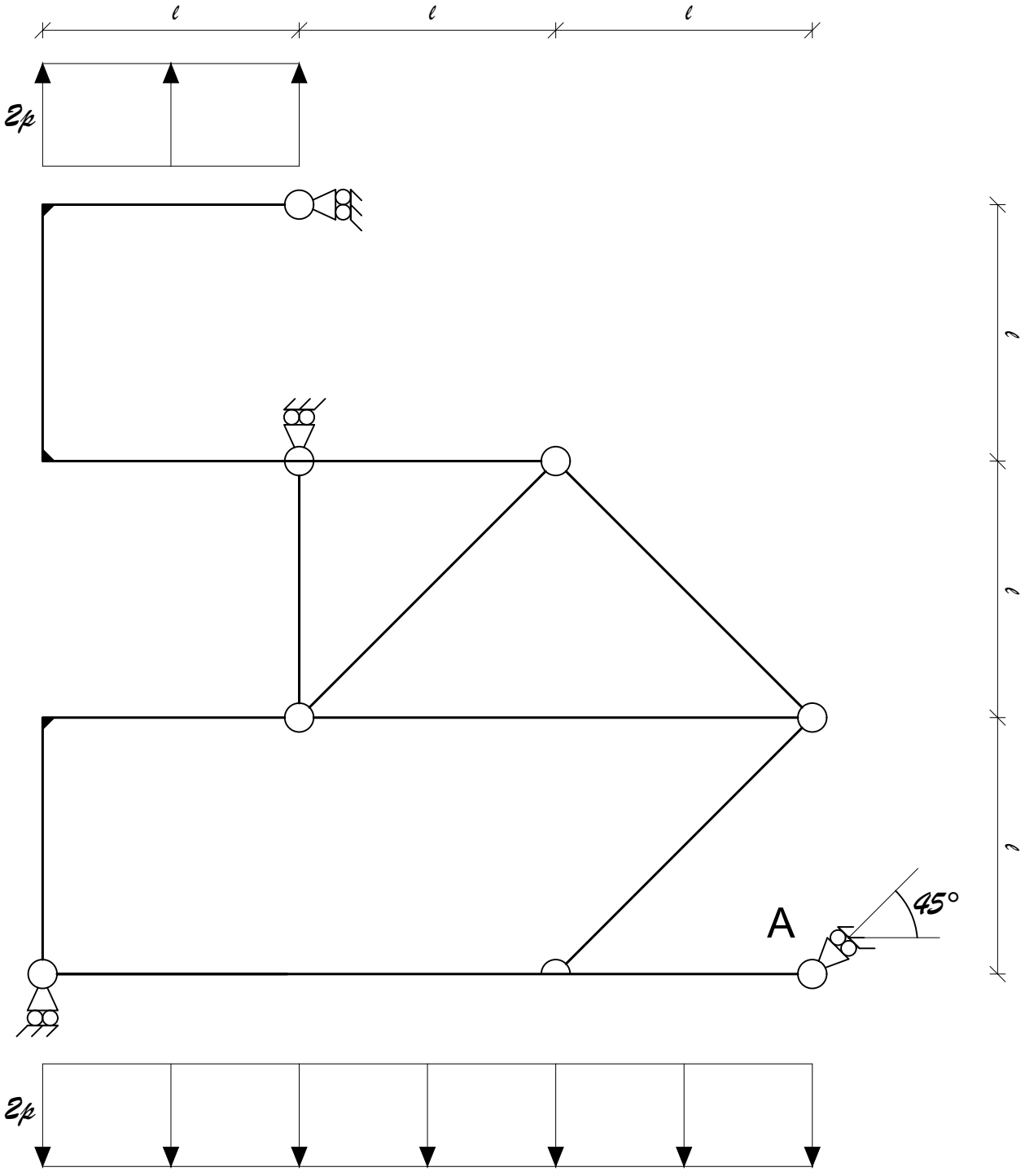
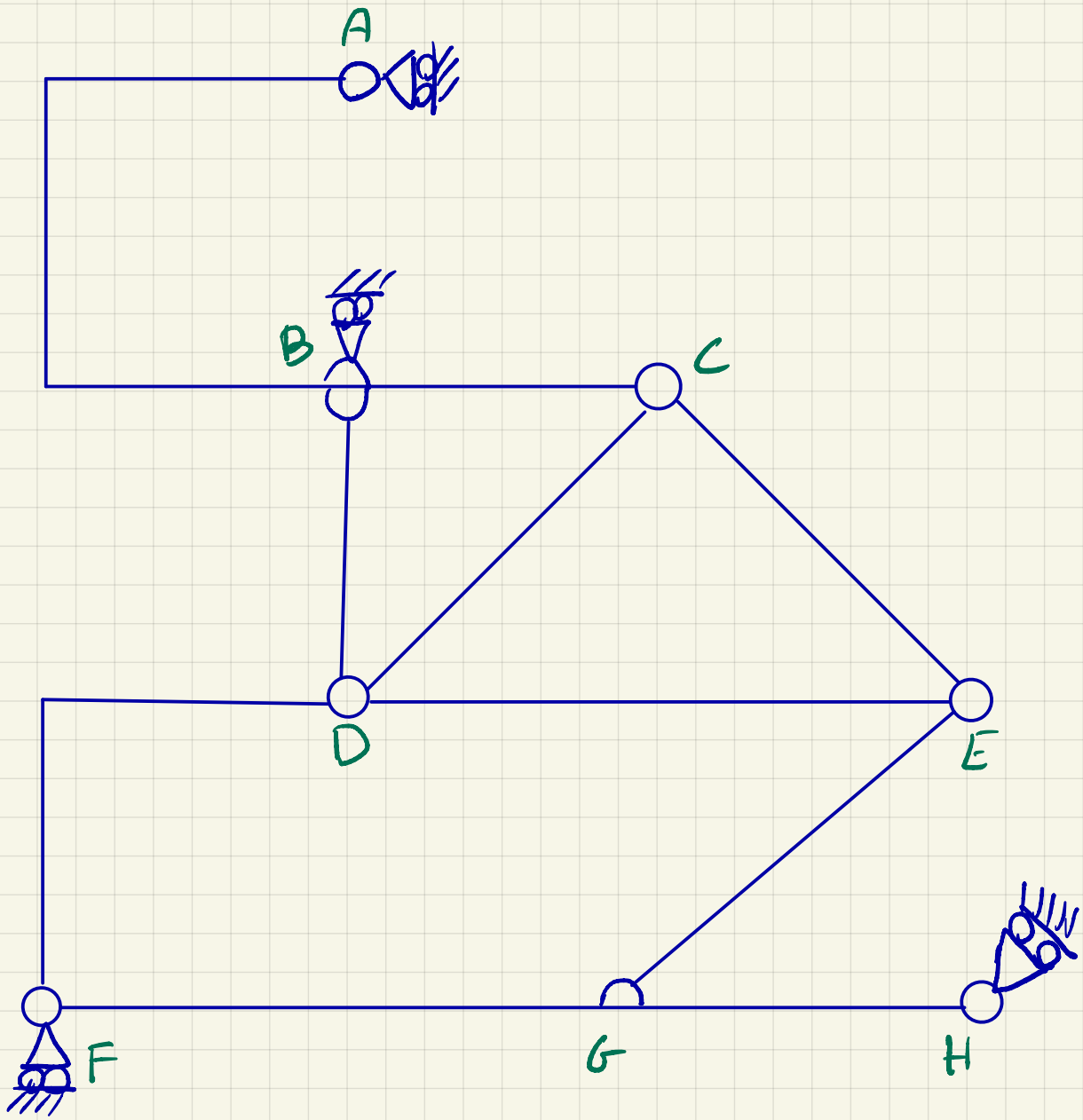
Prova Scritta di SCIENZA DELLE COSTRUZIONI - 8.02.2021 - FILA A

