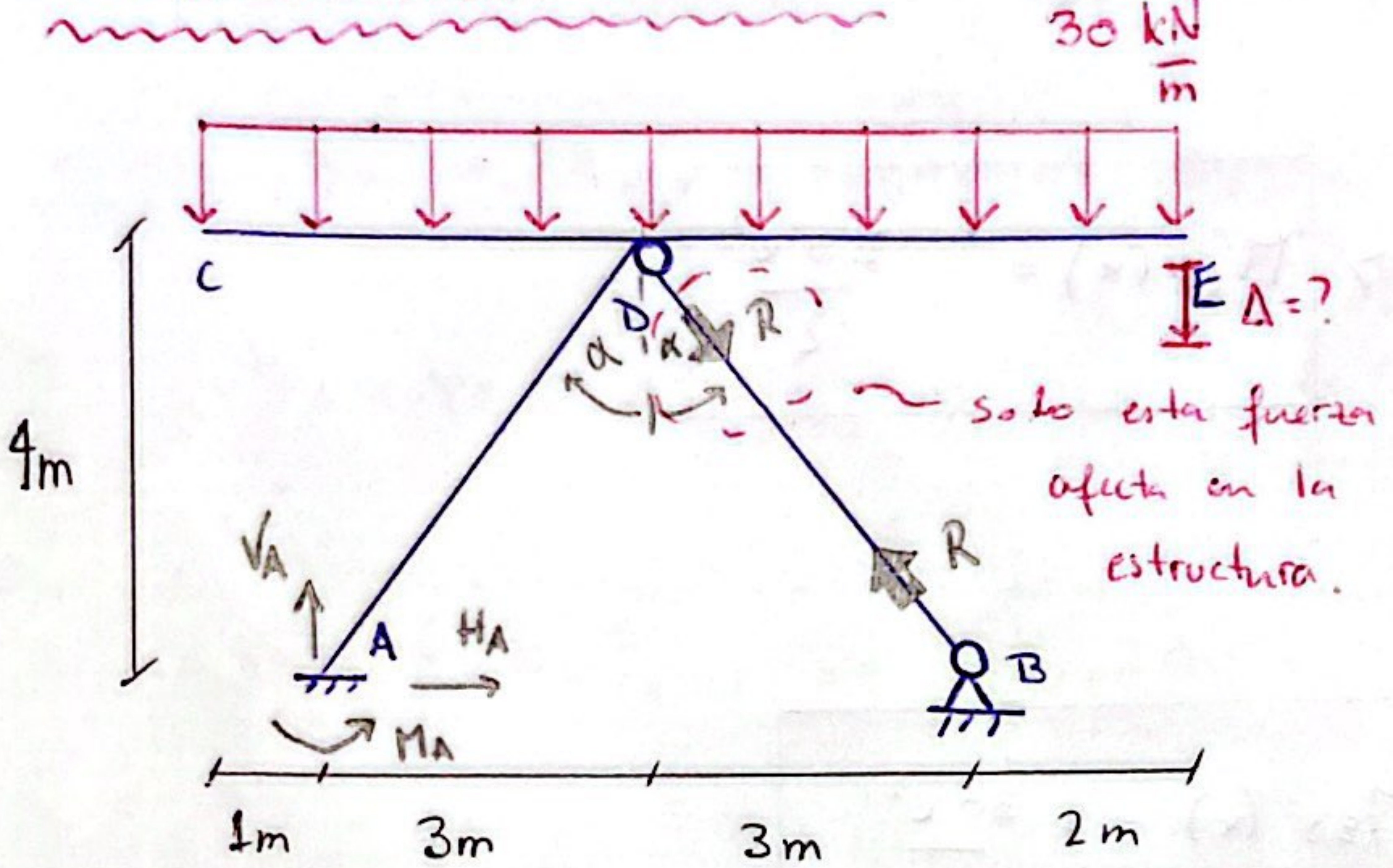
Luis Carcamo Del Rio

Pauta Auxiliar 1 - P1



- Determine Reacciones
- Diag. Esfuerzos Internos
- $\Delta_E = ?$

$\underline{\underline{GIE = 1}}$

1ro: Equilibrio de fuerzas → Reacciones en función de R.

