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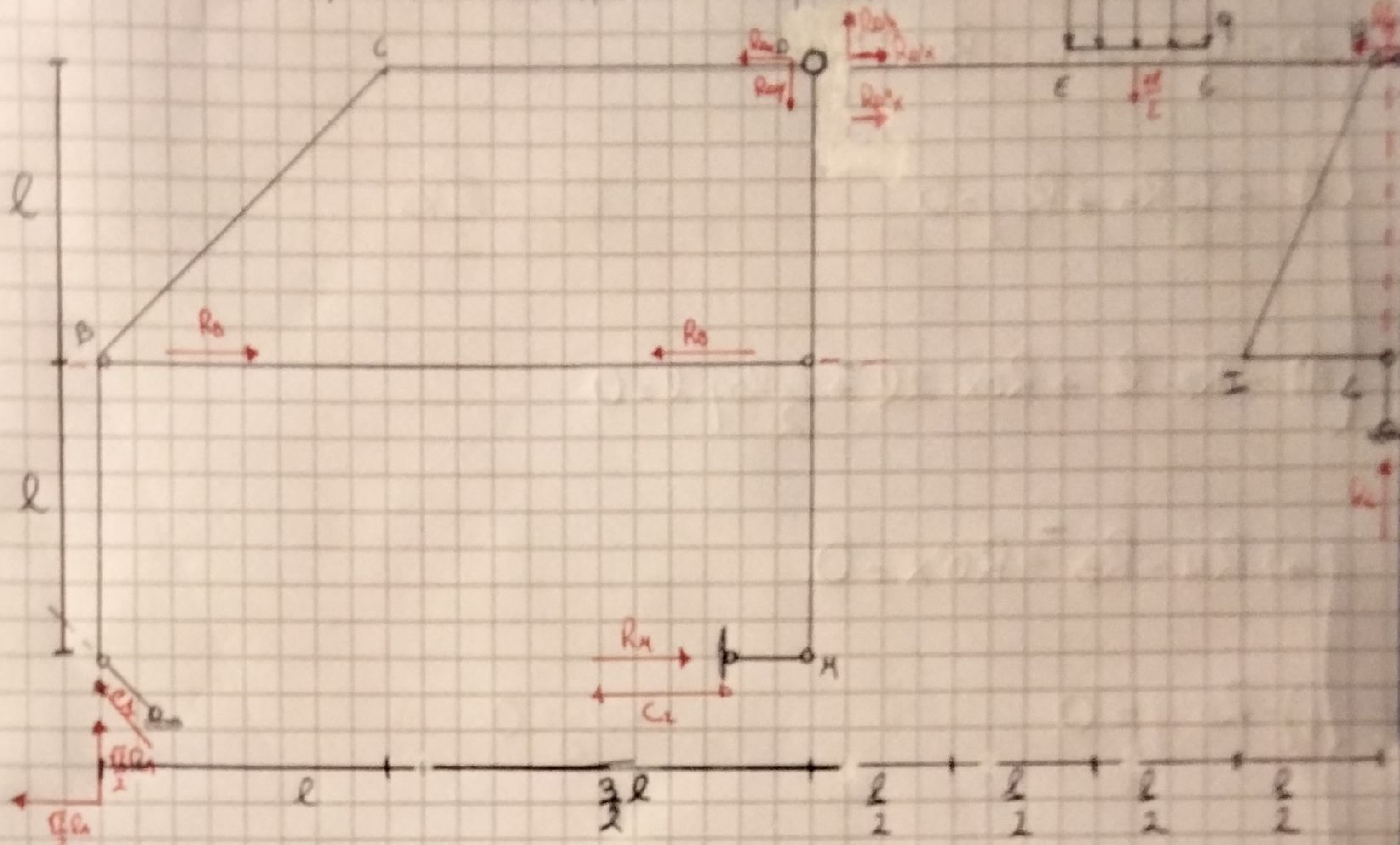
COMPITO

Dati: $l = 3{,}5\ m$ $h = 7{,}0\ m$ $q = 3{,}5\ m$



1) Classificazione

$t = 3$

$3t = 9$

$s = se + si = (1+1+1+1) + (1+4) = 9$

$\Rightarrow s = 3t$ Condizione necessaria di non labilità

2) Verifica condizione suff. di non labilità

• $C_1 \in$ appartiene asse pendolo in A C_{12} non esiste

• $C_1 \in$ appartiene asse pendolo in H

• C_3 intersezione pendolo in L e pendolo in H

∄ C proprio o improprio del piano compatibile con i vincoli applicati al sistema, esso è NON labile ($l = 0$). Dalla dualità statico-cinematica