Con riferimento alla struttura in figura:
1. svolgere l'analisi cinematica e classificare la struttura
2. se la struttura risulta staticamente determinata, procedere al punto seguente. Altrimenti, modificare il vincolo in A in modo tale da rendere la struttura staticamente determinata
3. calcolare le reazioni vincolari, e riportare i valori su questo foglio
4. tracciare i diagrammi delle azioni interne, indicando anche i valori di massimo e di minimo e la loro posizione

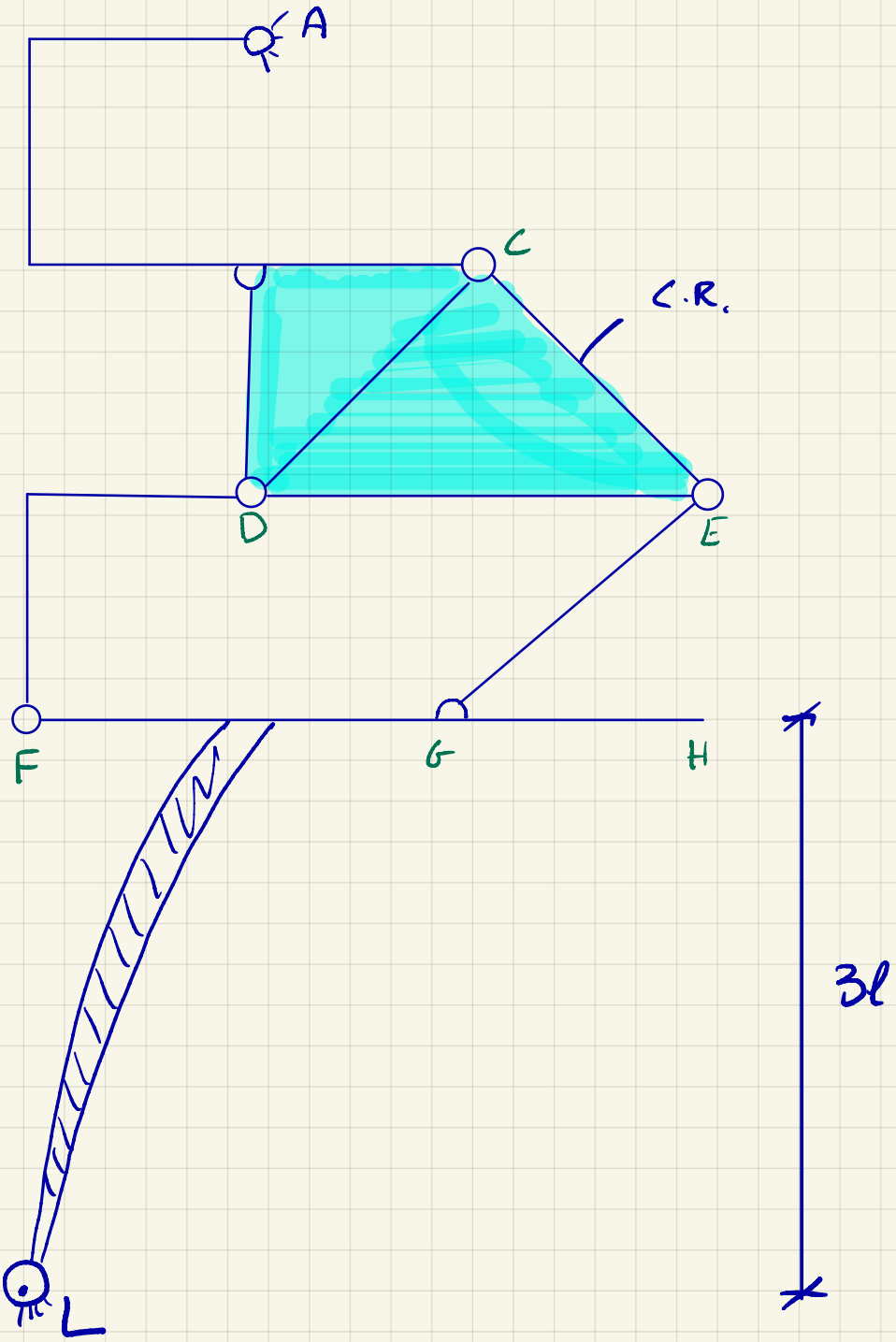




Analisi cinematica

