

# TECNICA DELLE COSTRUZIONI

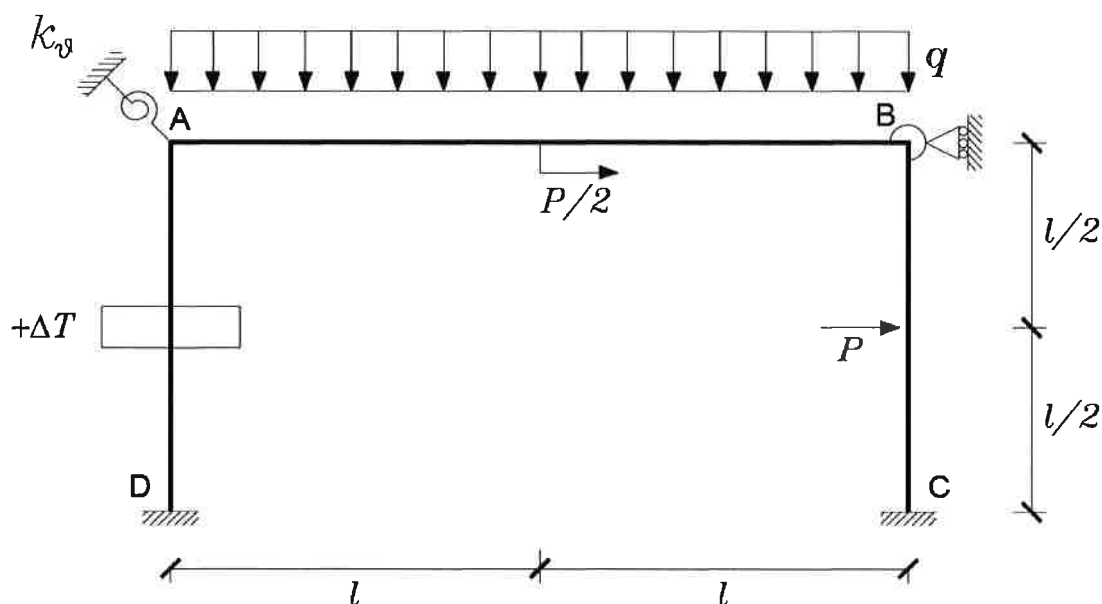
TEMA ESAME DEL 17 GIUGNO 2019

DOCENTI:  
PROF. FAUSTO MINELLI

ESERCITATORI:  
ING. FRANCESCA FEROLDI

DURATA: 2 ORE.

## Esercizio



$$k_{\theta} = \frac{7 EJ}{2 l}$$

$$\alpha \Delta T = \frac{11 ql^3}{12 EJ}$$

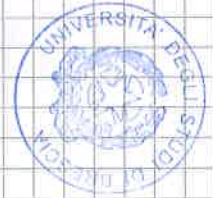
$$P = ql$$

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.