$i - l = s - 3t \Rightarrow i = 0$ STRUTTURA ISOSTATICA (i=0, l=0)

3) Prosvorni simboloxi

$$\begin{cases} \rightarrow) -\frac{\sqrt{2}}{2} R_A + R_B - R_{Dx} = 0 \\ \downarrow) -\frac{\sqrt{2}}{2} R_A + R_{Dy} = 0 \qquad R_{Dy} = \frac{\sqrt{2}}{2} R_A \\ A) -R_B \cdot l + R_{Dx} \cdot 2l - \frac{5}{2} R_{Dy} \cdot l = 0 \end{cases}$$

$$\begin{cases} \rightarrow) R_H - R_B - R_D''x = 0 \\ \downarrow) -R_D''y = 0 \qquad R_D''y = 0 \\ H) R_B \cdot l + R_D''x \cdot 2l = 0 \qquad R_D'x = -\frac{R_B}{2} \end{cases}$$

$$\begin{cases} \rightarrow) -R_H + R_D'x = 0 \qquad R_D'x = R_H \\ \downarrow) -R_L + \frac{ql}{2} + R_D'y = 0 \\ L) R_H \cdot l + q\frac{l}{2} \cdot \frac{3}{4} l - R_{Dx} \cdot l + R_D'y \cdot 2l = 0 \end{cases}$$

ekvivalentni sistem

$\rightarrow$) $R_{Dx} = R_{Dx} + R_D''x$

$\downarrow$) $R_{Dy} + R_D'y = R_D''y$

$R_{Dy} = R_D'y$

$$\begin{cases} -\frac{\sqrt{2}}{2} R_A + R_B - R_{Dx} = 0 \\ R_{Dy} = \frac{\sqrt{2}}{2} R_A \\ 2 R_{D''x} \cdot l + R_{Dx} 2l - \frac{5}{2} R_{Dy} \cdot l = 0 \quad \rightarrow -\frac{5}{2} R_{Dy} \cdot l + R_{D'x} = 0 \\ R_H + 2R_{D''x} - R_{D'x} = 0 \quad R_H = -R_{D''x} \quad R_{D'x} 2l = R_{Dy} \frac{5}{2} l \\ R_{D''y} = 0 \qquad R_{D'x} = R_{Dy} \frac{5}{4} \\ R_{D''x} = -\frac{R_B}{2} \\ R_{D'x} = R_H \\ R_L = R_{D'y} + \frac{ql}{2} \\ R_{D'x} \cdot l + \frac{3}{8} q l^2 - R_{D'x} \cdot l + R_{D'y} \cdot 2l = 0 \end{cases}$$

$$R_{D'y} \cdot 2l = -\frac{3}{8} q l^2$$

$$R_{D'y} = -\frac{3}{16} ql = -2{,}3\,KN$$

$$R_{Dy} = 2{,}3\,KN \; KN$$

$$\frac{\sqrt{2}}{2} R_A = 2{,}3\,KN \; KN$$

$$R_{D'x} = 2{,}88\,KN$$

$$R_H = 2{,}88\,KN$$

$$R_L = 3{,}83\,KN$$

$$R_B = R_{Dx} - \frac{\sqrt{2}}{2} R_A$$

$$R_H = 5{,}2\,KN$$

$$R_{Dx} = 8\,KN$$

$$R_{D''x}$$

(2)

