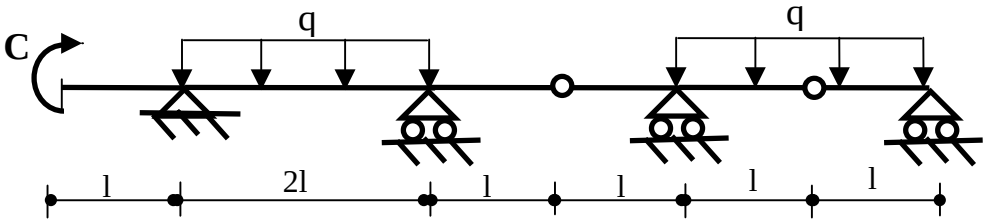
CORSO DI LAUREA IN INGEGNERIA MECCANICA
UNIVERSITÀ DEGLI STUDI DI FERRARA
PRIMA PROVA SCRITTA IN ITINERE DI STATICA, A. A. 2009/2010

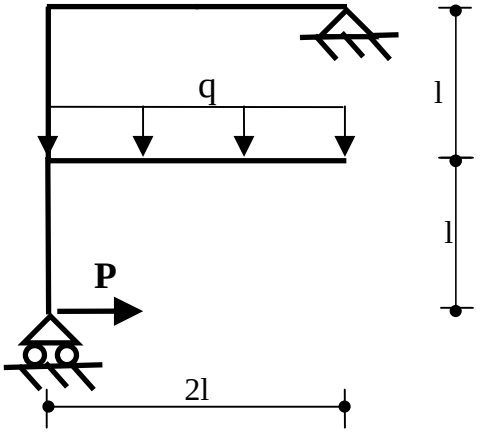
FERRARA, 27/10/2009

D

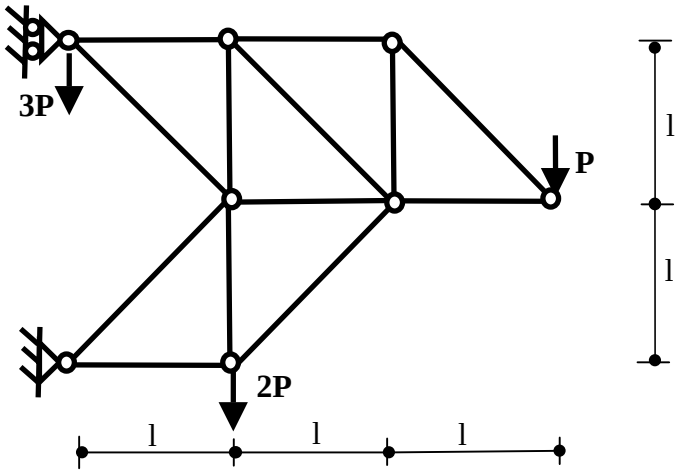
1) **Disegnare i diagrammi quotati delle azioni interne (N, T, M) per l=1 m, q= 25 kN/m, C=10 kNm.**



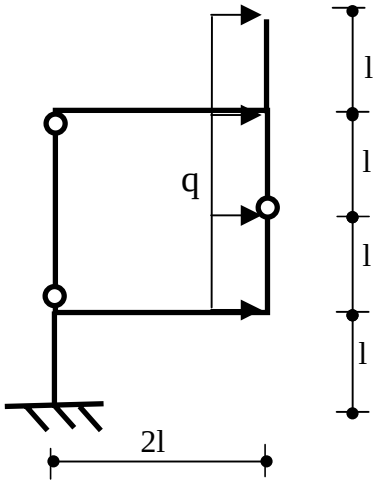
2) **Disegnare i diagrammi quotati delle azioni interne (N, T, M) per l= 1m, q= 25 kN/m, P=5 kN.**



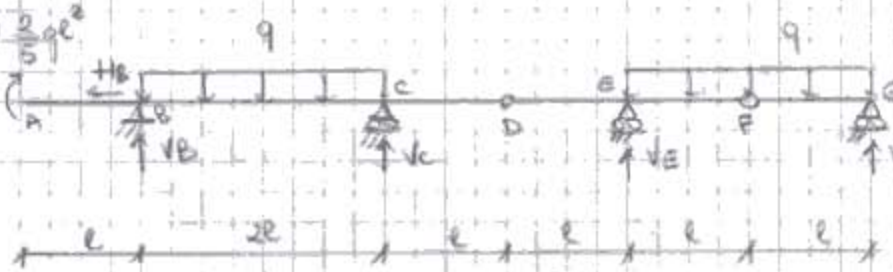
3) **Calcolare lo stato di sollecitazione per l=1 m, P= 5 kN.**



