

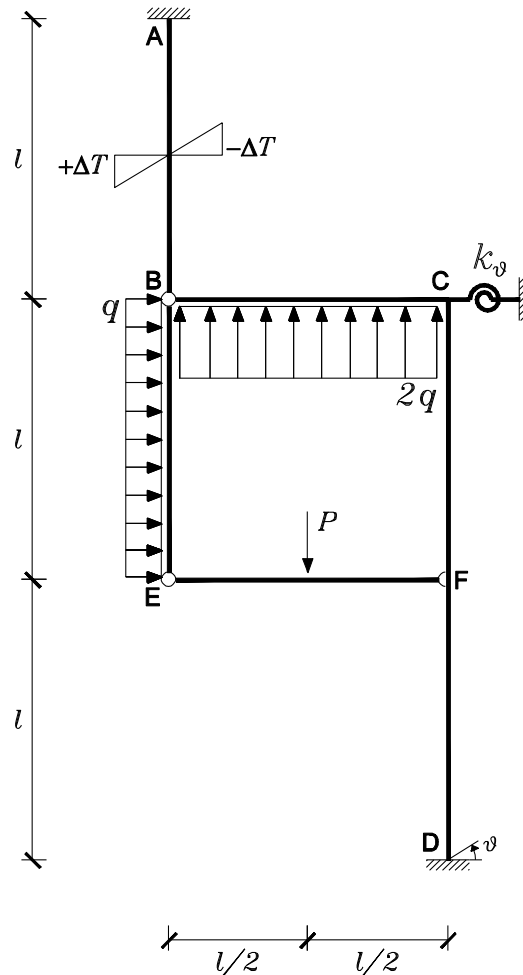
TECNICA DELLE COSTRUZIONI

TEMA ESAME DEL 20 GIUGNO 2016

DOCENTE: **PROF. GIOVANNI PLIZZARI**
PROF. FAUSTO MINELLI

ESERCITATORE: **ING. LUCA FACCONI**

Esercizio



$$\vartheta = \frac{1}{6} \frac{ql^3}{EJ};$$

$$P = 3ql;$$

$$\frac{\alpha \Delta T}{h} = \frac{1}{6} \frac{ql^2}{EJ};$$

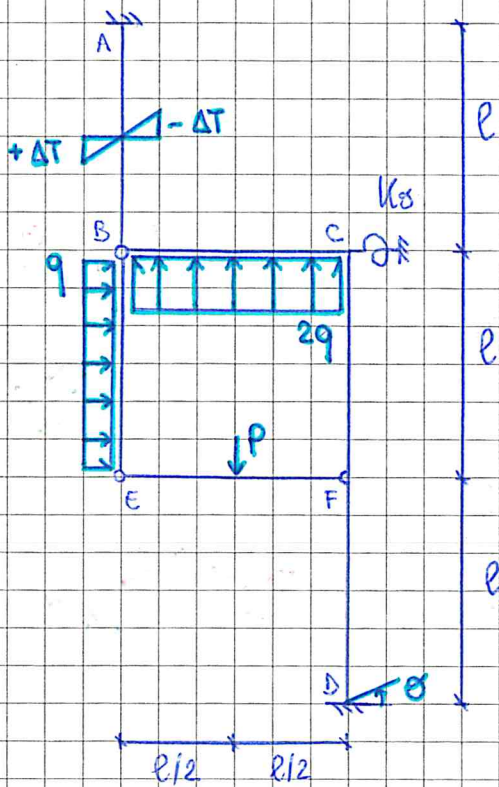
$$K_{\vartheta} = 3 \frac{EJ}{l}$$

Dato il telaio in figura

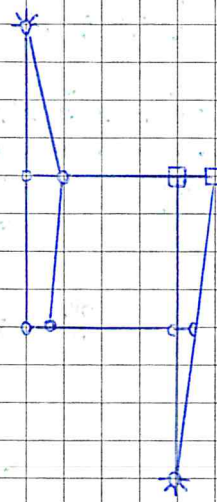
Si richiedono i grafici di:

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

TELAIO 20/06/2016

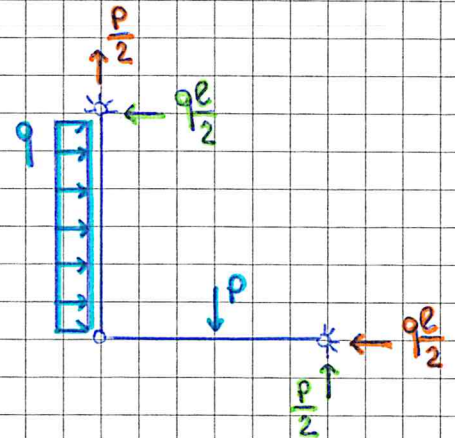


NODI SPOSTABILI :

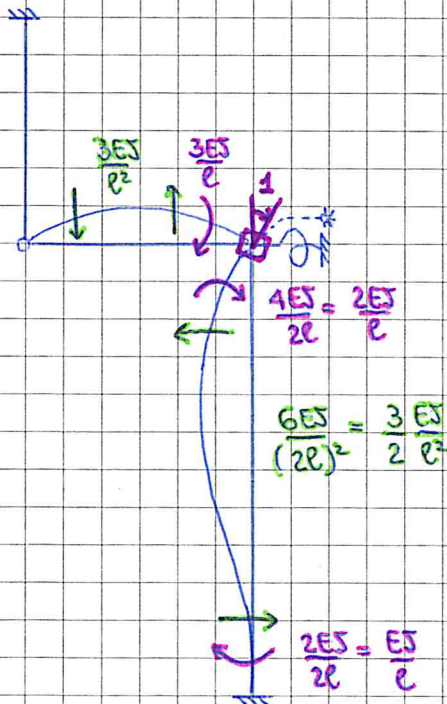


$$\begin{cases} m_{c\varphi} P_c + m_{c\varphi} M_c + m_{c\varphi} = 0 \\ h_{c\varphi} P_c + h_{c\varphi} M_c + h_{c\varphi} = 0 \end{cases}$$

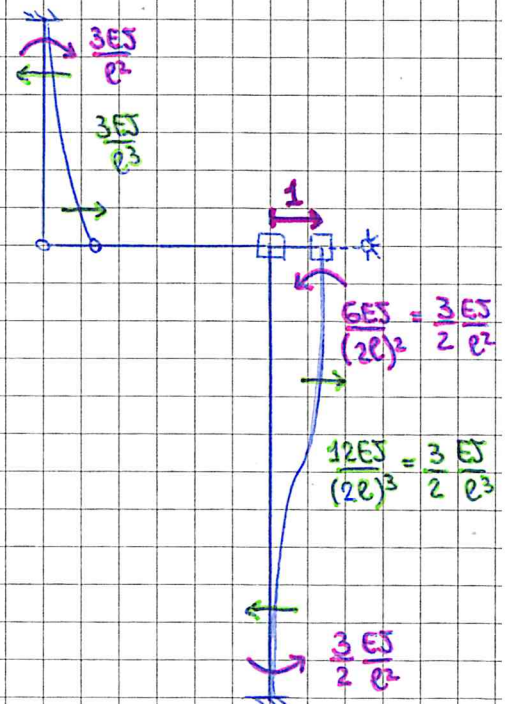
APPENDICE :



$$P_c = 1$$



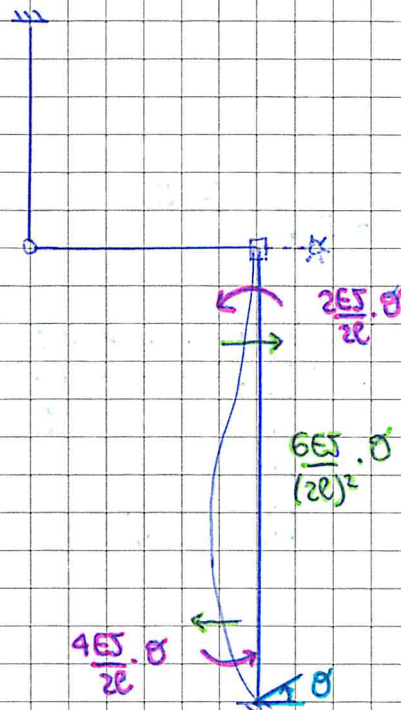
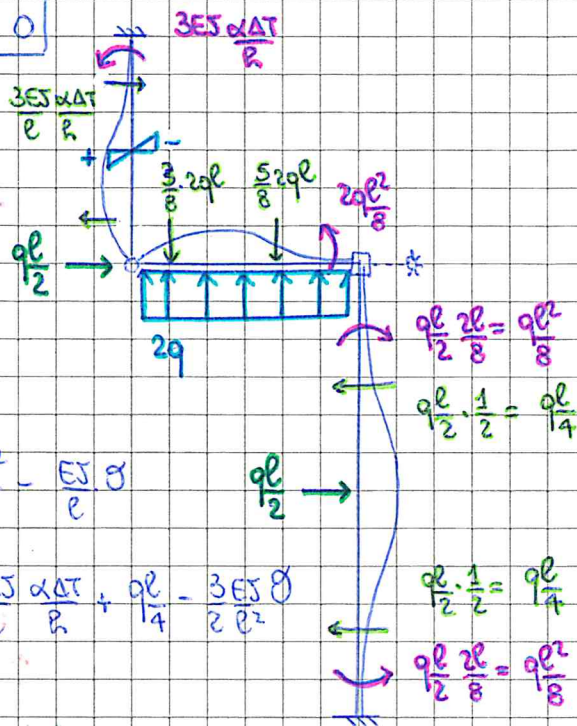
$$M_c = 1$$



