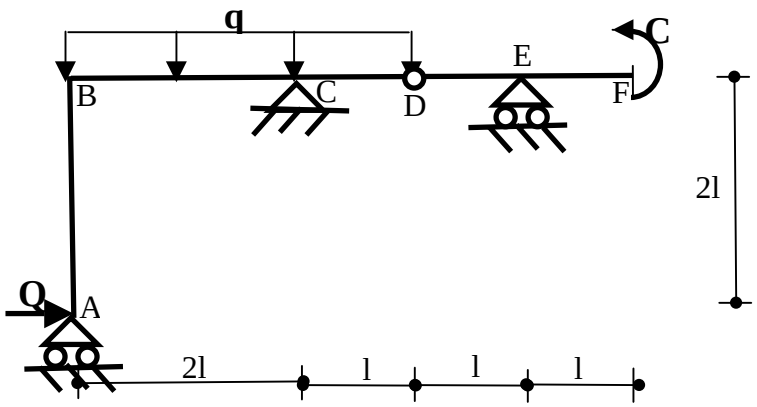
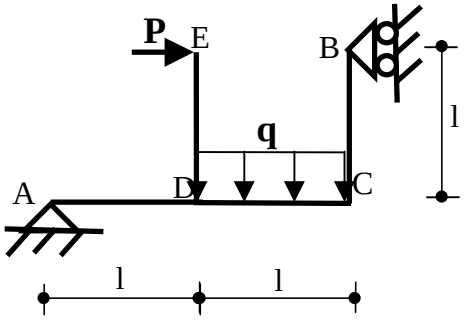
CORSO DI LAUREA IN INGEGNERIA MECCANICA
UNIVERSITÀ DEGLI STUDI DI FERRARA
PRIMA PROVA SCRITTA IN ITINERE DI STATICA
FERRARA, 29/10/2007

D

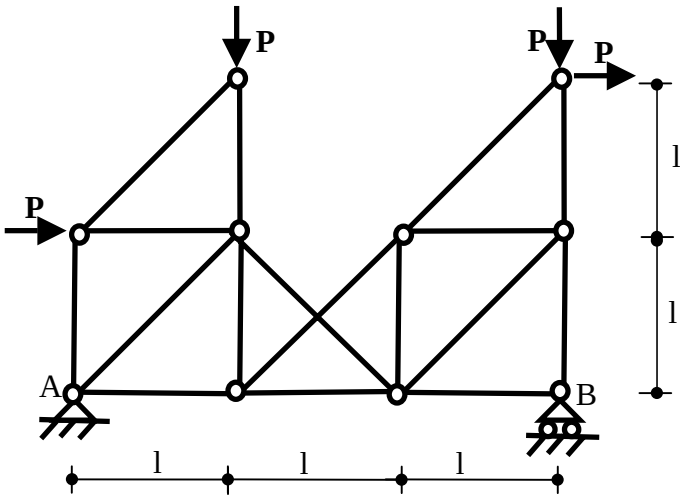
1) **Disegnare i diagrammi quotati delle azioni interne (N, T, M) per l=1.5m, q=2000 kg/m, Q=5/4ql, C=1/4ql².**



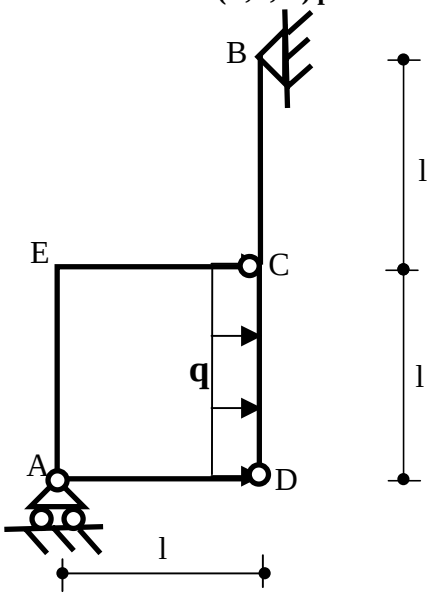
2) **Disegnare i diagrammi quotati delle azioni interne (N, T, M) per l=1.5 m, q= 2000 kg/m, P = 5/4ql.**