4) **Disegnare i diagrammi quotati di (N,T,M) per l=1 m, q = 25 kN/m.**



D1) $\frac{2}{5}ql^2$



$(F\uparrow)_{FG}$ $V_G \cdot l = q\cdot l \cdot \frac{l}{2} = 12.5\ kN$

$(D\curvearrowright)_{DEFG}$ $V_E \cdot l = -q\frac{l}{2}\cdot 3l + 2q\cdot l\cdot 2l$

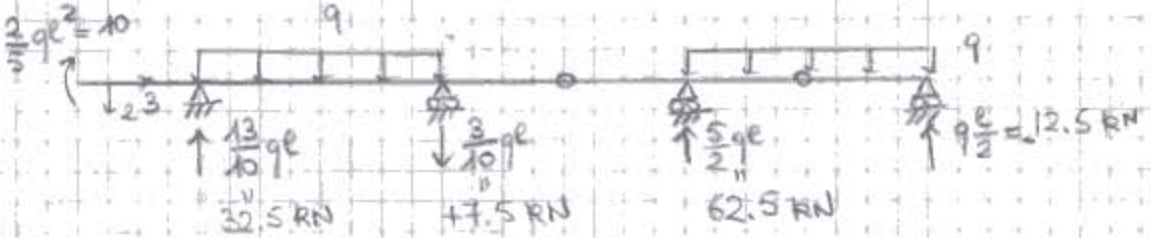
$= \frac{5}{2}ql = 62.5\ kN$

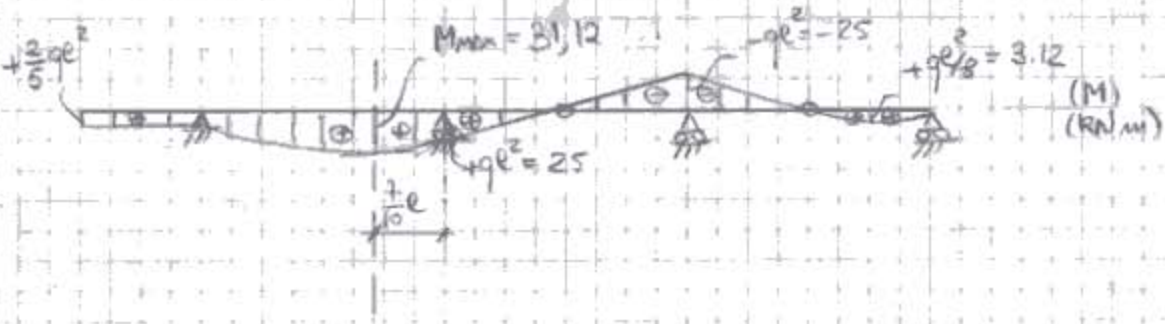
$(D\curvearrowright)_{ABCD}$ $V_C \cdot l + V_B \cdot 3l = -\frac{2}{5}ql^2 + 2ql\cdot 2l = +\frac{18}{5}ql^2$ (I)

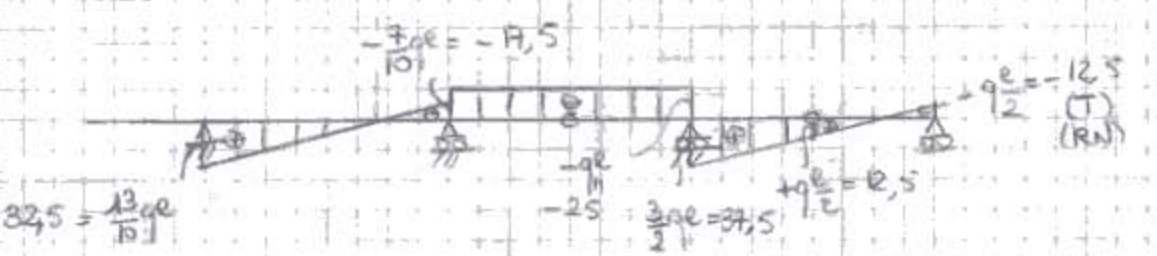
$(\uparrow)$ $V_B + V_C = 4ql - \frac{5}{2}ql - q\frac{l}{2} = ql$ (II)

$2V_B = ql\left(+\frac{18}{5} - 1\right) = +\frac{13}{5}ql \rightarrow V_B = +\frac{13}{10}ql = 32.5\ kN$