$$\begin{cases} m_{c\varphi} = \frac{2ES}{l} + \frac{3ES}{l} + K_s = \frac{5ES}{l} + K_s \\ h_{c\varphi} = \frac{3ES}{2l^2} \end{cases}$$

$$\begin{cases} m_{c\varphi} = -\frac{3ES}{2l^2} \\ h_{c\varphi} = -\frac{3ES}{2l^3} - \frac{3ES}{l^3} = -\frac{9ES}{2l^3} \end{cases}$$

$$q; P; \theta; \Delta T \neq 0$$



$$m_{\text{top}} = \frac{ql^2}{8} - \frac{ql^2}{4} - \frac{EJ}{l} \theta$$

$$h_{\text{top}} = \frac{ql}{2} + \frac{3EJ}{l} \frac{\alpha \Delta T}{R} + \frac{ql}{4} - \frac{3EJ}{2l^2} \theta$$

$$\begin{cases} (5 \frac{EJ}{l} + K_0) \varphi_c - \frac{3EJ}{2l^2} m_c + \frac{ql^2}{8} - \frac{ql^2}{4} - \frac{EJ}{l} \theta = 0 \\ \frac{3EJ}{2l^2} \varphi_c - \frac{3EJ}{2l^3} m_c + \frac{3EJ}{l} \frac{\alpha \Delta T}{R} + \frac{3ql}{4} - \frac{3EJ}{2l^2} \theta = 0 \end{cases}$$

$$P = 3ql$$

$$\frac{\alpha \Delta T}{R} = \frac{1}{6} \frac{ql^2}{EJ}$$

$$K_0 = \frac{3EJ}{l}$$

$$\theta = \frac{1}{6} \frac{ql^3}{EJ}$$

$$\begin{cases} (5 \frac{EJ}{l} + \frac{3EJ}{l}) \varphi_c - \frac{3EJ}{2l^2} m_c + \frac{ql^2}{8} - \frac{ql^2}{4} - \frac{EJ}{l} \cdot \frac{1}{6} \frac{ql^3}{EJ} = \phi \\ \frac{3EJ}{2l^2} \varphi_c - \frac{3EJ}{2l^3} m_c + \frac{3EJ}{l} \frac{1}{6} \frac{ql^2}{EJ} + \frac{3ql}{4} - \frac{3EJ}{2l^2} \cdot \frac{1}{6} \frac{ql^3}{EJ} = \phi \end{cases}$$

$$\begin{cases} 8 \frac{EJ}{l} \varphi_c - \frac{3EJ}{2l^2} m_c - \frac{7}{24} ql^2 = 0 \\ \frac{3EJ}{2l^2} \varphi_c - \frac{3EJ}{2l^3} m_c + ql = 0 \end{cases}$$

$$\begin{vmatrix} 8 & -\frac{3}{2} & -\frac{7}{24} \\ 3 & -\frac{3}{2} & 1 \end{vmatrix} \times 3 \quad \begin{vmatrix} 24 & -\frac{3}{2} & -\frac{21}{24} \\ \frac{3}{2} & -\frac{3}{2} & 1 \end{vmatrix} \times 1$$

$$\left(\frac{3}{2} - 24 \right) \varphi_c + \left(1 + \frac{21}{24} \right) = 0$$