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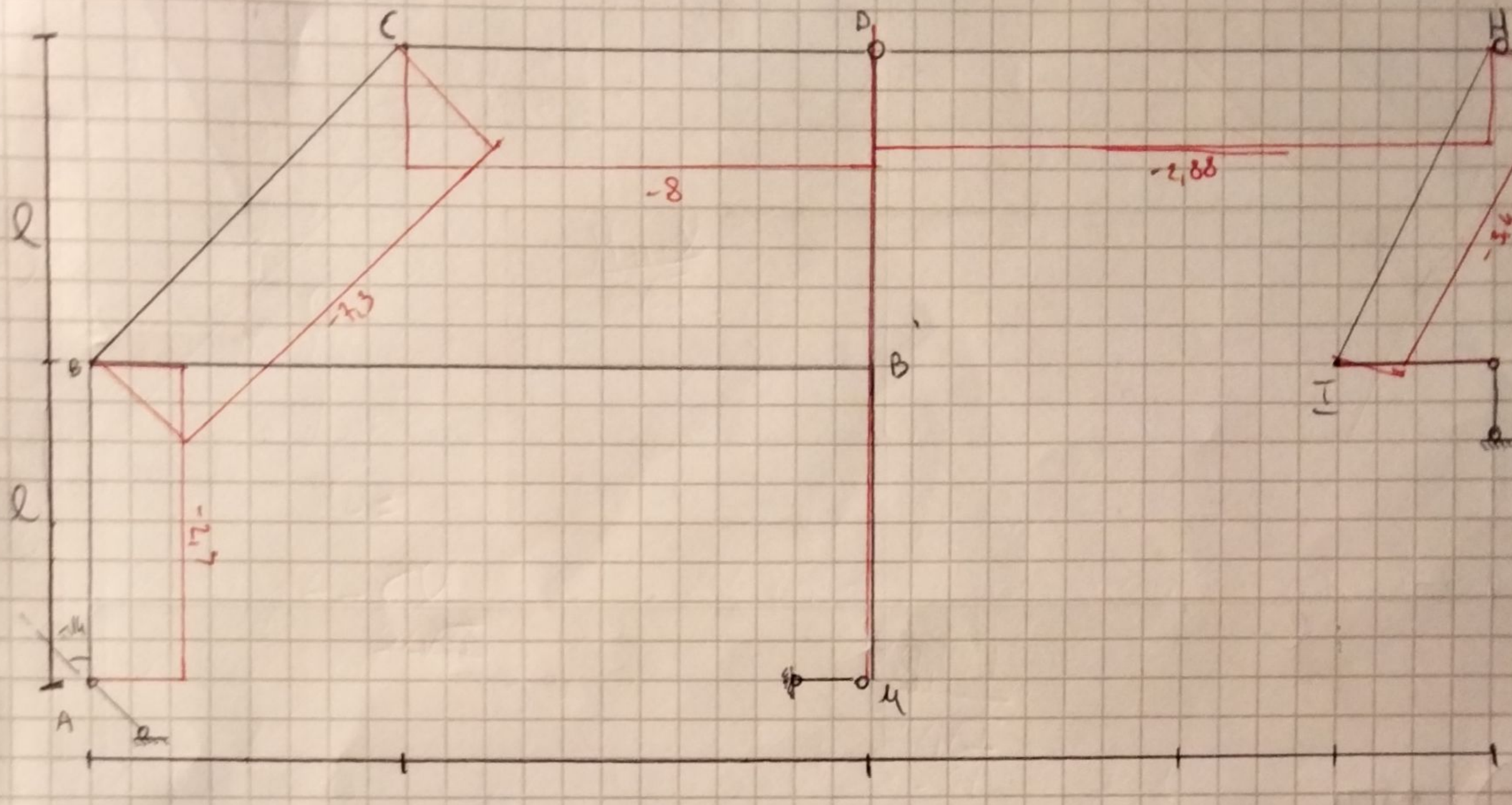


(N) ←□→

$N_{AB} = -\frac{\sqrt{2}}{2} R_A = -2,3\,KN$

$N_{BC} = -\frac{\sqrt{2}}{2} R_A \frac{\sqrt{2}}{2} - R_B \cdot \frac{\sqrt{2}}{2} = -7,3\,KN$