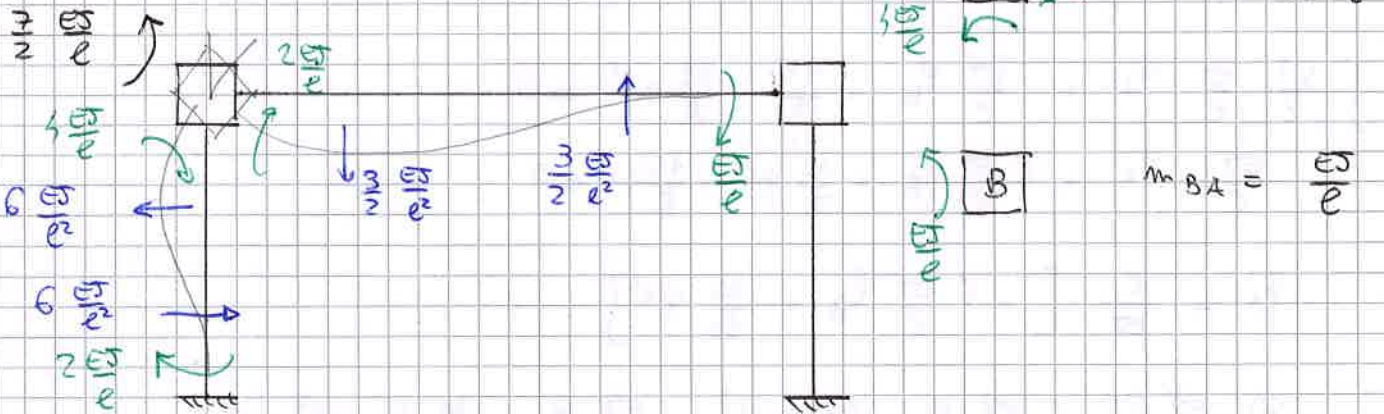
SOLUZIONE



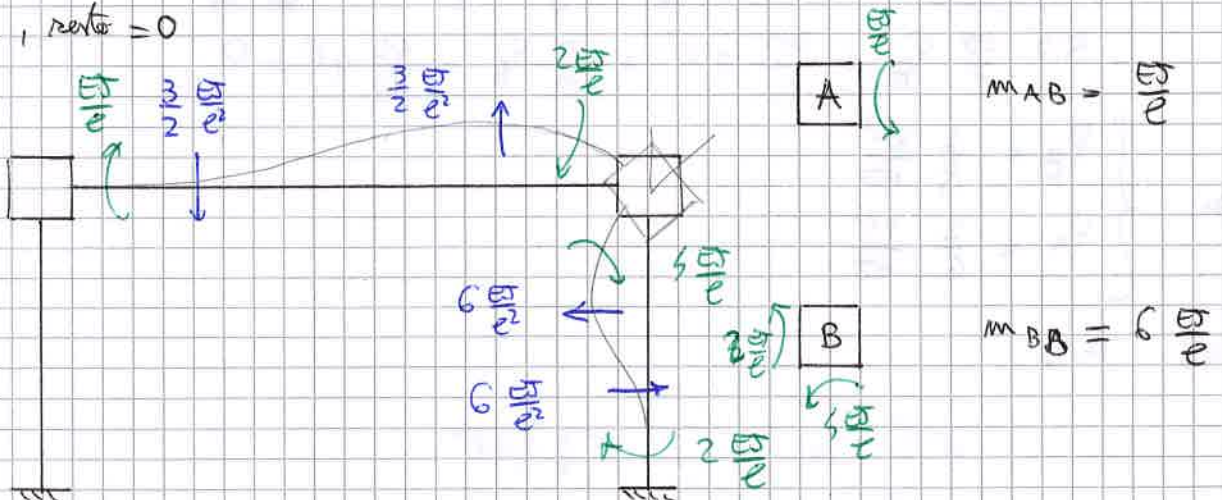
La struttura risulta a nodi fissi. Si evidenziano due rotazioni nei nodi A e B.

$$\begin{cases} m_{AA} \varphi_A + m_{AB} \varphi_B + m_{A0} = 0 \\ m_{BA} \varphi_A + m_{BB} \varphi_B + m_{B0} = 0 \end{cases}$$