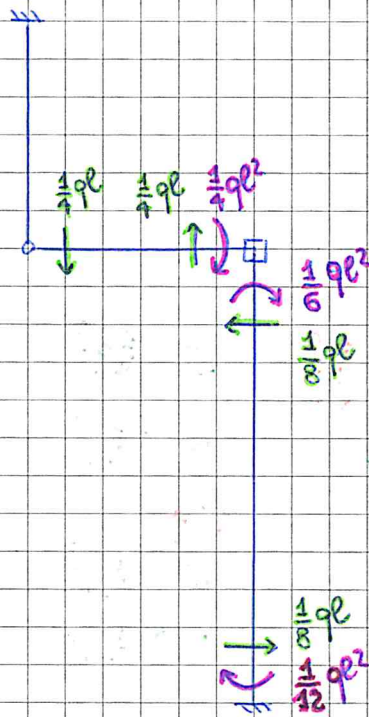
$$\varphi_c = \frac{15}{8} \cdot \frac{ql}{46} = \frac{1}{12} \frac{ql^3}{EJ}$$

ORARIA

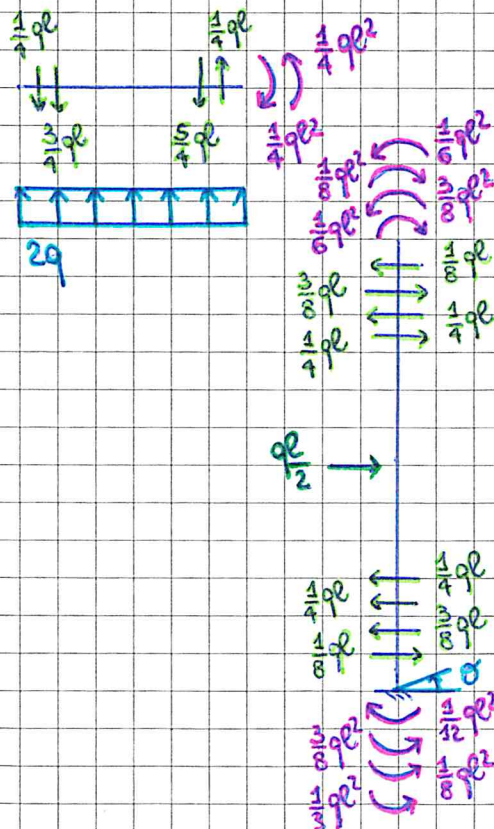
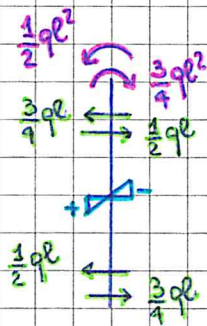
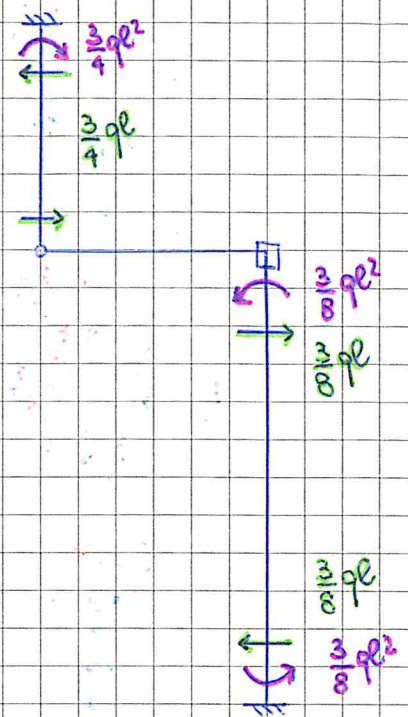
$$m_c = \left(\frac{8EJ}{l} \cdot \frac{1}{12} \frac{ql^3}{EJ} - \frac{7}{24} ql^2 \right) \cdot \frac{2l^2}{3EJ} = \frac{1}{4} \frac{ql^4}{EJ}$$