- Aste ABC, BD e DC triangolo isostatico non labile (CIR B, C, D non allineate)
- Aste DEC + Corpo rigido ABCD triang. isostatico non labile (CIR DCE non allineate)
- Si possono combinare i carrelli A e B in una cerniera in A poiché agenti sulla stessa asta

- Analogamente per quanto concerne i carrelli FH. Sono equiv. a una corniera in L

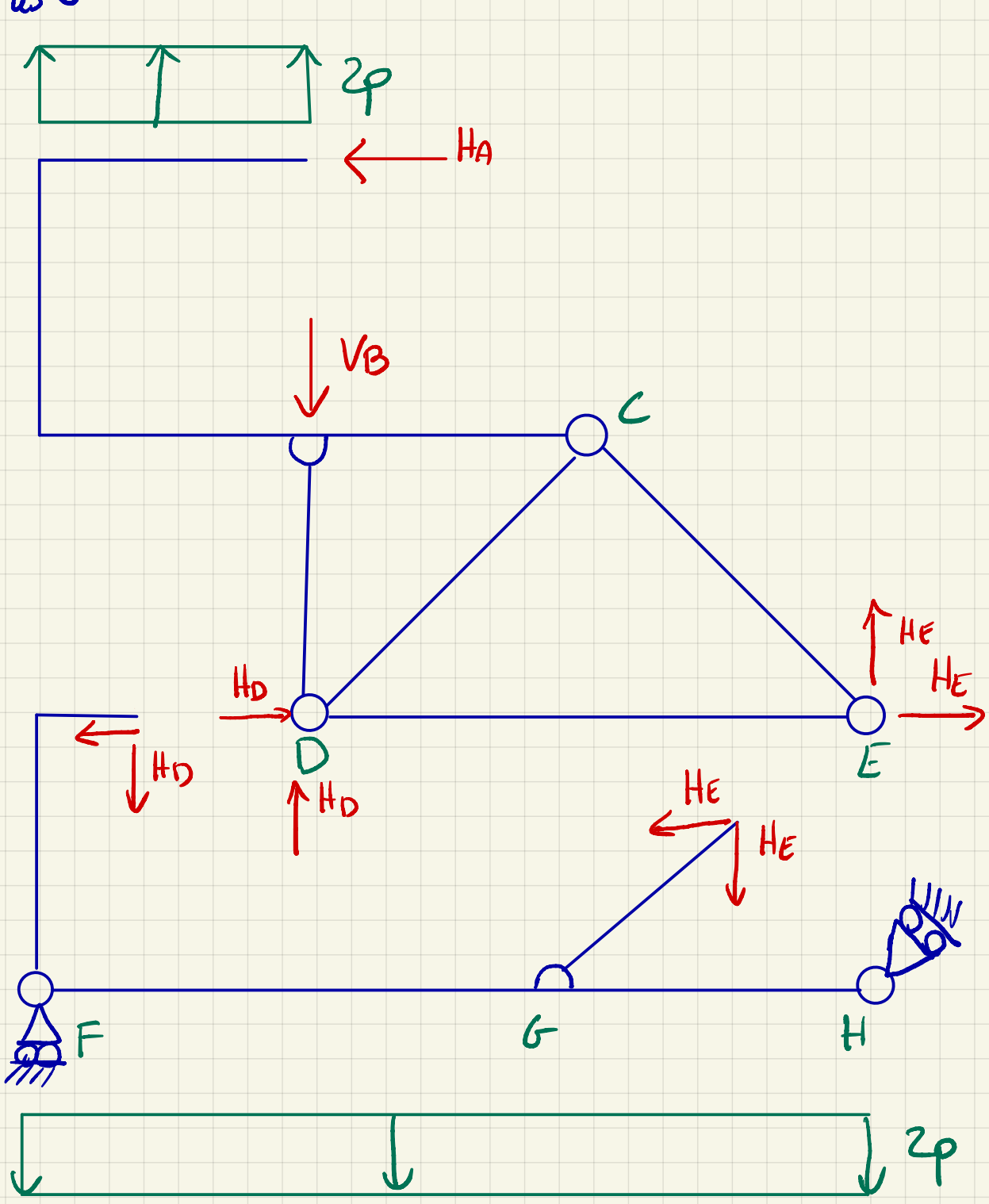


Risulta un quadrilatero articolato non labile. I CIR a terra sono i punti A e L. Il CIR relativo si ottiene combinando le due bielle FD e GE.
È il p.to improprio $R_{\infty} \angle 65°$