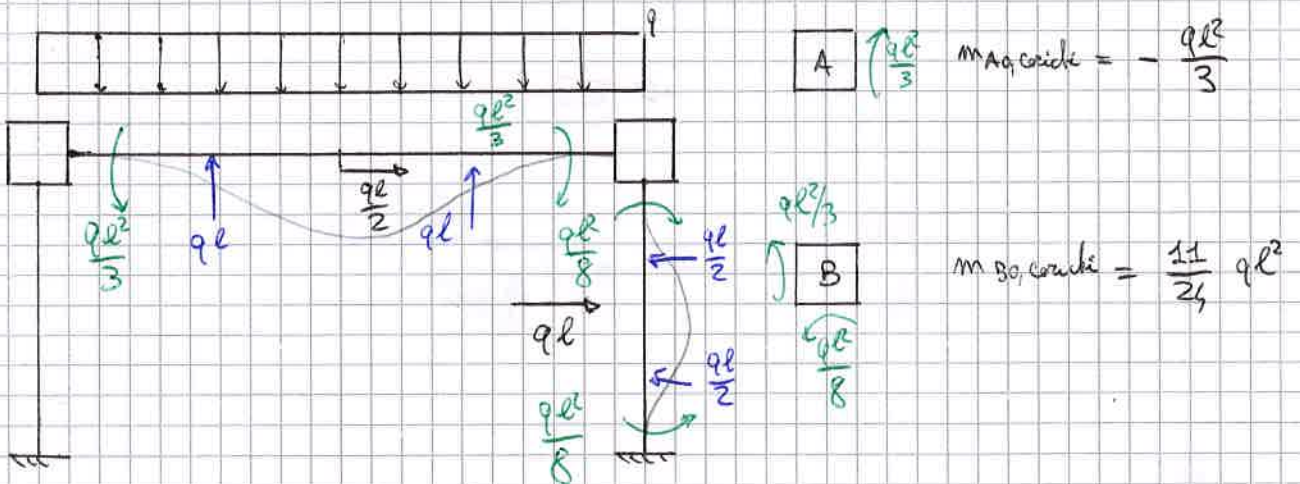
•  $\varphi_A = 1, resto = 0$



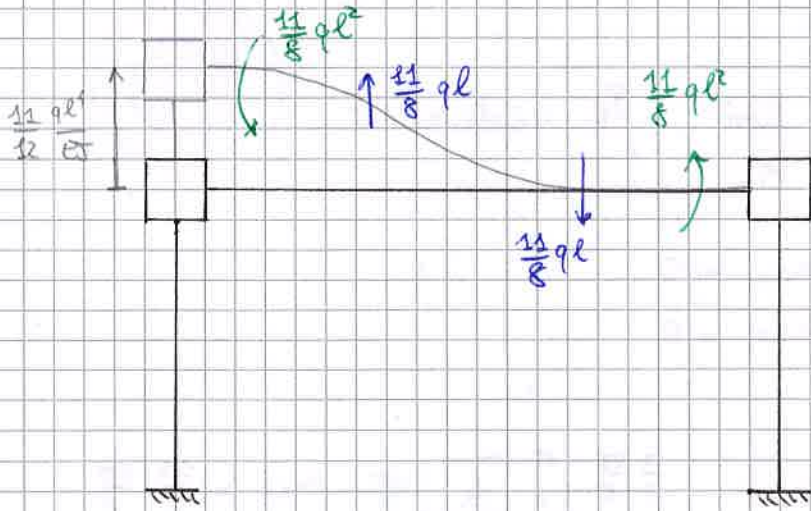
•  $\varphi_B = 1, resto = 0$



• Carichi  $\neq 0, resto = 0$



$\Delta T \neq 0, \text{ resto } = 0$



$\frac{11}{8} ql^2$   
A

$m_{A0, \Delta T} = -\frac{11}{8} ql^2$

B  
 $\frac{11}{8} ql^2$

$m_{B0, \Delta T} = -\frac{11}{8} ql^2$

$$\textcircled{1} \left\{ \begin{aligned} \frac{13}{2} \frac{ES}{e} \varphi_A + \frac{ES}{e} \varphi_B - \frac{ql^2}{3} - \frac{11}{8} ql^2 &= 0 \\ \frac{ES}{e} \varphi_A + 6 \frac{ES}{e} \varphi_B + \frac{11}{24} ql^2 - \frac{11}{8} ql^2 &= 0 \end{aligned} \right.$$

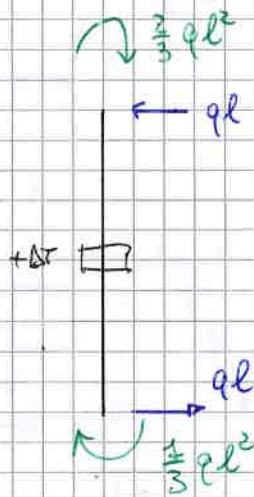
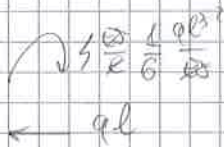
$$\textcircled{2} \quad \varphi_A = \frac{e}{ES} \left[ -6 \frac{ES}{e} \varphi_B + \frac{11}{32} ql^2 \right]$$

$$\textcircled{1} \quad \frac{13}{2} \frac{ES}{e} \left[ -6 \frac{ES}{e} \varphi_B + \frac{11}{32} ql^2 \right] + \frac{ES}{e} \varphi_B - \frac{11}{8} \frac{11}{24} ql^2 = 0$$