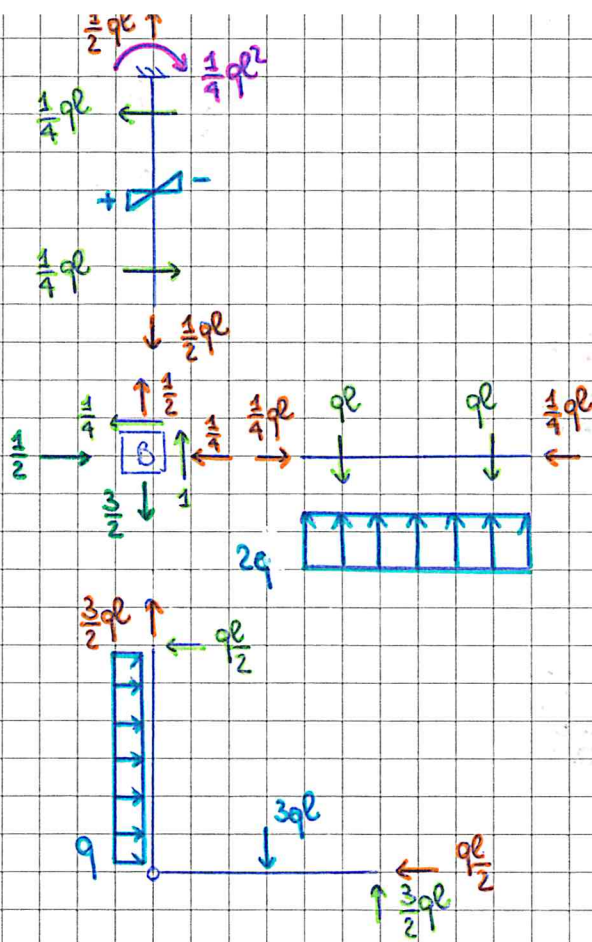
VERBA DESTRA

$$\varphi_c = \frac{1}{12} \frac{ql^3}{EI}$$



$$M_c = \frac{1}{4} \frac{ql^4}{EI}$$

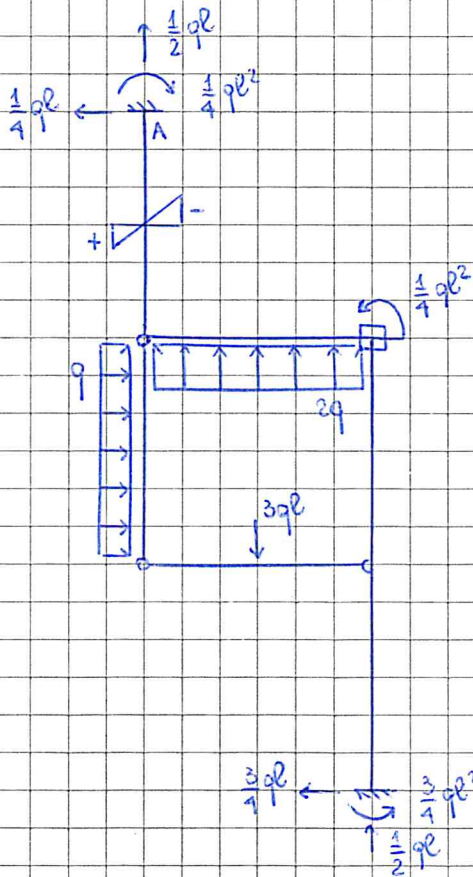
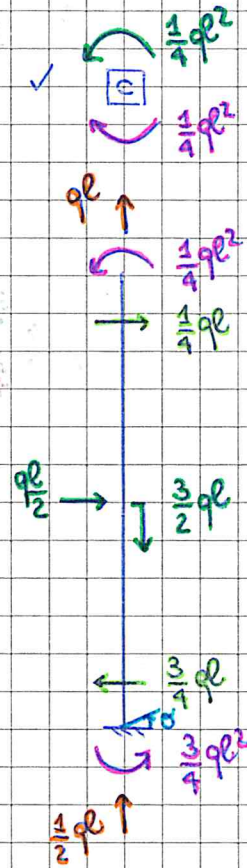




MOMENTO NAUZA MOUA :

$$M_c = \varphi_c k_b = \frac{1}{12} \frac{ql^3}{EI} \cdot \frac{3EI}{l} = \frac{1}{4} ql^2$$

ANTIORARIO!