Reazioni vincolari

Dopo aver "aperto" le due bielle DF e GE, si possono determinare le RV in A e B solvendo:

$$\begin{cases} \sum M_{(L)} = 0 & \text{GLOBALE} \\ \sum F = 0 \quad \text{ACDE} & \text{AUSILIARIA} \end{cases}$$



EQUIL. BIELLE

$$\sum_{DF} M_{(F)} = 0 \rightarrow V_D = H_D$$

$$\sum_{EG} M_{(G)} = 0 \rightarrow H_E = V_E$$

EQUILIBRIO GLOBALE

$$\curvearrowright \sum M_{(L)} = 0 \qquad + \cdot 6l - V_B l + 2pl\frac{l}{2} - 6pl \cdot \frac{3}{2}l = 0$$

$$V_B - 8pl = 0 \qquad (1)$$

EQUAZIONE AUSILIARIA

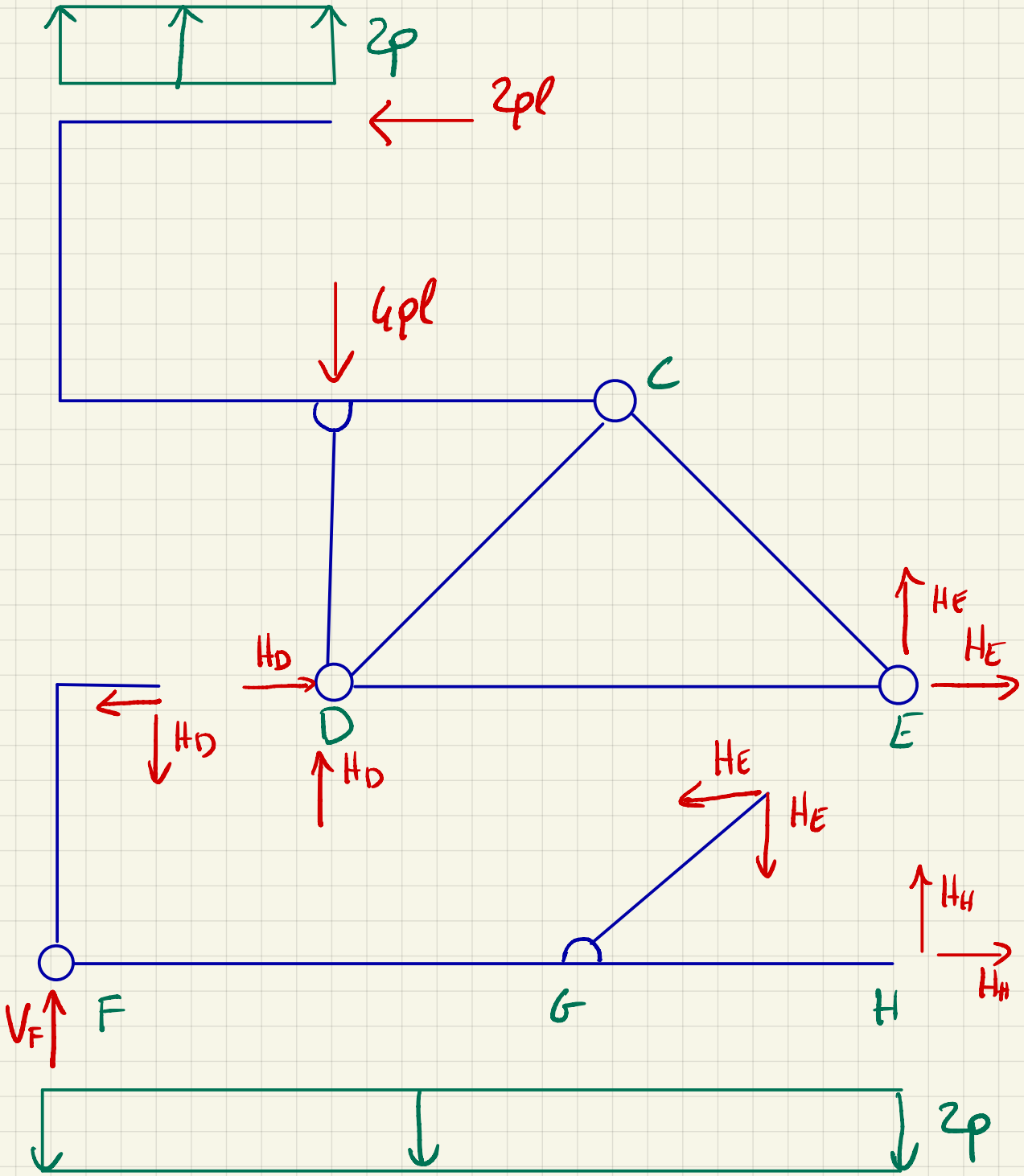
$$\sum_{ACDE} F_{\downarrow} = 0 \qquad \downarrow \rightarrow \qquad -H_A + V_B - 2pl = 0 \qquad (2)$$