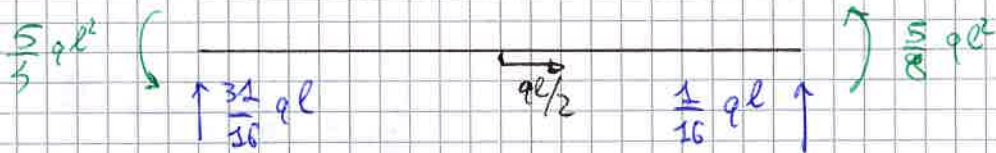
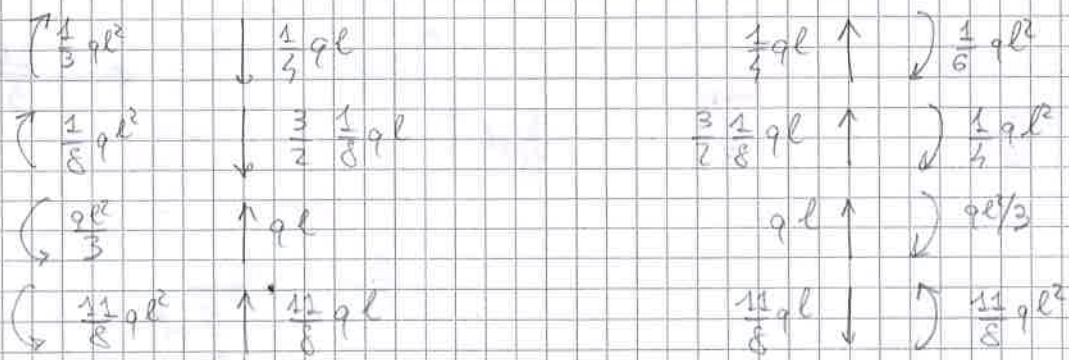
$$-57 \frac{ES}{e} \varphi_B + \frac{209}{24} ql^2 + \frac{ES}{e} \varphi_B - \frac{51}{24} ql^2 = 0$$

$$\Rightarrow \left\{ \begin{aligned} \varphi_B &= \frac{1}{8} \frac{ql^2}{ES} \\ \varphi_A &= \frac{1}{6} \frac{ql^2}{ES} \end{aligned} \right.$$