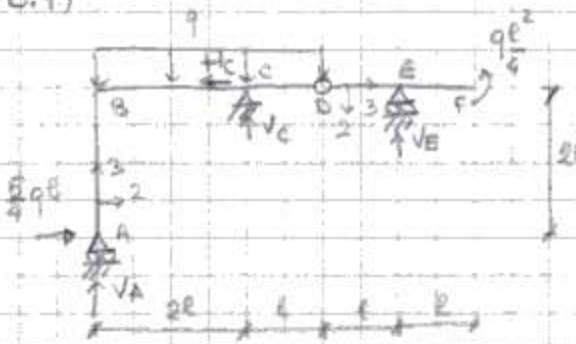
3) **Calcolare lo stato di sollecitazione per l=1.5m, P= 3500 kg.**



4) **Disegnare i diagrammi quotati dell'azione interna(N,T,M) per l=1.5 m, q=2000 kg/m.**



D.1)



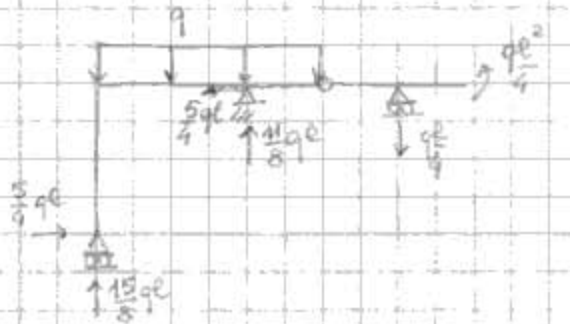
$(D)_{DEF}$ $V_E \ell = -q\frac{\ell^2}{4} \rightarrow V_E = -q\frac{\ell}{4}$

$(\rightarrow)$ $H_C = \frac{5}{4}q\ell$

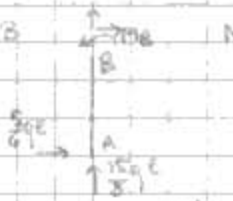
$(A\uparrow)$ $-V_C 2\ell - q\frac{\ell}{4}4\ell + q\frac{\ell^2}{4} - 3q\ell\frac{3\ell}{2} + \frac{5}{4}q\ell 2\ell = 0$

$\hookrightarrow V_C = \frac{q\ell}{2}\left(1 + \frac{9}{2} - \frac{1}{4} - \frac{5}{2}\right) = \frac{11}{8}q\ell$

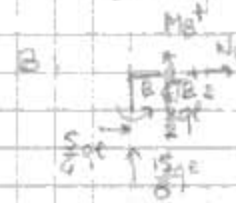
$(L\uparrow)$ $V_A = 3q\ell + q\frac{\ell}{4} - \frac{11}{8}q\ell = \frac{15}{8}q\ell$



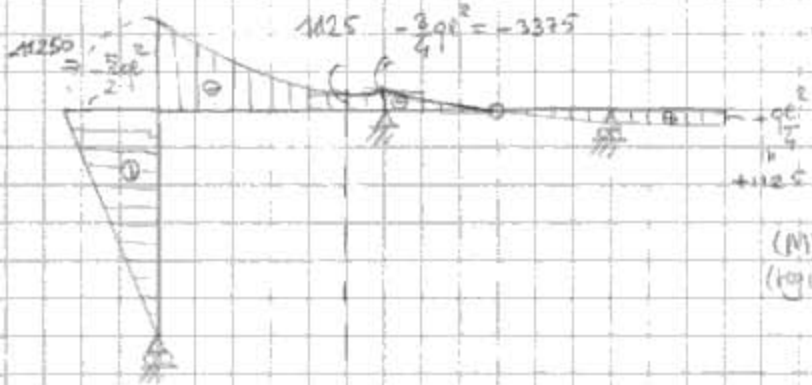
Equilibrio a A: $M_A = 0$, $N_A = -\frac{15}{8}q\ell$, $T_A = -\frac{5}{4}q\ell$



Equilibrio di AB: $M_B^- = -\frac{5}{4}q\ell 2\ell = -\frac{5}{2}q\ell^2$



Diagrammi qualitativi di (M,T,N):