$V_C = ql - V_B = -\frac{3}{10}ql = -7.5\ kN$

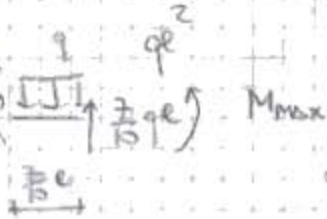






$(N) = 0$

$\frac{13}{10} - 2 = \frac{13-20}{10} = -\frac{7}{10}$ $q\frac{l}{10}$ ↓ A ↑ ql ↓ $\frac{3}{10}ql$

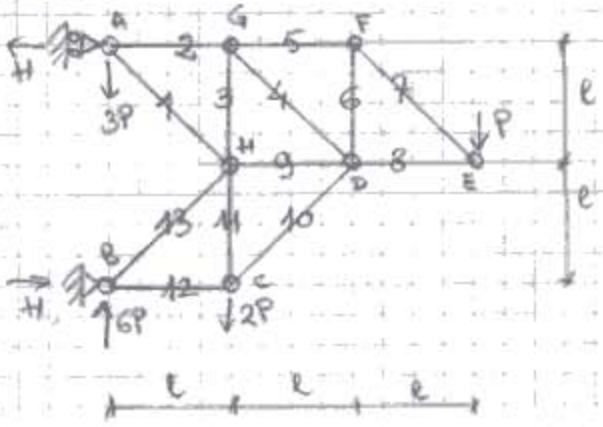


$M_{max} = \frac{7}{10}ql\cdot\frac{7}{10}l\cdot\frac{1}{2} + ql^2$

$\overset{!}{=}\left(\frac{49}{200} + 1\right)ql^2$

$\overset{!}{=}\frac{249}{200}ql^2 = 31,12\ kNm$

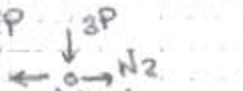
D3)



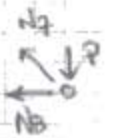
(A7) $H2\ell = 2P\ell + 3P\ell$

$\hookrightarrow H = \frac{5}{2}P = 12.5\ \text{kN}$

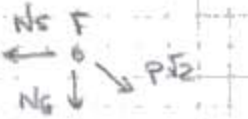
ASTA	N	kN
1	$-3P\sqrt{2}$	-21
2	$\frac{11}{2}P$	27,5
3	$-\frac{9}{2}P$	22,5
4	$\frac{9}{2}\sqrt{2}P$	32
5	P	5
6	-P	-5
7	$P\sqrt{2}$	7
8	-P	-5
9	-9P	-45
10	$\frac{7}{2}\sqrt{2}P$	25
11	$-\frac{3}{2}P$	-7,5
12	$\frac{7}{2}P$	17,5
13	$-6P\sqrt{2}$	-42



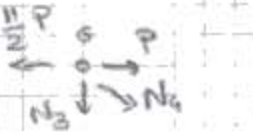
$$\begin{cases} N_1\frac{\sqrt{2}}{2} = -3P \rightarrow N_1 = -3P\sqrt{2} \\ N_2 = \frac{5}{2}P - N_1\frac{\sqrt{2}}{2} = \frac{5}{2}P + 3P = \frac{11}{2}P \end{cases}$$



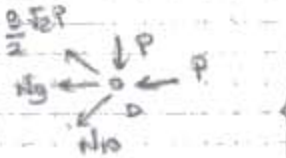
$$\begin{cases} N_7\frac{\sqrt{2}}{2} = P \rightarrow N_7 = P\sqrt{2} \\ N_8 = -N_7\frac{\sqrt{2}}{2} = -P \end{cases}$$



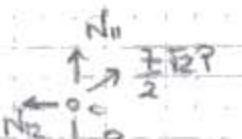
$$\begin{cases} N_5 = P\sqrt{2}\frac{\sqrt{2}}{2} \\ N_5 = -P\sqrt{2}\frac{\sqrt{2}}{2} \end{cases}$$



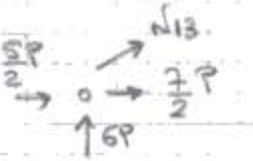
$$\begin{cases} N_4\frac{\sqrt{2}}{2} = \left(\frac{11}{2} - 1\right)P = \frac{9}{2}P \rightarrow N_4 = \frac{9}{2}\sqrt{2}P \\ N_3 = -N_4\frac{\sqrt{2}}{2} = -\frac{9}{2}P \end{cases}$$



$$\begin{cases} N_{10}\frac{\sqrt{2}}{2} = \frac{9}{2}\sqrt{2}P\frac{\sqrt{2}}{2} - P = \frac{7}{2}P \rightarrow N_{10} = \frac{7}{2}\sqrt{2}P \\ N_9 = -P - \frac{9}{2}\sqrt{2}P\frac{\sqrt{2}}{2} - N_{10}\frac{\sqrt{2}}{2} = P\left(-1 - \frac{9}{2} - \frac{7}{2}\right) = -9P \end{cases}$$



$$\begin{cases} N_{11} = 2P - \frac{7}{2}\sqrt{2}\frac{\sqrt{2}}{2}P = -\frac{3}{2}P \\ N_{12} = +\frac{7}{2}\sqrt{2}P\frac{\sqrt{2}}{2} \end{cases}$$