DA (1) $\quad V_B = 6H_A - 8pl$

DA (2) $\quad -H_A + 6H_A - 8pl - 2pl = 0$

$$5H_A = 10pl \rightarrow \boxed{\begin{array}{l} H_A = 2pl \\ V_B = 4pl \end{array}}$$

EQUILIBRIO GLOBALE



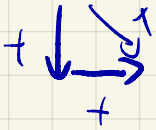
$$\Sigma F_H = 0 \rightarrow \boxed{H_H = 2pl}$$

$$\Sigma F_V = 0 \qquad \cancel{2pl} - \cancel{4pl} + \cancel{2pl} + V_F - 6pl = 0 \qquad \boxed{V_F = 6pl}$$

Controllo RV

$$\circlearrowleft \Sigma M_{(A)} = 0 \qquad 6pl^2 + pl^2 + 6pl \cdot \frac{l}{2} - 2pl \cdot 2l - 2pl \cdot 3l \stackrel{?}{=} 0 \qquad \text{ok!}$$

$\sum_{FEH} F_\downarrow = 0 \qquad -6pl + 6pl = 0 \qquad$ ok!



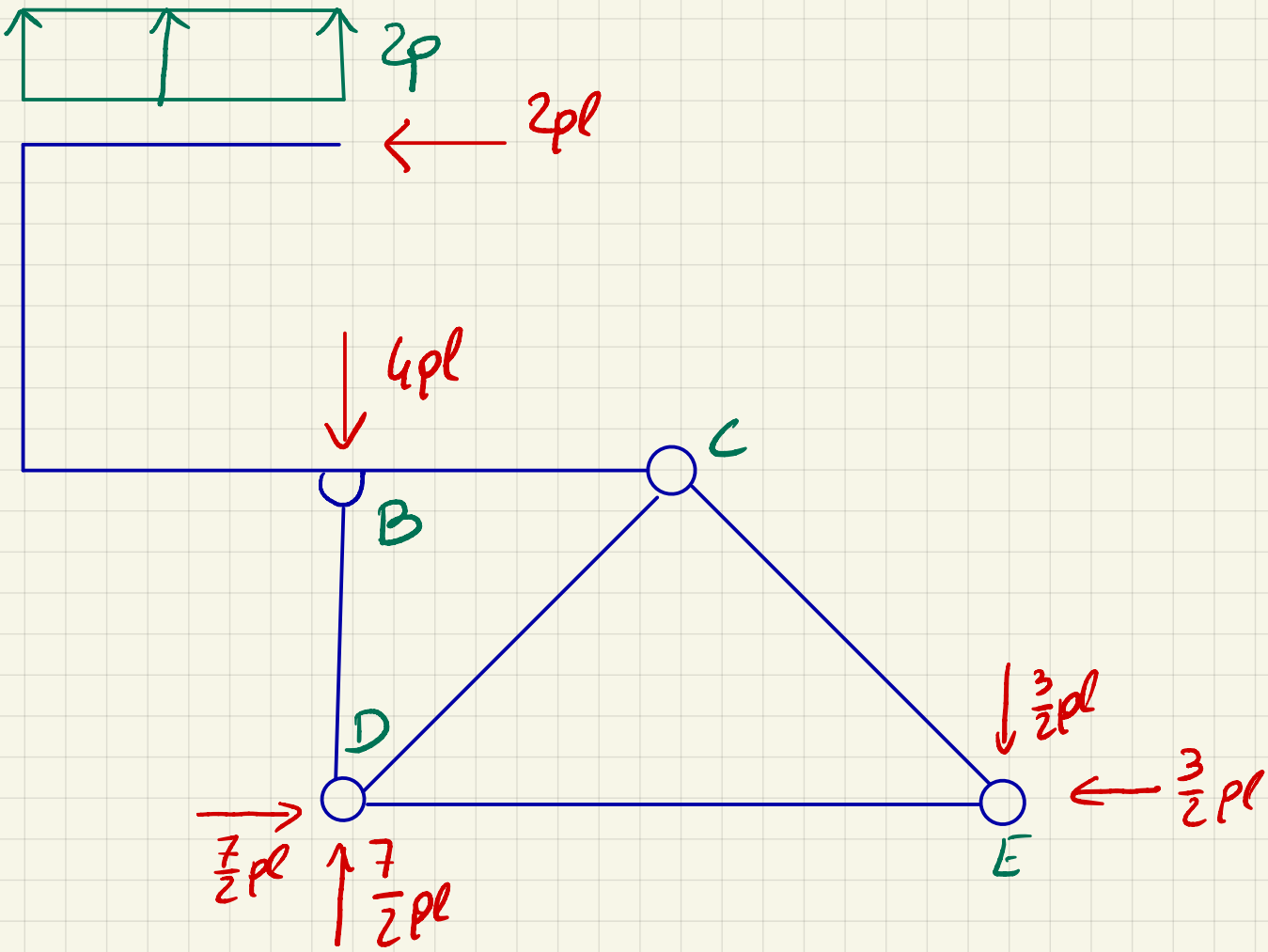
Azioni interne

Biella: $\circlearrowleft \sum_{ACDE} M_{(D)} = 0 \qquad 2pl \cdot 2l - pl^2 + H_E \cdot 2l = 0$