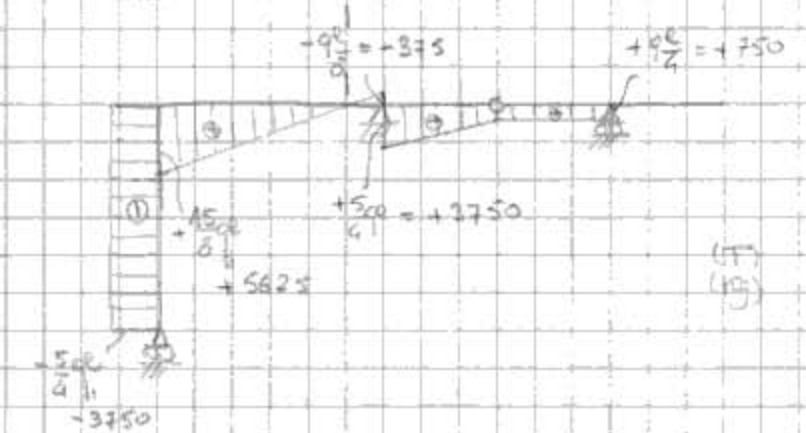


Equilibrio a B: M_B^+, N_B^+, T_B^+

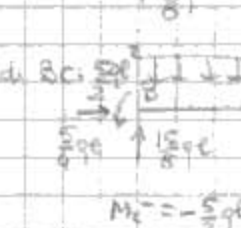
$N_B^+ = -\frac{5}{4}q\ell$

$T_B^+ = \frac{15}{8}q\ell$

$M_B^+ = +\frac{3}{4}q\ell^2$

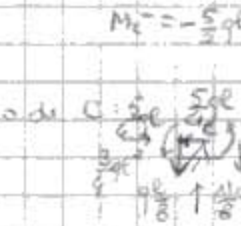


Equilibrio di BC: $N_C^- = \frac{5}{4}q\ell$, $T_C^+ = -\frac{q\ell}{8}$



$M_C^- = -\frac{5}{2}q\ell^2 + \frac{15}{4}q\ell^2 - 2q\ell^2 = +\frac{3}{4}q\ell^2$

Equilibrio di C: $N_C^+ = 0$, $T_C^+ = \frac{10}{8}q\ell = \frac{5}{4}q\ell$, $M_C^+ = -\frac{3}{4}q\ell^2$

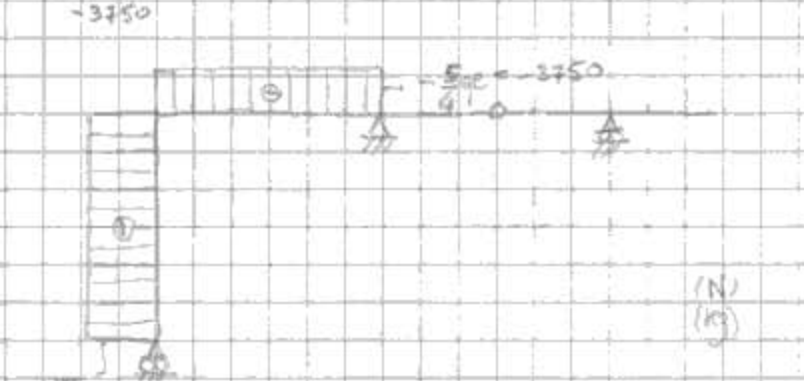


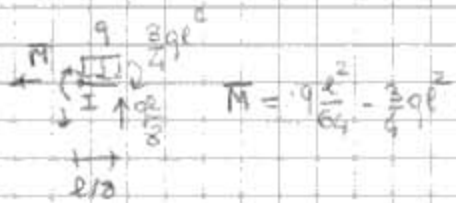
Equilibrio di CD: $N_D^- = 0$, $T_D^- = \frac{q\ell}{4}$

$M_D = \frac{3}{4}q\ell^2 + \frac{q\ell^2}{12} - \frac{5}{4}q\ell^2 = 0$

Equilibrio di DE: $M_E^- = M_E^- = q\frac{\ell^2}{4}$

Equilibrio a E: $N_E^+ = 0$, $T_E^+ = q\frac{\ell}{4}$, $M_E^+ = q\frac{\ell^2}{4}$