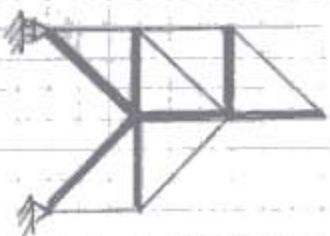


$$\begin{cases} N_{13}\frac{\sqrt{2}}{2} = -6P \rightarrow N_{13} = -6P\sqrt{2} \\ \frac{5}{2}P + \frac{7}{2}P = -N_{13}\frac{\sqrt{2}}{2} \end{cases}$$

$\frac{12}{2}P$

$\parallel$

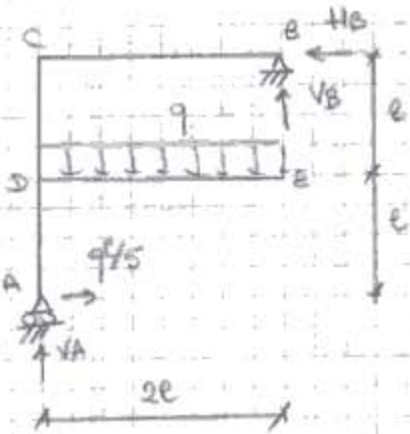
$6P$



– TIRANTE

– PUNTONE

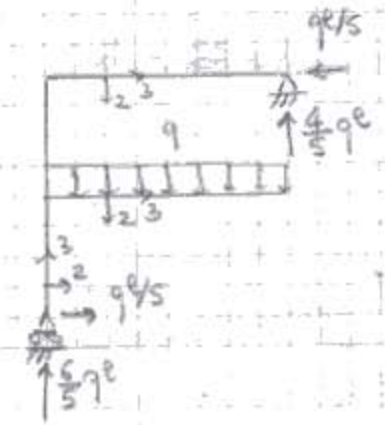
12)

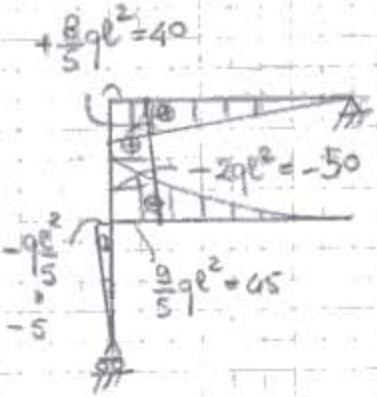


$(\leftarrow)\ H_B = q\ell/5$

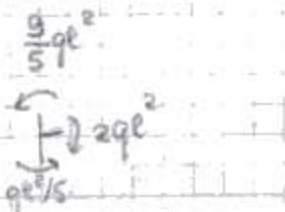
$(\curvearrowright A)\ V_B 2\ell = -q\frac{\ell}{5}2\ell + 2q\ell^2 = \frac{8}{5}q\ell^2 \rightarrow V_B = \frac{8}{10}q\ell^2 = \frac{4}{5}q\ell$

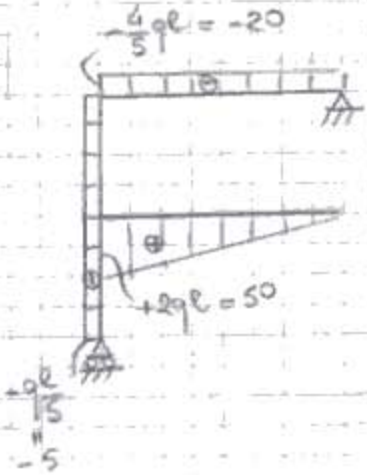
$(\uparrow)\ V_A = 2q\ell - \frac{8}{10}q\ell = \frac{12}{10}q\ell = \frac{6}{5}q\ell$



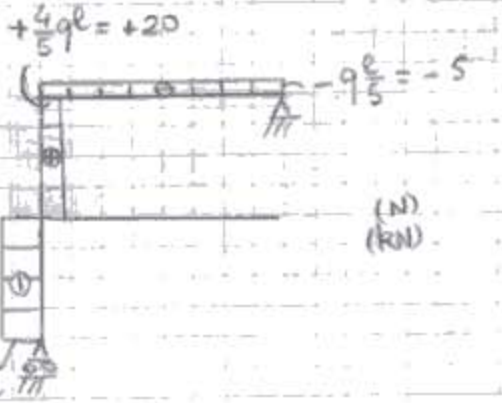


(M)
(RN_m)