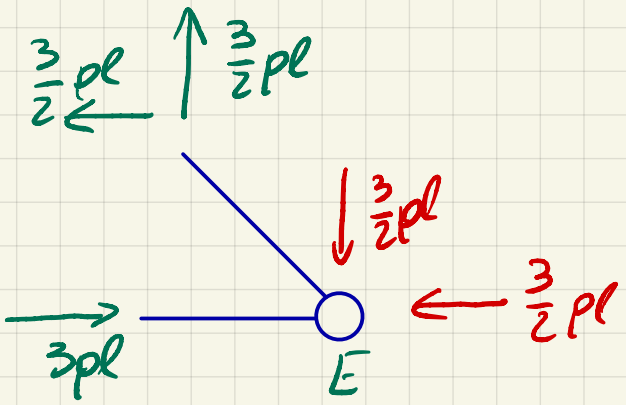
$$H_E = -\frac{3}{2}pl$$

$\rightarrow \sum F_H = 0 \qquad H_D - \frac{3}{2}pl - 2pl = 0 \qquad H_D = \frac{7}{2}pl$

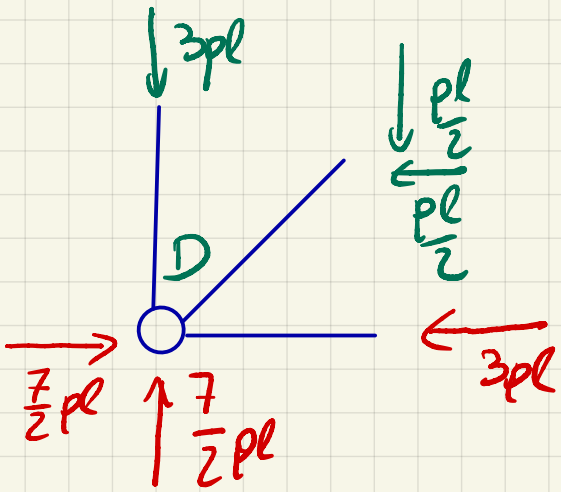