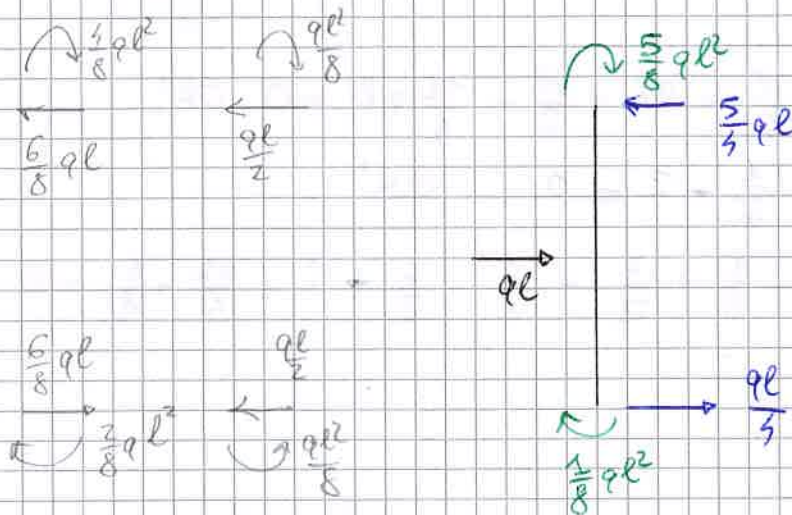
Certa AD

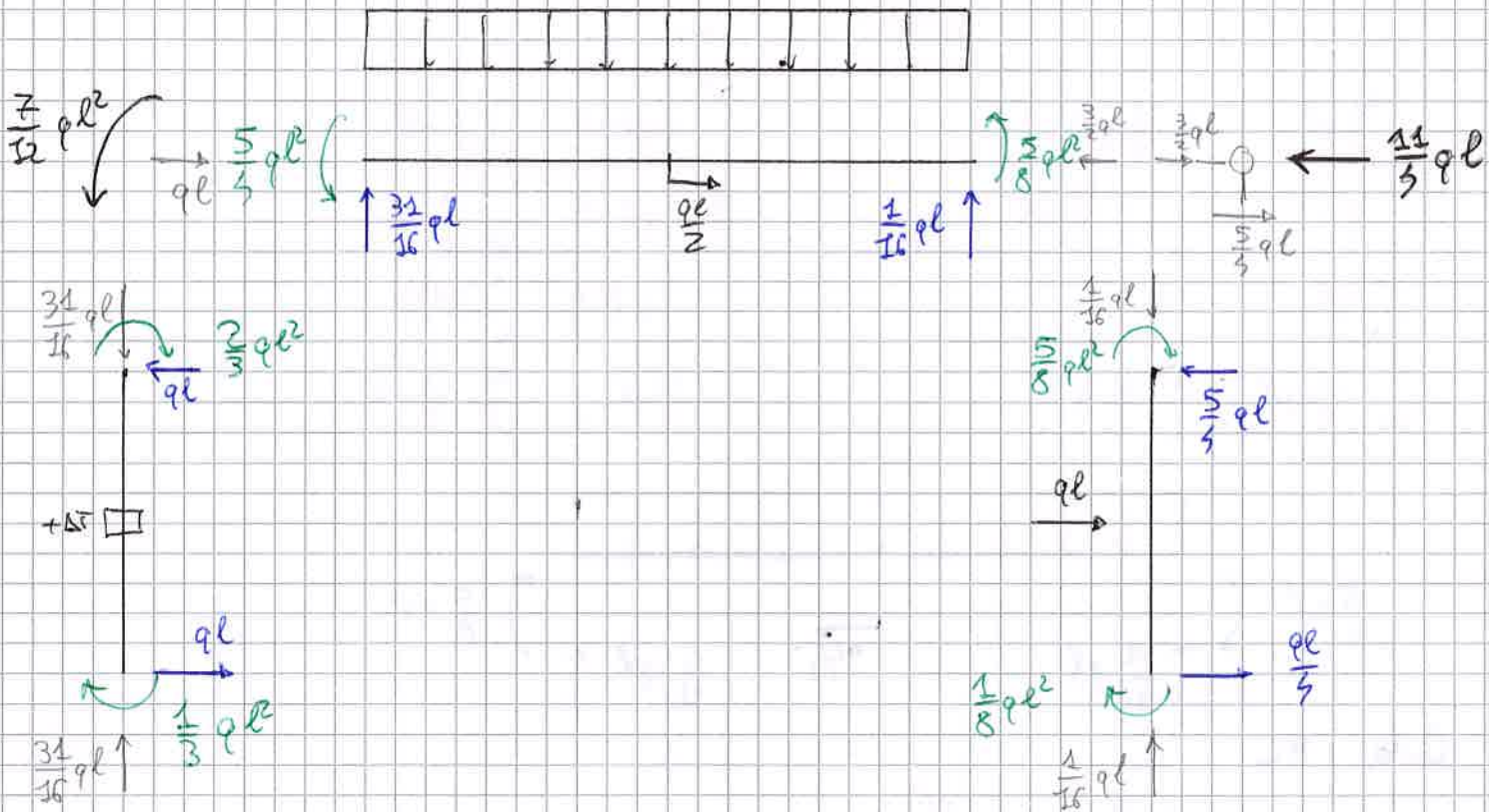


asta AB



asta BC





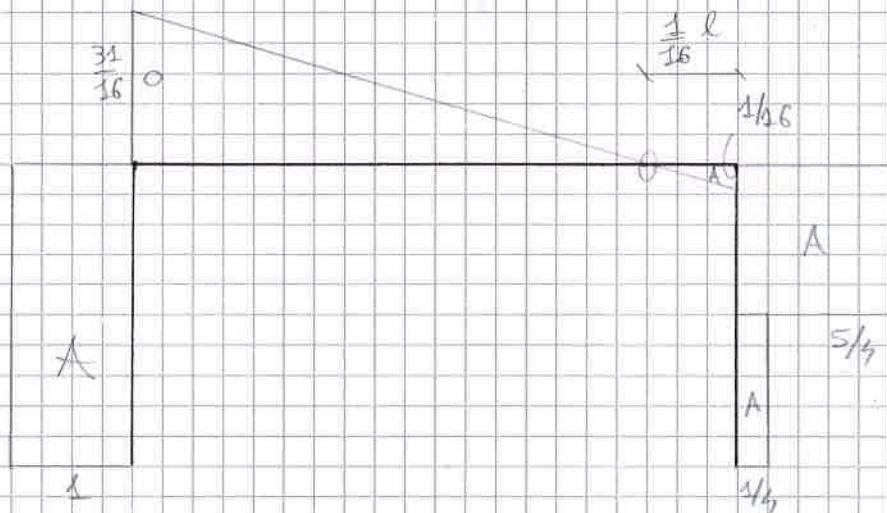
$$\sum H = 0 \quad ql + \frac{ql}{3} + ql + \frac{ql}{2} - \frac{11}{3}ql = 0 \quad \text{OK!}$$

$$\sum V = 0 \quad \frac{31}{16} + \frac{1}{16} - 2 = 0 \quad \text{OK!}$$