$N_{CD} = -R_{Dx} = -8\,KN$

$N_{MD} = 0$

$N_{DH} = -R_H = -2,88\,KN$

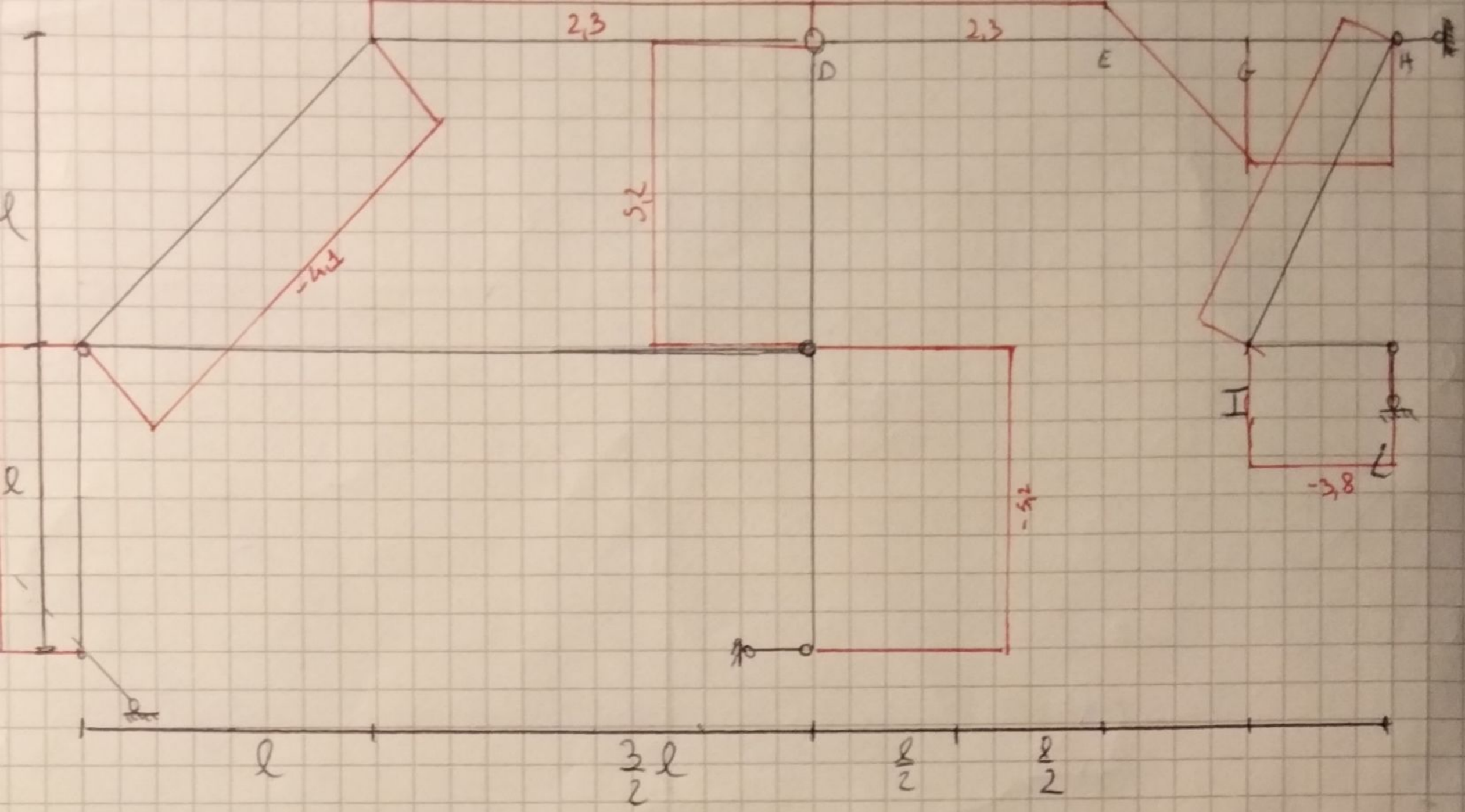
$N_{HI} = -R_M \cdot \sin\theta = -3,42\,KN$

$\text{arctan}\left(\frac{l}{l}\right) = 45°$

$\text{arctan}(2) = 63,43°$

$\cos\theta = 0,4472$

$\sin\theta = 0,8943$



(T) ↑□↓

$T_{AB} = \frac{\sqrt{2}}{2} R_A = 2,3\,KN$

$T_{BC} = 2\frac{\sqrt{2}}{2} R_A \cdot \frac{\sqrt{2}}{2} - R_B \frac{\sqrt{2}}{2} = 4,1\,KN$

$T_{CD} = R_{Dy} = 2,3\,KN$

$T_{HB'} = -R_H = -5,2\,KN$

$T_{B'D''} = R_{D''x} = 5,2\,KN$

$T_{LI} = -R_L = -3,8\,KN$

$T_{IH} = R_L \cos\theta = 1,9\,KN$

$T_{D'E} = R_{D'y} = 2,3\,KN$

$T_{GH} = R_{D'y} - q\frac{l}{2} = -3,8\,KN$

(M) ↑□↑

$M_A = 0\,KN \cdot m$

$M_B = \frac{\sqrt{2}}{2} R_A \cdot l = 8\,KN \cdot m$

$M_C = \frac{\sqrt{2}}{2} R_A \cdot 2l - R_B l + \frac{\sqrt{2}}{2} R_D l = 12,1\,KN \cdot m$