Reticolare

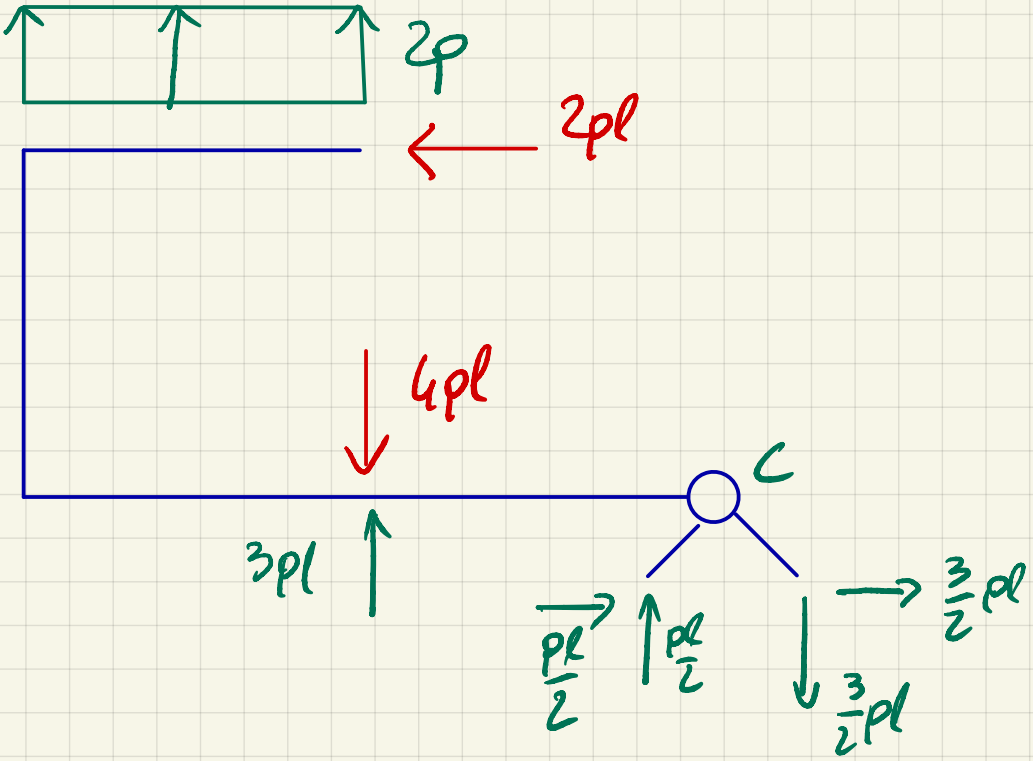


NODO E

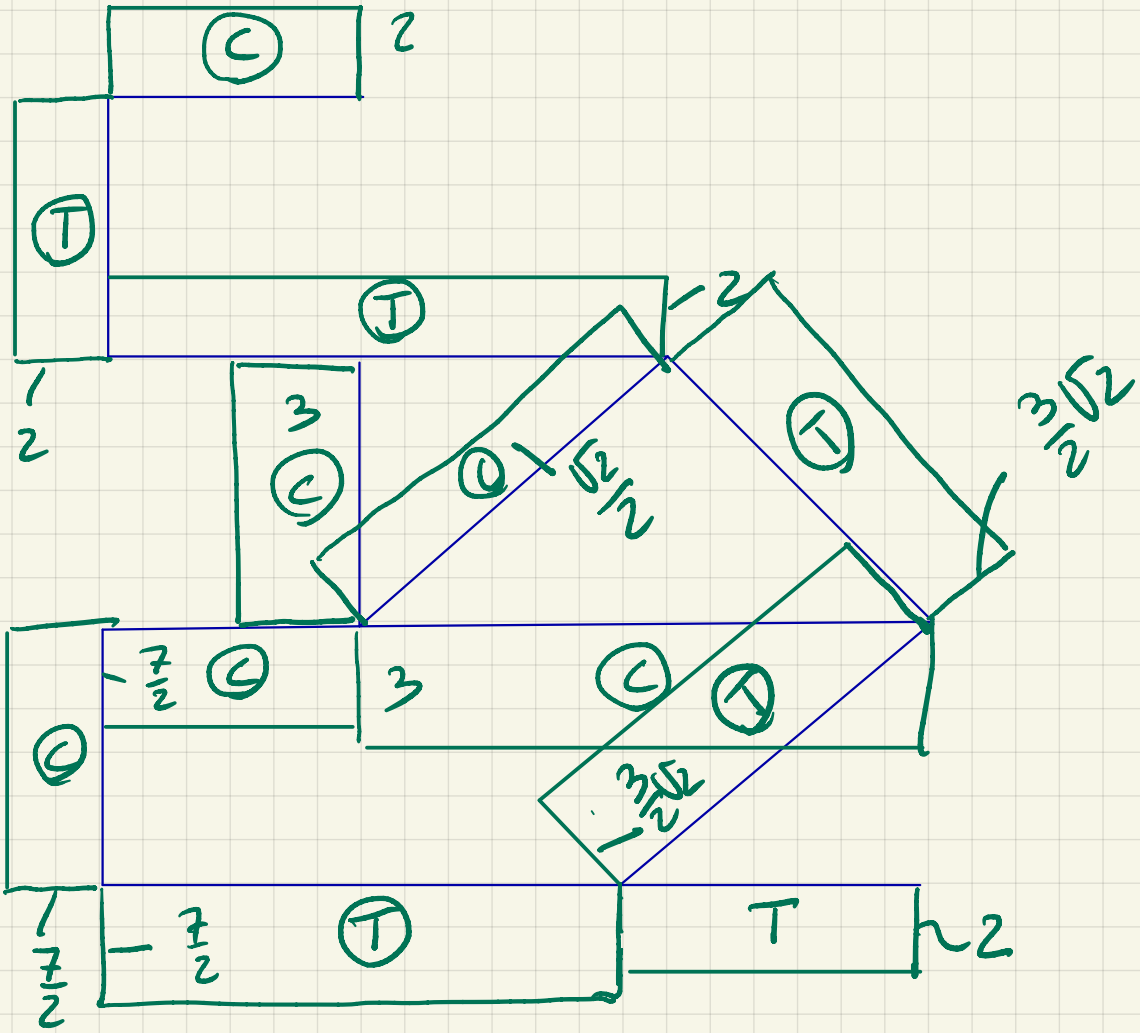

3/2 pl
3/2 pl
3/2 pl
3/2 pl
3pl
E

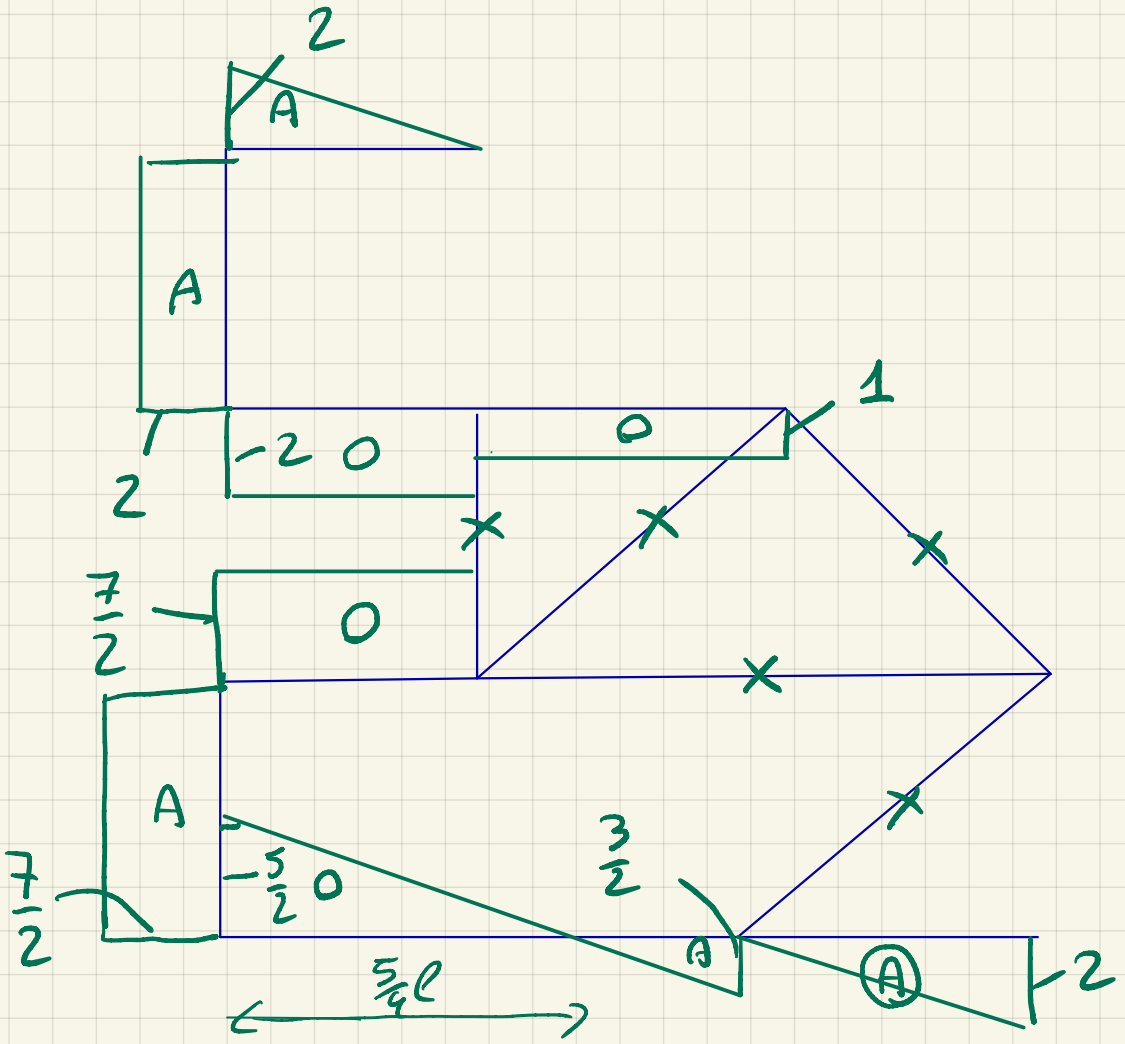
NODO D


3pl
pl/2
pl/2
D
7/2 pl