$\Sigma F_x = 0$: $H_A = -R \operatorname{sen} \alpha$

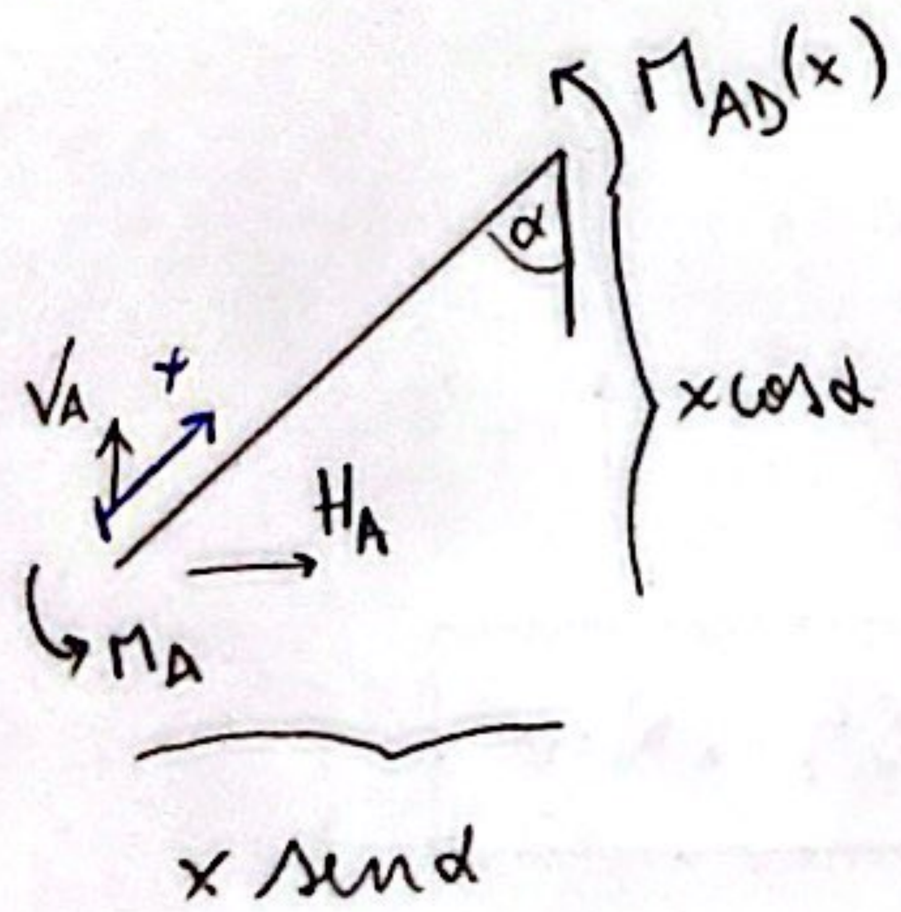
$\Sigma F_y = 0$: $V_A = 270 + R\cos\alpha$

$\Sigma M_A = 0$: $30 \cdot 9 \cdot (4{,}5 - 1) - M_A + R \operatorname{sen}\alpha \cdot 4 + R\cos\alpha \cdot 3 = 0$

$\rightarrow M_A = 4{,}8R + 945$

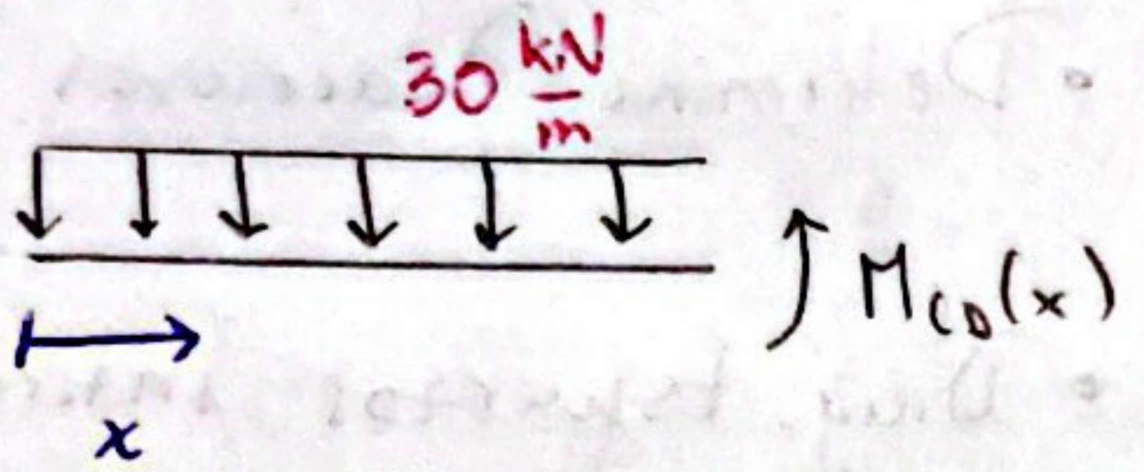
2do: Diagramas de Momento (xq' $GA_c = EA = \infty$)