$M_D = M_{D'} = M_{D''} = 0$

$M_H = 0$ $M_{B'} = R_H \cdot l = 18,2\,KN \cdot m$

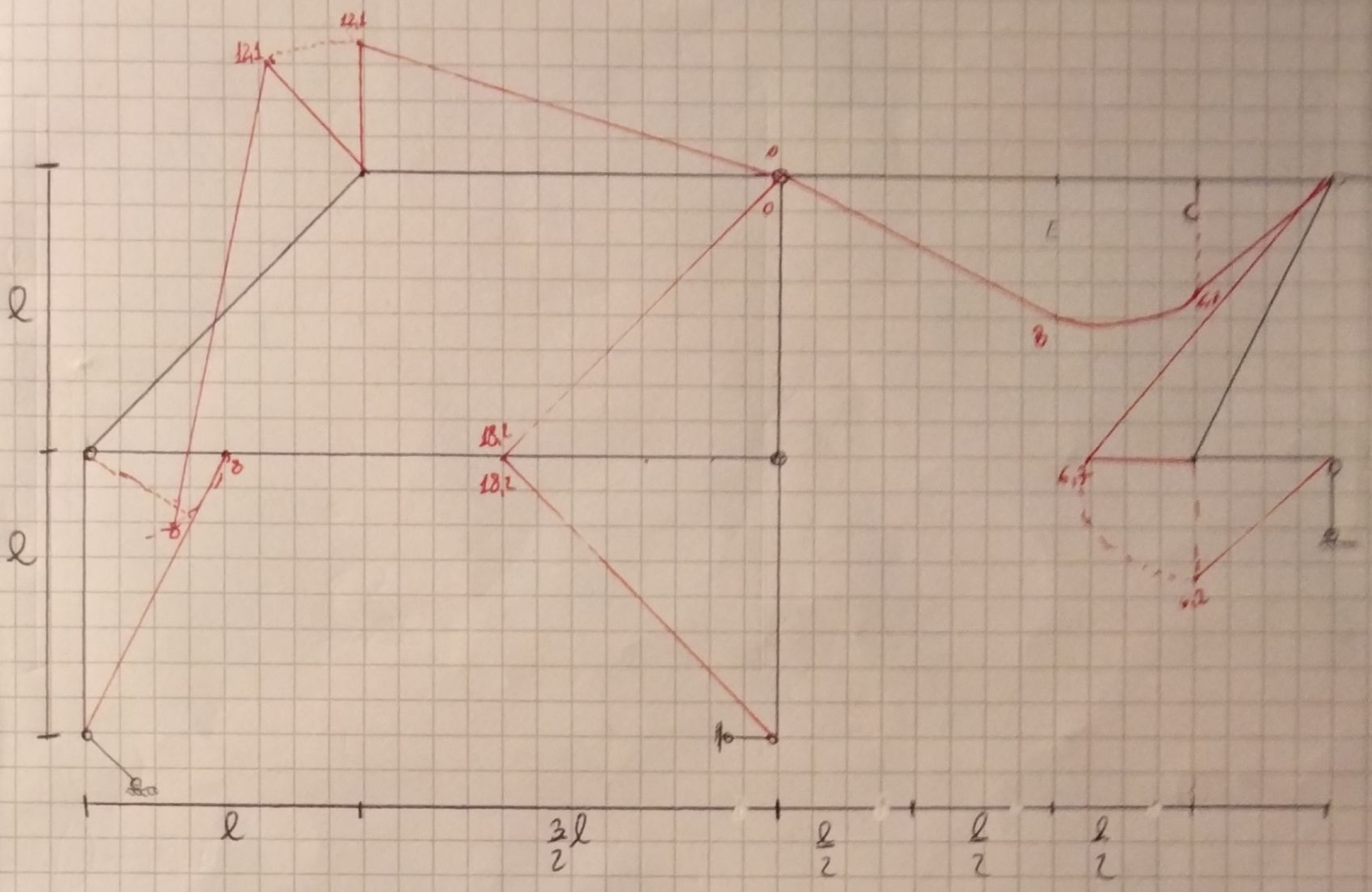
$M_L = 0$

$M_I = R_L \cdot \frac{l}{2} = 6,7\,KN \cdot m$

$M_H = 0$

$M_G = R_L \cdot \frac{l}{2} = 6,7\,KN \cdot m$

$M_E = R_{Dy} \cdot l = 8\,KN \cdot m$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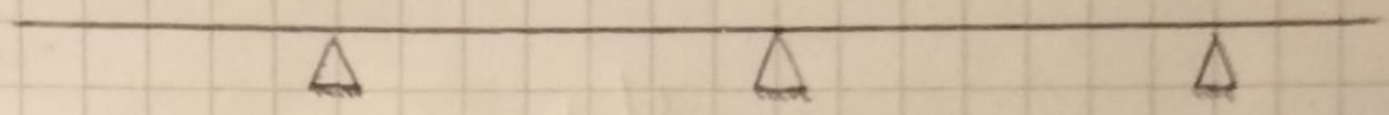
Dati: $l = 3{,}5\ m$ $\quad q = 1{,}75\ \frac{kN}{m}$ $\quad F = 35\ kN$ $\quad C = 7{,}00\ kN\,m$