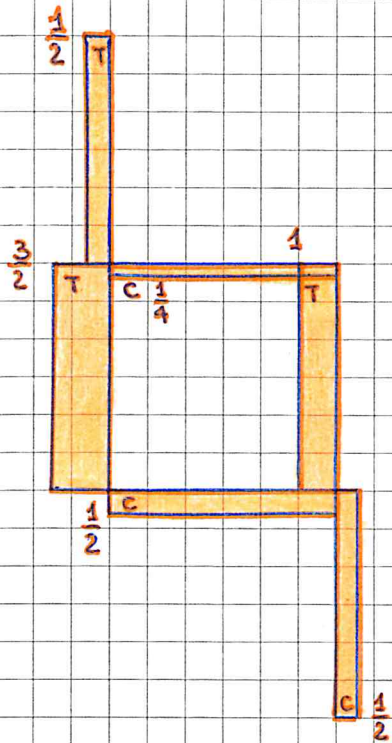


$$\sum F^{\rightarrow} = -\frac{1}{4}ql + ql - \frac{3}{4}ql = 0$$

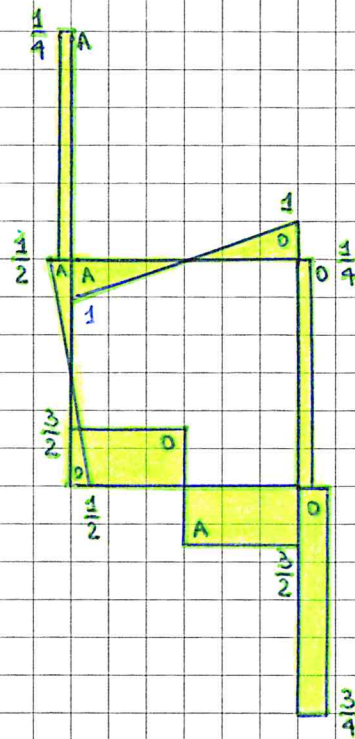
$$\sum F^{\uparrow} = \frac{1}{2}ql + 2ql - 3ql + \frac{1}{2}ql = 0$$

$$\begin{aligned} \sum M^{\curvearrowright} &= \frac{1}{4}ql^2 - ql \cdot \frac{3l}{2} - 2ql \cdot \frac{l}{2} - \frac{1}{4}ql^2 + 3ql \cdot \frac{l}{2} - \frac{3}{4}ql^2 - \frac{1}{2}ql \cdot l + \frac{3}{4}ql^2 \\ &= 0 \end{aligned}$$

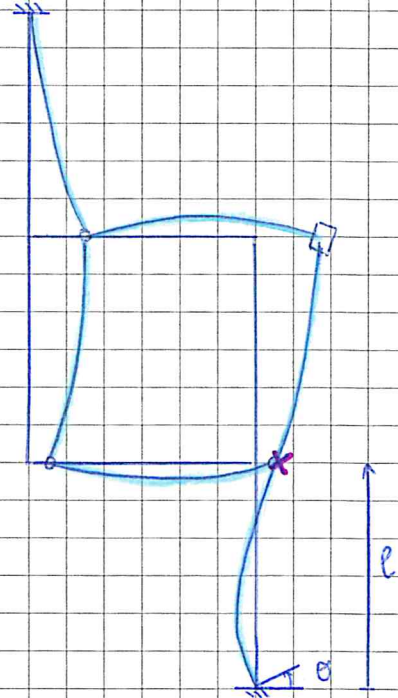
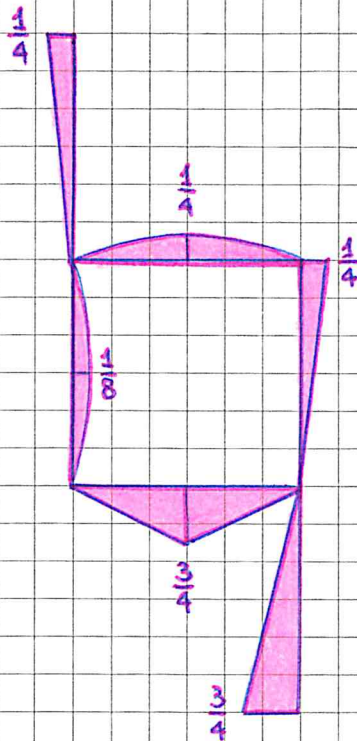
(N)



(V)



(M)



$$M_{CB}|_{l/2} = \frac{1}{4}ql^2 - \frac{1}{4}ql \cdot l = 0$$

FLESSI:

*) anta $\overline{CB}$ $x = \frac{2l}{2} = l$

*) anta $\overline{AB}$ $M(x) = -\frac{1}{4}qlx$

$$y'' = \frac{qlx}{4ES} + 2 \cdot \frac{1}{6} \frac{ql^2}{ES} \geq 0$$

$$x \geq -\frac{4l}{3} \quad \forall x$$

NO FLESSO!