Tramo AD: $x \in [0,5]$



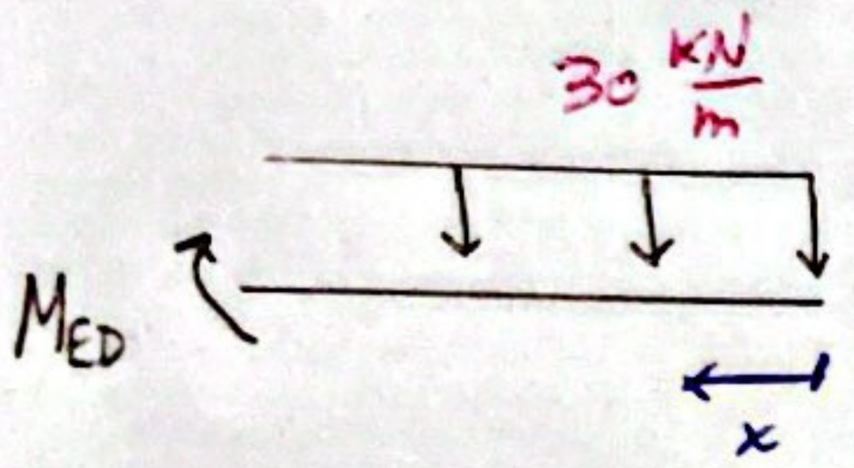
$\Rightarrow$ $\boxed{M_{AD}(x) = V_A \operatorname{sen}\alpha - H_A \cos\alpha - M_A}$

Tramo CD : $x \in [0,4]$



$$\Rightarrow \boxed{M_{CD}(x) = -\frac{30x^2}{2}}$$

Tramo ED : $x \in [0,5]$



$$\Rightarrow \boxed{M_{ED}(x) = -\frac{30x^2}{2}}$$

3ro: Calculamos $U_{INT} = \frac{1}{2}\left[\int_0^L \left(\frac{N(x)^2}{EA} + \frac{M(x)^2}{EI} + \frac{Q(x)}{GA_c}\right) dx\right]$

$$U_{INT} = \frac{1}{2}\left[\int_0^5 \frac{M_{AD}^2}{EI}\,dx + \int_0^4 \frac{M_{CD}^2}{EI}\,dx + \int_0^5 \frac{M_{ED}^2}{EI}\,dx + \left(\int_0^5 \frac{R^2}{EA}\,dx\right)\right]$$

→ Esfuerzo Axial de Biela.

$$\longrightarrow U_{INT} = 0{,}00089\,(R^2 + 303{,}371R + 35919{,}1)$$

4to: Aplicamos Menabrea

$$\frac{dU_{INT}}{dR} = 0 \Rightarrow 0{,}00178\,(R + 151{,}685) = 0$$

$$\Rightarrow \boxed{R = -151{,}69 \text{ kN}}$$

5to: Obtengo reacciones.