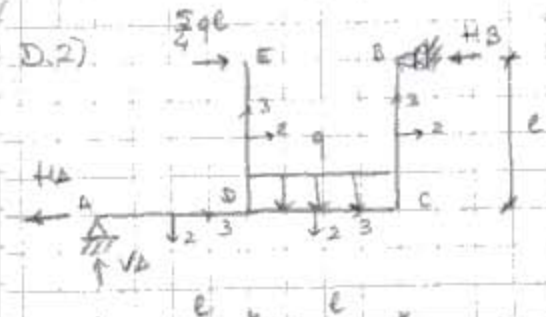




$\overline{M} = q\frac{\ell^2}{64} - \frac{3}{4}q\ell^2 - \frac{1}{2}\frac{q\ell^2}{64} = -\frac{95}{128}q\ell^2$

$= 1125$ kgm

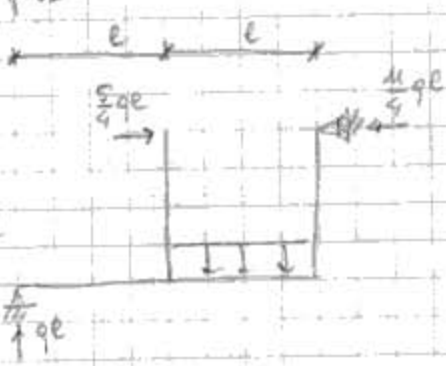
D.2)



(↑) $V_A = q\ell$

(↺) $H_B\ell = \frac{5}{4}q\ell^2 + \frac{3}{2}q\ell^2 + \frac{11}{4}q\ell^2 \rightarrow H_B = \frac{11}{4}q\ell$

(→) $H_A = \frac{5}{4}q\ell - \frac{11}{4}q\ell = \frac{5}{4}q\ell = -\frac{3}{2}q\ell$



Equilibrio in A:

$N_A = -\frac{3}{2}q\ell$

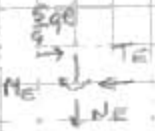
$T_A = q\ell$

$M_A = 0$

Equilibrio di AD:

$M_D^- = q\ell^2$

Equilibrio in E:

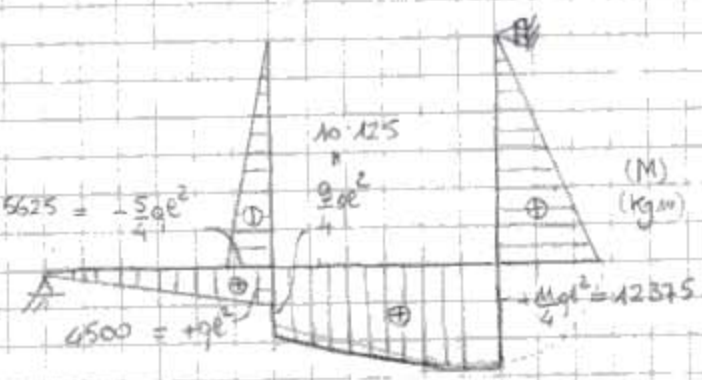


$N_E = 0$

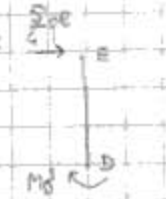
$T_E = \frac{5}{4}q\ell$

$M_E = 0$

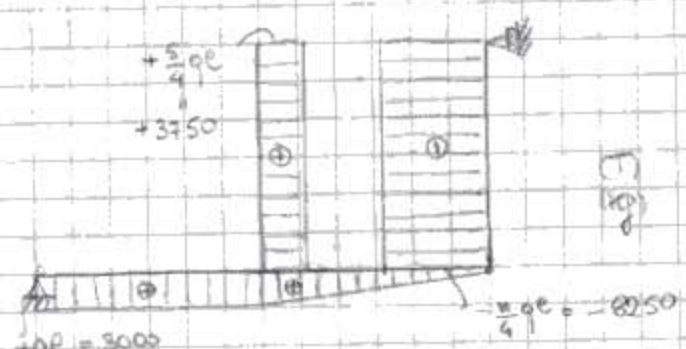
Diagrammi quotati dell'azione Tensa:



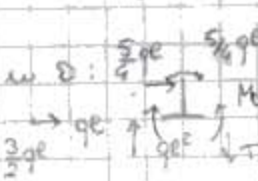
Equilibrio in ED:



$M_D^2 = -\frac{5}{4}q\ell^2$



Equilibrio in D:

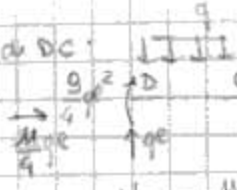


$N_{D^+} = -\left(\frac{3}{2}q\ell + \frac{5}{4}q\ell\right) = -\frac{11}{4}q\ell$

$T_{D^+} = q\ell$

$M_{D^+} = q\ell^2 + \frac{5}{4}q\ell^2 = \frac{9}{4}q\ell^2$

Equilibrio di DC:

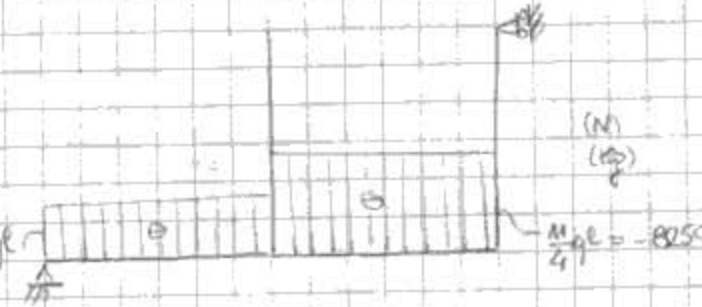


$N_C = -\frac{11}{4}q\ell$

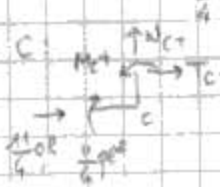
$T_{C^-} = q\ell - q\ell = 0$

$M_{C^-} = \frac{9}{4}q\ell^2 + q\ell^2 - q\ell^2 \frac{3}{2}$

$= \frac{11}{4}q\ell^2$



Equilibrio in C:

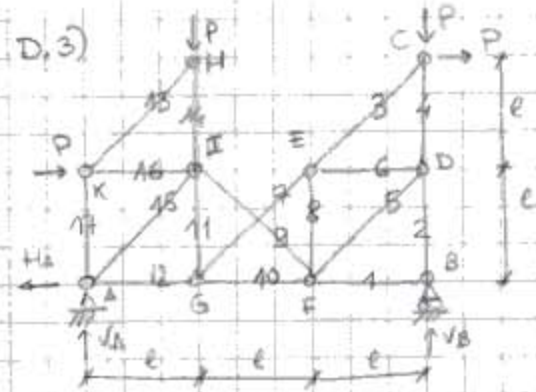


$N_{C^+} = 0$

$T_{C^+} = -\frac{11}{4}q\ell$

$M_{C^+} = \frac{11}{4}q\ell$

D, 3)

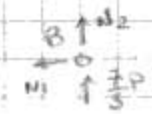


$(\rightarrow)$ $H_A = 2P$

(A) $V_B\, 3e = 2Pe + 3Pe + 2Pe = 7Pe \rightarrow V_B = \frac{7}{3}P = 8167\,kg$

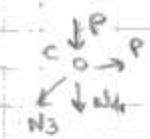
$(\uparrow)$ $V_A = (2 - \frac{7}{3}P) = -\frac{P}{3} = -1167\,kg$

Metodo dell'equilibrio dei nodi



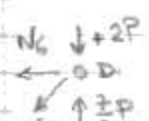
$N_1 = 0$

$N_2 = -\frac{7}{3}P$



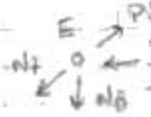
$N_3 \frac{\sqrt{2}}{2} = P$

$N_4 = -P = N_3 \frac{\sqrt{2}}{2} = -2P$



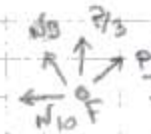
$N_5 \frac{\sqrt{2}}{2} = (\frac{7}{3} - 2)P = \frac{P}{3}$

$N_6 = -N_5 \frac{\sqrt{2}}{2} = -\frac{P}{3}$



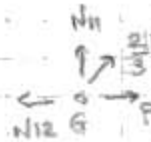
$N_7 \frac{\sqrt{2}}{2} = P\frac{\sqrt{2}}{2} - \frac{P}{3} + \frac{2}{3}P$