7/2 pl
3pl


2p
2pl
4pl
C
3pl
pl/2
pl/2
3/2 pl
3/2 pl

Diagrammi

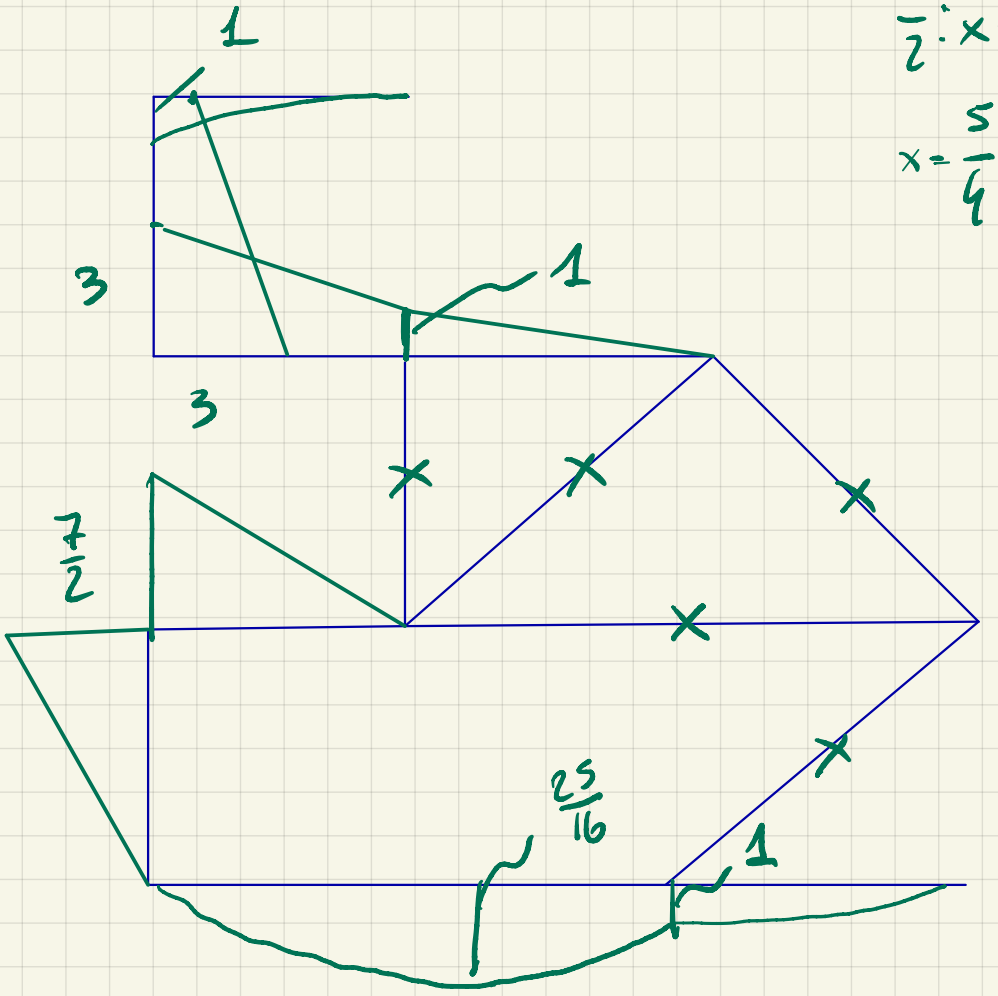




$\frac{T}{p\ell}$

$\frac{5}{2} : x = 4 : 2\ell$

$x = \frac{5}{4}\ell$



$\frac{M}{p\ell^2}$