$H_A = 91{,}01$ kN	$V_A = 148{,}65$ kN	$M_A = 216{,}89$ kN·m

$\underline{\underline{6^{to}}}$: Obtenemos diagramas finales, recordando que $Q(x) = \frac{dM}{dx}$

$\boxed{M_{AD}(x) = 16{,}38x - 216{,}89} \Rightarrow \boxed{Q_{AD}(x) = 16{,}38}$ (Tramo AD)

$N_{AD}(x) = -V_A \cos\alpha - H_A \operatorname{sen}\alpha \Rightarrow \boxed{N_{AD}(x) = -173{,}53}$

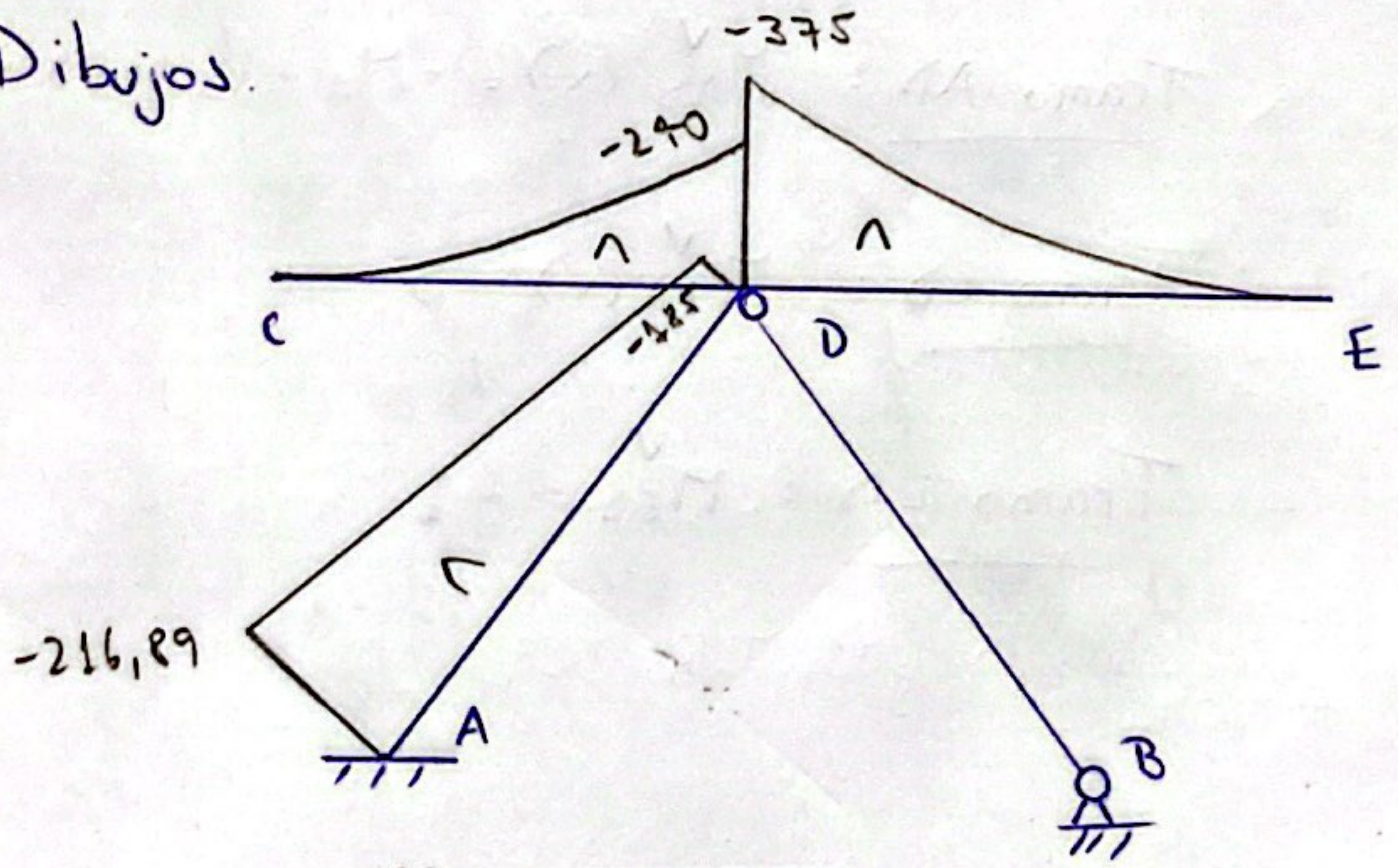
$\boxed{M_{CD}(x) = -15x^2} \Rightarrow \boxed{Q_{CD}(x) = -30x} \wedge \boxed{N_{CD}(x) = 0}$