$N_8 = P\frac{\sqrt{2}}{2} - N_7 \frac{\sqrt{2}}{2} = \frac{P}{3}$



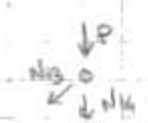
$N_9 \frac{\sqrt{2}}{2} = -\frac{P}{3} - \frac{P}{3}\frac{\sqrt{2}}{2}\frac{\sqrt{2}}{2} = -\frac{2}{3}P$

$N_{10} = P\frac{\sqrt{2}}{3}\frac{\sqrt{2}}{2} + N_9 \frac{\sqrt{2}}{2} = P$



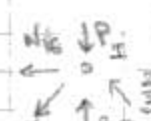
$N_{11} = -\frac{2}{3}\sqrt{2}P\frac{\sqrt{2}}{2}$

$N_{12} = P + \frac{2}{3}\sqrt{2}P\frac{\sqrt{2}}{2} = \frac{5}{3}P$



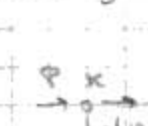
$N_{13} = 0$

$N_{14} = -P$



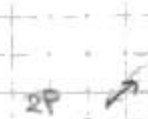
$N_{15}\frac{\sqrt{2}}{2} = \frac{2}{3}P + \frac{2}{3}P\frac{\sqrt{2}}{2}\frac{\sqrt{2}}{2}P = \frac{4}{3}P - P = \frac{P}{3}$

$N_{16} = -\frac{2}{3}P\sqrt{2}\frac{\sqrt{2}}{2} - N_{15}\frac{\sqrt{2}}{2} = -P$



$N_{16} = -P$

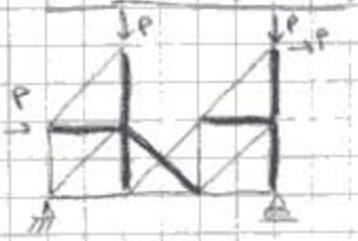
$N_{17} = 0$



$\frac{P}{3}\sqrt{2}\frac{\sqrt{2}}{2} = \frac{P}{3}$

$2P = \frac{P}{3}\sqrt{2}\frac{\sqrt{2}}{2} + \frac{5}{3}P$

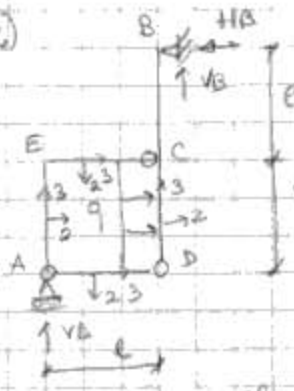
ASTA	N	Kg
1	0	0
2	$-\frac{7}{3}P$	-8167
3	$P\sqrt{2}$	4950
4	$-2P$	-7000
5	$\frac{P\sqrt{2}}{3}$	1650
6	$-\frac{P}{3}$	-1167
7	$\frac{2}{3}\sqrt{2}P$	3300
8	$+\frac{P}{3}$	+1167
9	$-\frac{2}{3}P\sqrt{2}$	-3300
10	$+P$	+3500
11	$-\frac{2}{3}P$	-2333
12	$+\frac{5}{3}P$	5833
13	0	0
14	$-P$	-3500
15	$+\frac{P}{3}\sqrt{2}$	1650
16	$-P$	-3500
17	0	0



— TIRANTE

— PUNTONE

D.4)



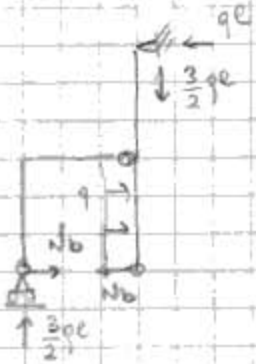
$(\leftarrow)$ $H_B = q\ell$

$(B\uparrow)$ $V_A \ell = \frac{3}{2} q\ell^2 \rightarrow V_A = \frac{3}{2} q\ell$

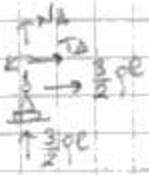
$(\uparrow)$ $V_B = -\frac{3}{2} q\ell$

Eq.me della somma in C:

$(C\uparrow)_{AEC}$ $N_D \ell = \frac{3}{2} q\ell^2 \rightarrow N_D = \frac{3}{2} q\ell$



Equilibrio in A:

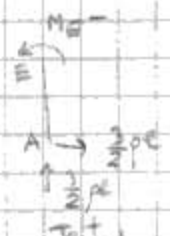


$N_A = -\frac{3}{2} q\ell$

$T_A = -\frac{3}{2} q\ell$

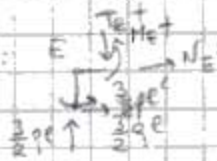
$M_A = 0$

Equilibrio di AE:



$M_E = -\frac{3}{2} q\ell^2$

Equilibrio in E:

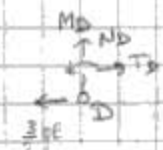


$N_E^+ = -\frac{3}{2} q\ell$

$T_E^+ = \frac{3}{2} q\ell$

$M_E^+ = -\frac{3}{2} q\ell^2$

Equilibrio in D:

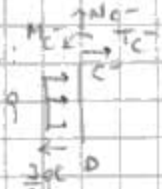


$N_D = 0$

$T_D = \frac{3}{2} q\ell$

$M_D = 0$

Equilibrio di DC:

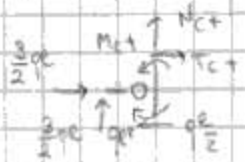


$N_C^- = 0$

$T_C^- = \frac{q\ell}{2}$

$M_C^- = \frac{3}{2} q\ell^2 + \frac{q\ell^2}{2} + q\ell^2$

Equilibrio in C:

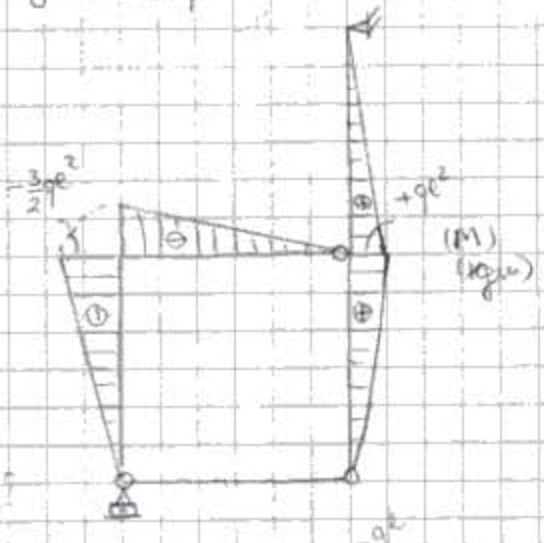


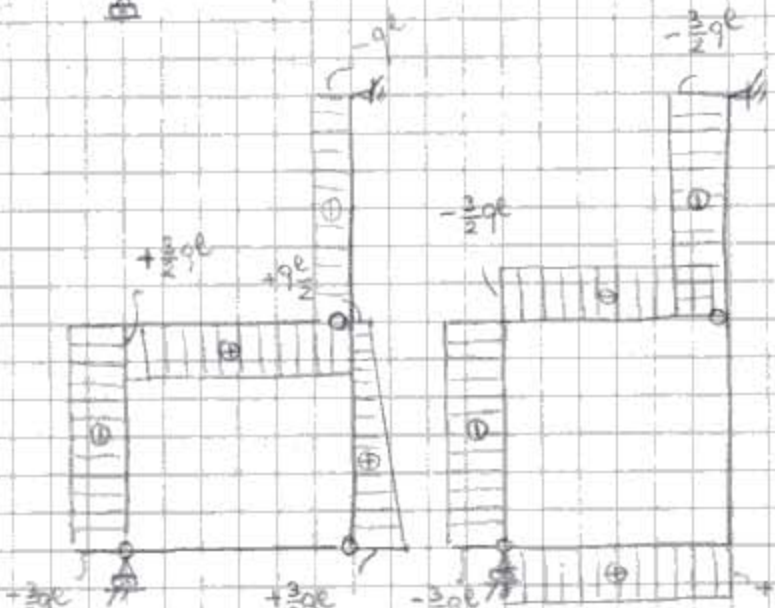
$N_{C+} = \frac{3}{2} q\ell$

$T_{C+} = -q\ell$

$M_{C+} = q\ell^2$

Diagrammi quotati dell'azione interna:





(T)
(Kg)

(N)
(Kg)