1) Classificazione

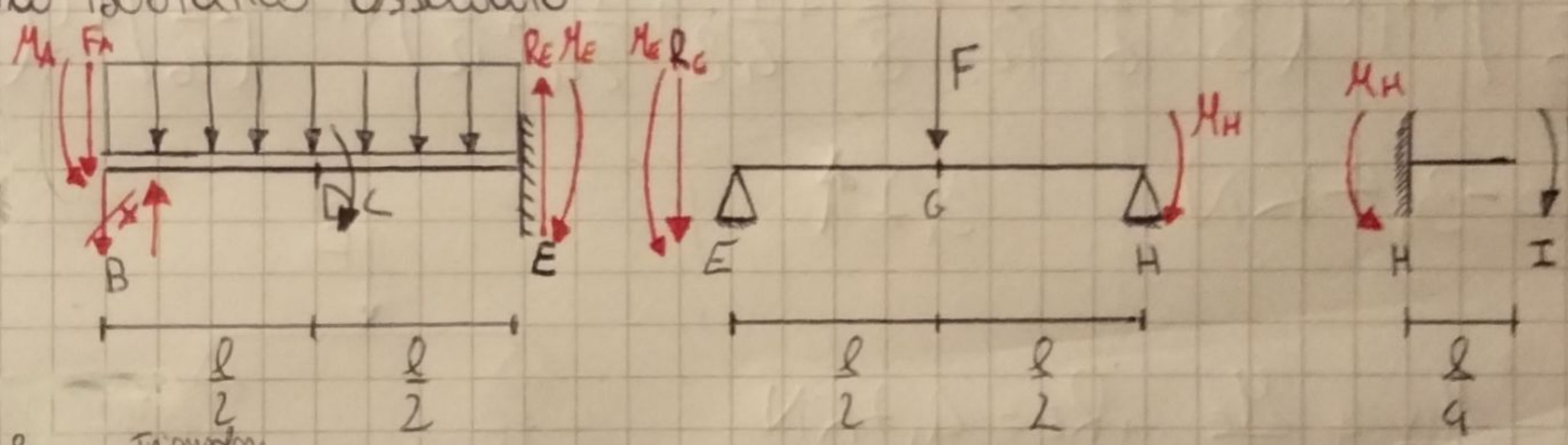


$t = 1$
$2t = 2$
$s^* = 3$
$\Rightarrow s^* \geq 2t$ Condizione necessaria di non labilità

$l = 0 \Rightarrow \nexists$ (vincolo proprio o improprio del piano compatibile con i vincoli esterni applicati alla trave

Dalla dualità statico-cinematica $i - l = s^* - 2t \Rightarrow i = 1$ TRAVE 1 VOLTA IPERSTATICA
$(i = 1,\ l = 0)$

2) Schema isostatico associato



$F_A = \cancel{Q} + q\frac{l}{2} + \frac{q}{2}\frac{l}{2} = \frac{3}{4}ql$ $\qquad R_E = X + ql + F_A$ $\qquad M_H = C$

$q\frac{l}{2}\frac{l}{2} + \frac{q}{2}\frac{l}{2}\frac{l}{6}$ $\qquad M_E = M_A + X \cdot l + F_A \cdot l + q\frac{l^2}{2} - C$

$M_A = \frac{ql^2}{4} + \frac{ql^2}{24} = \frac{7}{24}ql^2$

$V_B = V_B^{(q)} + V_B^{(x)} + V_B^{(F_A)} + V_B^{(M_A)} + V_B^{(F_A)} + V_B^{(\varphi_{HE})} + V_B^{(C)}$

$V_B^{(q)} = \frac{ql^4}{8EI}$ $\qquad V_B^{(F_A)} = \cancel{\quad} + \left(\frac{ql^2}{2} + \frac{ql}{4}\right)\frac{l^3}{3EI}$ $\qquad V_B^{(C)} = \frac{Cl^2}{8EI}$

$V_B^{(x)} = \frac{Xl^3}{3EI}$ $\qquad V_B^{(M_A)} = \left(\frac{ql^2}{4} + \frac{ql^2}{24}\right)\frac{l^2}{2EI}$ $\qquad V_B^{(\varphi_{HE})} = \varphi_{HE} \cdot l$

$$\varphi_{HE} = \varphi_{HE}^{(F)} + \varphi_{HE}^{(M_H)} + \varphi_{HE}^{(M_E)}$$

$$\varphi_{HE}^{(F)} = -\frac{Fl^2}{16EI}$$

$$\varphi_{HE}^{(M_H)} = -\frac{Cl}{6EI}$$

$$M_E = M_A + Xl + F_A l + \frac{ql^2}{2} - C$$

$$M_H = C$$

$$\varphi_{HE}^{(M_E)} = \frac{M_A l}{6EI} + \frac{Xl^2}{6EI} + \frac{F_A l^2}{6EI} + \frac{ql^3}{12EI} - \frac{Cl}{6EI}$$

$$\frac{Xl^3}{3} + \frac{ql^4}{8} + \frac{3}{8}Cl^2 + \frac{ql^4}{6} + \frac{ql^4}{12} + \frac{ql^4}{8} + \frac{ql^4}{48} - \frac{Fl^3}{16} - \frac{Cl^2}{6} + \frac{7}{24}ql^4 +$$

