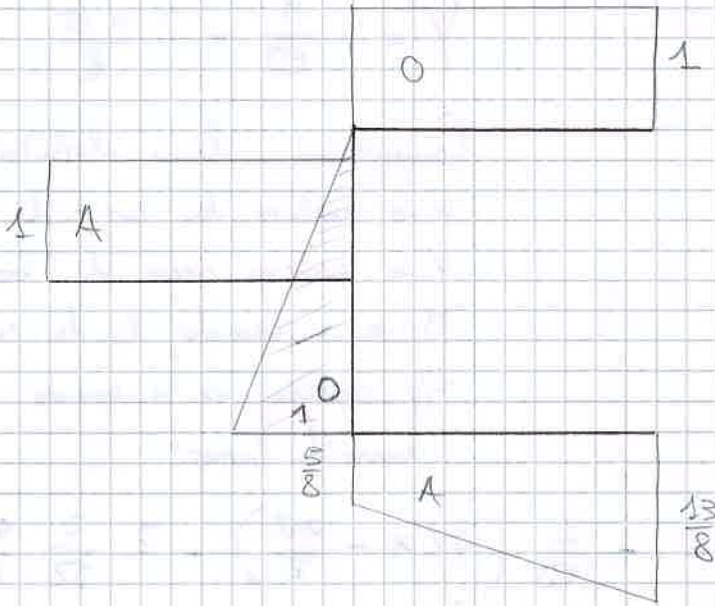


$$\begin{aligned} \sum V = 0 & \quad 1 - \frac{13}{8} + 1 + 1 - \frac{11}{8} = 0 \\ \sum H = 0 & \quad -ql + ql = 0 \\ \sum M(F) = 0 & \quad \frac{13}{8} \cdot 2 - \frac{3}{2} - \frac{1}{2} - 2 + \frac{1}{2} + \frac{11}{8} - \frac{3}{8} = 0 \end{aligned}$$

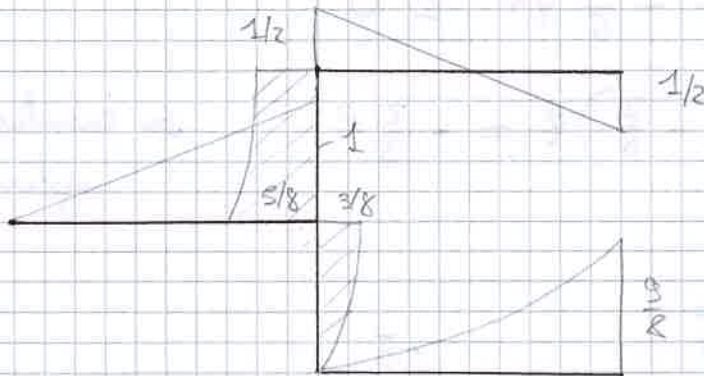


2 foglio

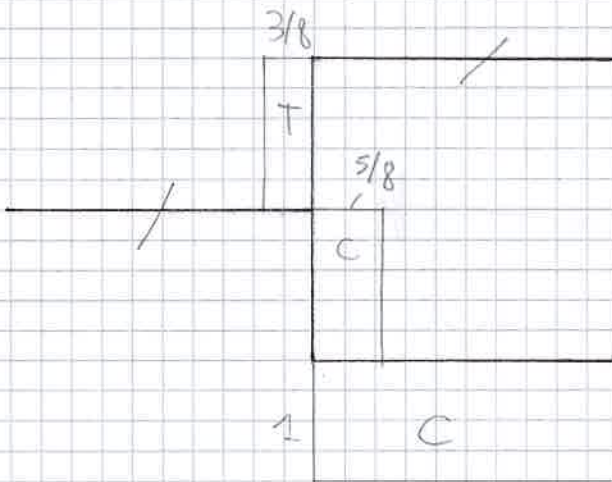
$V [qel]$



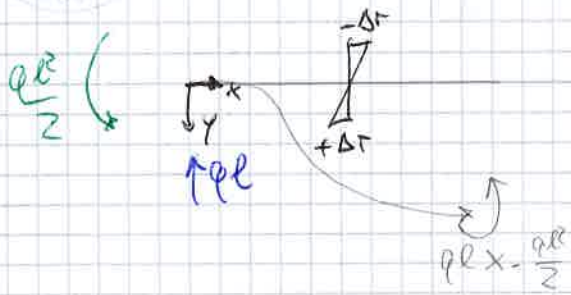
$M [qe^2]$



$N [qel]$



Studio della deformata termica



$$Y'' = -\frac{\pi}{E\sigma} - 2 \frac{\alpha \Delta T}{k}$$

Convenzioni linea elastica

$x \rightarrow$ positivo da sx a dx

$y \rightarrow$ positivo verso il basso

$M \rightarrow +$ quando tende sotto

$1/\rho =$ curvatura $\rightarrow +$ quando la concavità è verso il basso (+)

$$Y'' = -\frac{\pi}{E\sigma} - 2 \frac{\alpha \Delta T}{k} = -\frac{1}{E\sigma} \left(q\ell x - \frac{q\ell^2}{2} \right) - 2 \frac{7}{12} \frac{q\ell^2}{E\sigma}$$

$$-q\ell x + \frac{q\ell^2}{2} - \frac{7}{6} q\ell^2 \stackrel{?}{\geq} 0$$

$$x \leq \left(\frac{1}{2} - \frac{7}{6} \right) \ell = -\frac{2}{3} \ell$$

\rightarrow curvatura sempre negativa.

Deformata