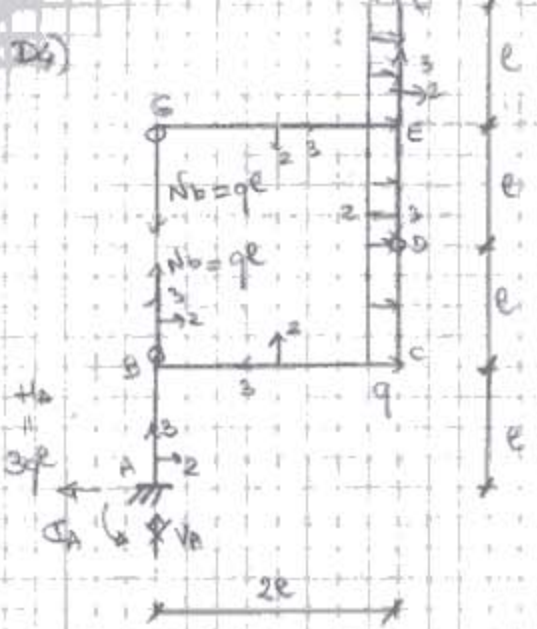


(T)
(RN)



(N)
(RN)

D4)

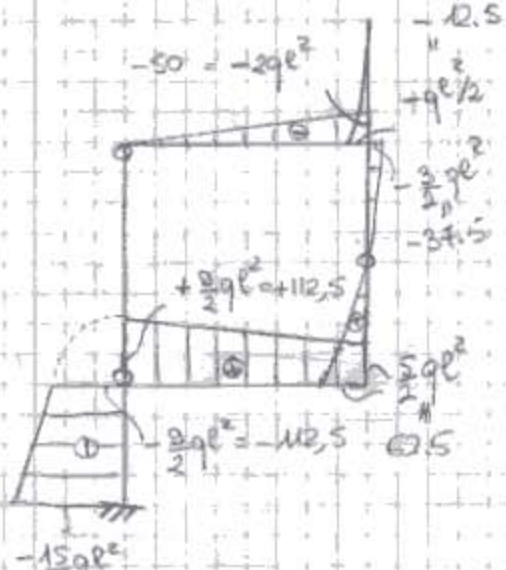


$(\rightarrow)$ $H_A = 3qe$

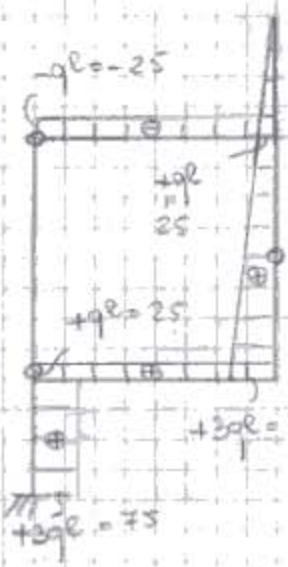
$(\uparrow)$ $V_A = 0$

$(\curvearrowleft)$ $M_A = 3qe\,(1+\frac{3}{2})e = \frac{15}{2}qe^2$

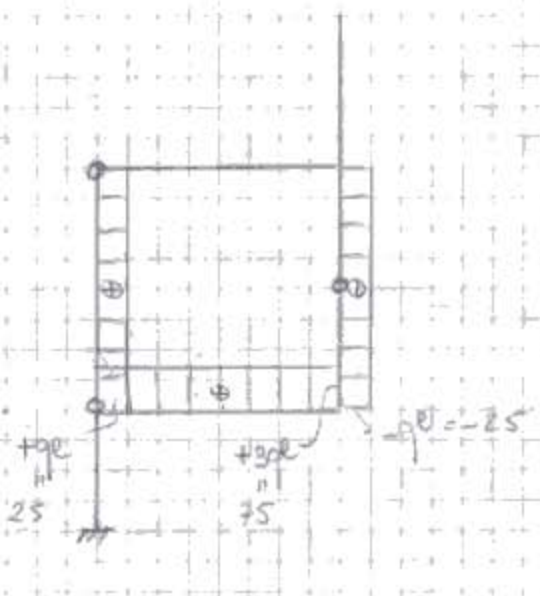
$(D)_{GFED}$ $N_b/e = 5qe$



(M) (RNm)



(T) (RN)



(N) (RN)

$M_B = \frac{15}{2}qe^2 - 3qe^2 = \frac{9}{2}qe^2$