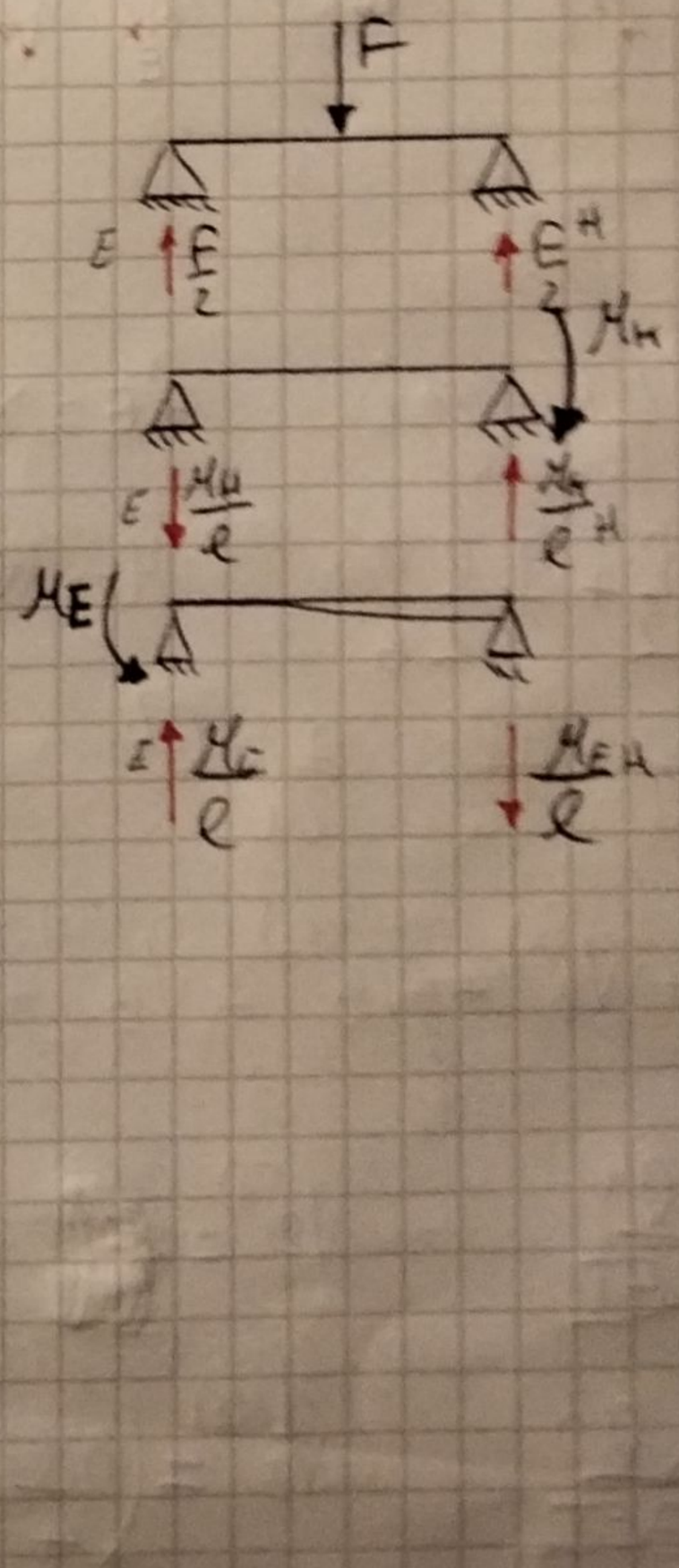
$$\frac{Xl^3}{6} + \frac{3}{24}ql^4 + \frac{ql^4}{12} - \frac{Cl^2}{6}$$