$$\sum M(b) = 0 \quad -\frac{1}{3} - \frac{1}{8} + \frac{7}{12} - \frac{1}{2} - \frac{1}{2} + 2 + \frac{11}{3} + \frac{1}{8} = 0 \quad \text{OK!}$$

AZIONI INTERNE

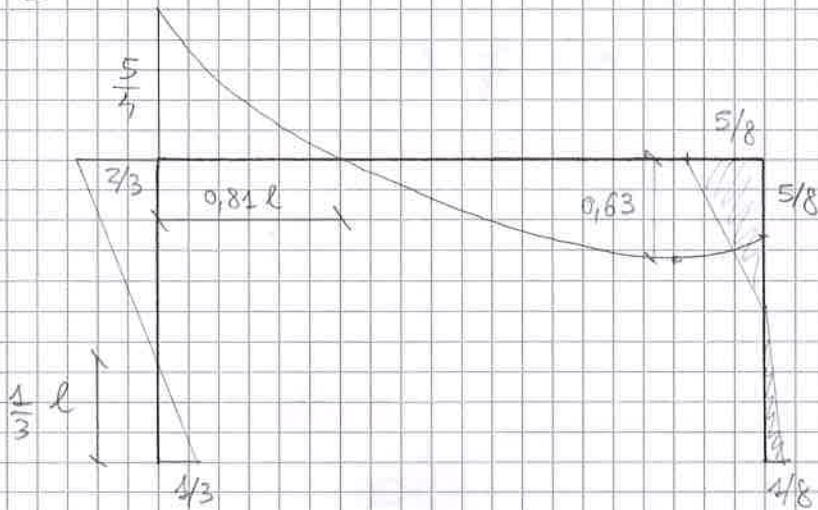
$V [ql]$



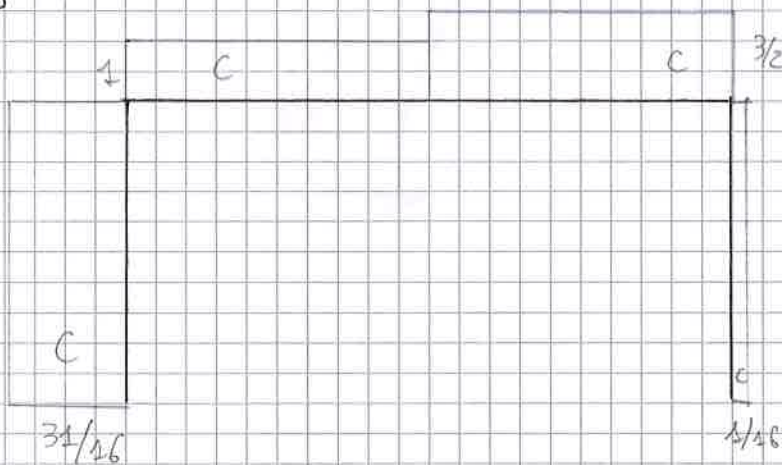


2° foglio

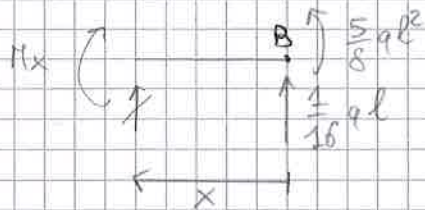
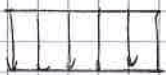
$M [ql^2]$