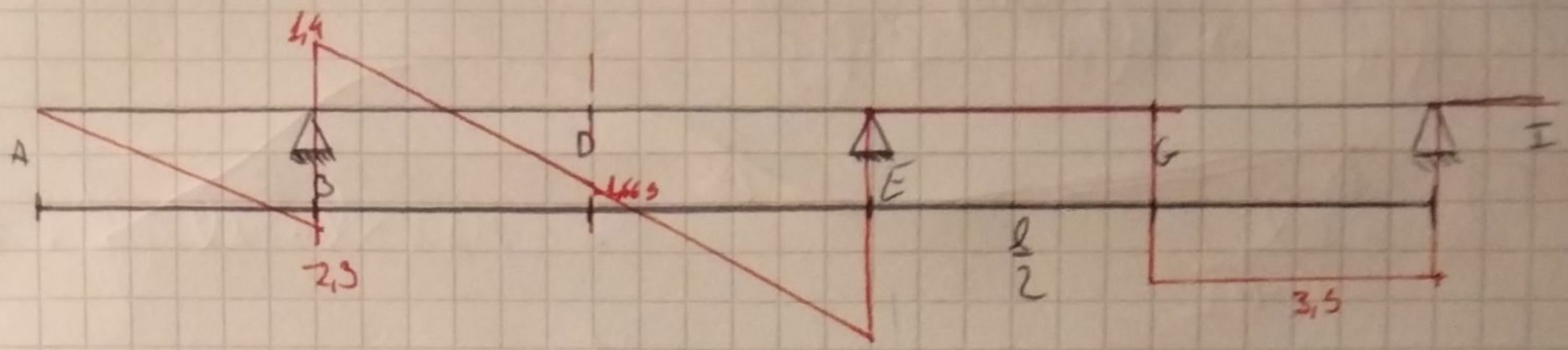
$$Xl^3\left(\frac{1}{3} + \frac{1}{6}\right) + ql^4\left(\frac{1}{8} + \frac{1}{6} + \frac{1}{12} + \frac{1}{8} + \frac{1}{48} + \frac{7}{24} + \frac{1}{12}\right) + Fl^3\left(-\frac{1}{16}\right) + C\left(-\frac{1}{6} + \frac{3}{8} - \frac{1}{6}\right)$$

$$X = -3{,}7\,KN \qquad 3{,}7 \uparrow$$

$$\uparrow R_E = \frac{F}{2} - \frac{M_H}{l} + \frac{M_E}{l} \qquad +R_E = 4{,}7\,KN$$

$$\uparrow R_H = \frac{F}{2} + \frac{M_H}{l} - \frac{M_E}{l} = 3{,}5\,KN$$





$T_A = 0$

$T_B^- = -2,3\ KN$

$T_B^+ = T_B^- + X = 1,4\ KN$

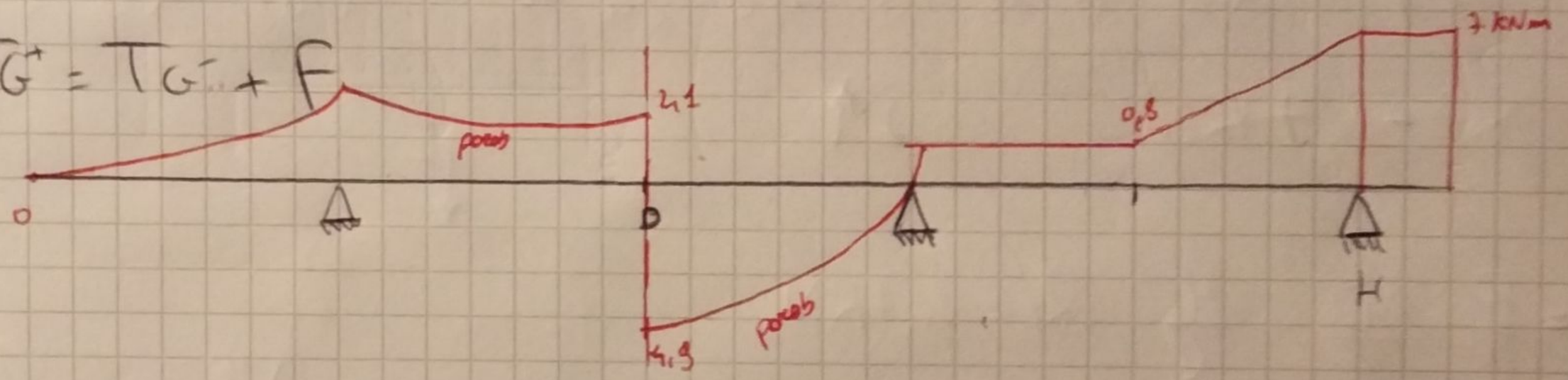
$T_D = T_B^+ - q\frac{l}{2} = -1665\ KN$

$T_E^- = T_D - q\frac{l}{2} = -4,7\ KN$

$T_E^+ = T_E^- + R_E = 0\ KN$

$T_G^- = 0$

$T_G^+ = T_G^- + F$



$M_A = 0$

$M_B = M_A = 2,1\ KN$

$M_H = 7\ KN \cdot m$

$M_G = (-Rl/2 = 0,87$

$M_E = (-R_H l + F\frac{l}{2} = 0875$

$M_D^+ = (-R_H\frac{3}{2} + Fl + q\frac{l^2}{8}$

$= -4,9$

$M_D^- =$

$-4,9 + C = 2,1$