$N [ql]$



Momento massimo (arto AB)



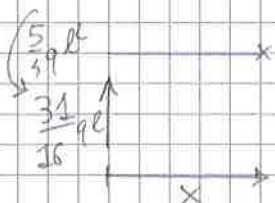
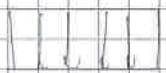
$$\frac{1}{16} ql = qx \rightarrow x = \frac{l}{16}$$

$$\sum M(x) = 0$$

$$M_x = \frac{1}{16} ql \frac{l}{16} + \frac{5}{8} ql^2 - q \frac{l}{16} \frac{l}{16} \frac{1}{2} =$$

$$= \frac{321}{512} ql^2 \approx 0,63 ql$$

Stato art. AB



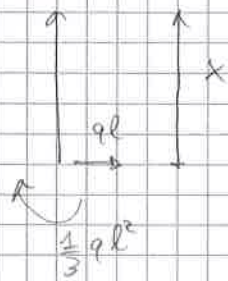
$$\sum M(x) = 0$$

$$\frac{5}{16} ql^2 + q \frac{x}{2} - \frac{31}{16} ql x = 0$$

$$x^2 - \frac{31}{8} lx + \frac{5}{2} l^2 = 0$$

$$x_{1,2} = \left\langle \begin{matrix} 3,05 l \\ 0,81 l \end{matrix} \right. \text{ @ acc}$$

flessa asta A D

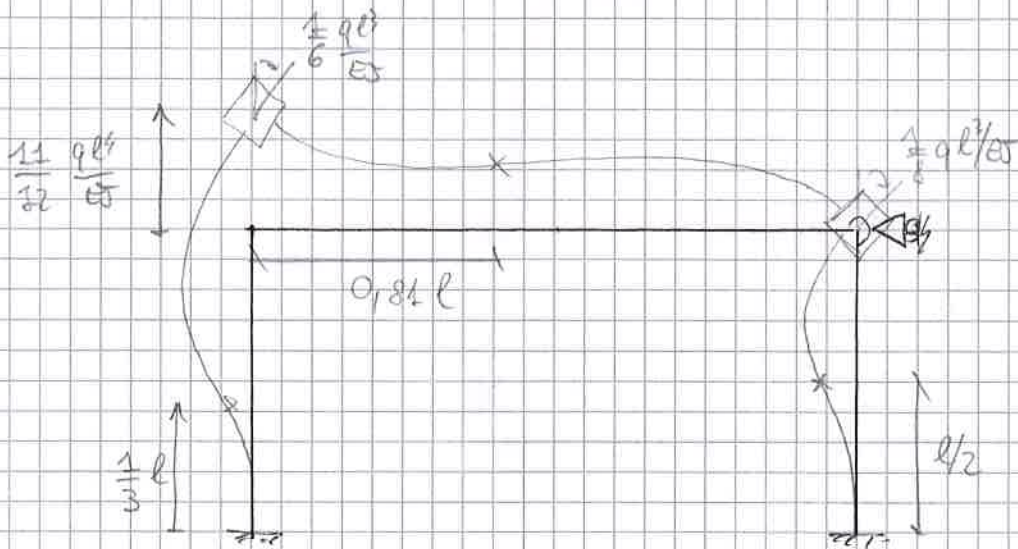


$$\sum \kappa(x) = 0$$

$$\frac{1}{3} ql^2 - qlx = 0$$

$$x = \frac{1}{3} l$$

Deformata qualitativa



flessa asta BC

$$\frac{5}{8} ql^2$$

$$\frac{5}{4} ql$$

$$\frac{5}{4} ql$$

$$ql$$

$$\frac{1}{4} ql$$

$$\frac{1}{8} ql^2$$