(Tramo CD)

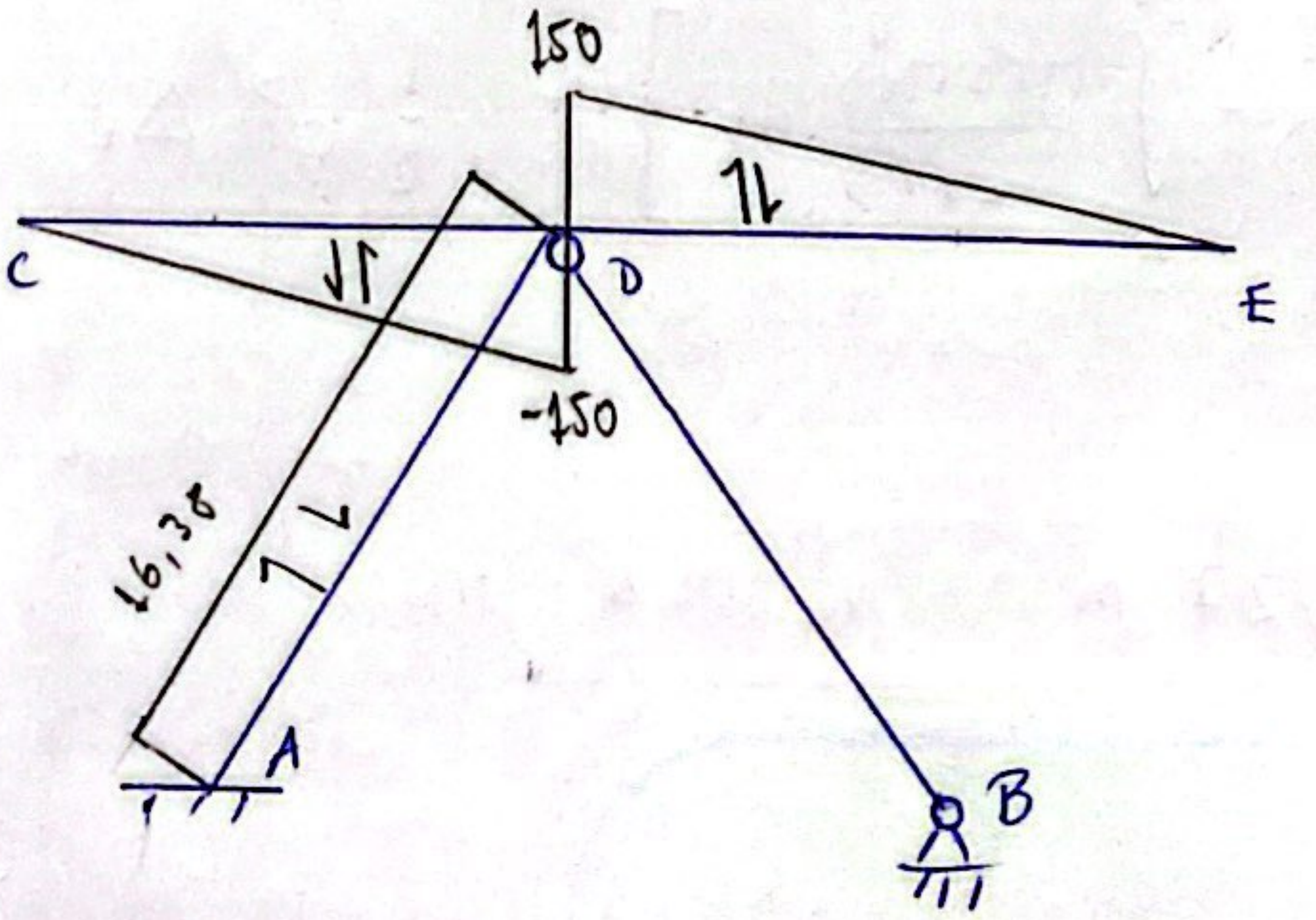
$\boxed{M_{ED}(x) = -15x^2} \xRightarrow{\frac{dM}{dx} = -Q(x)} \boxed{Q_{ED}(x) = 30x} \wedge \boxed{N_{ED}(x) = 0}$

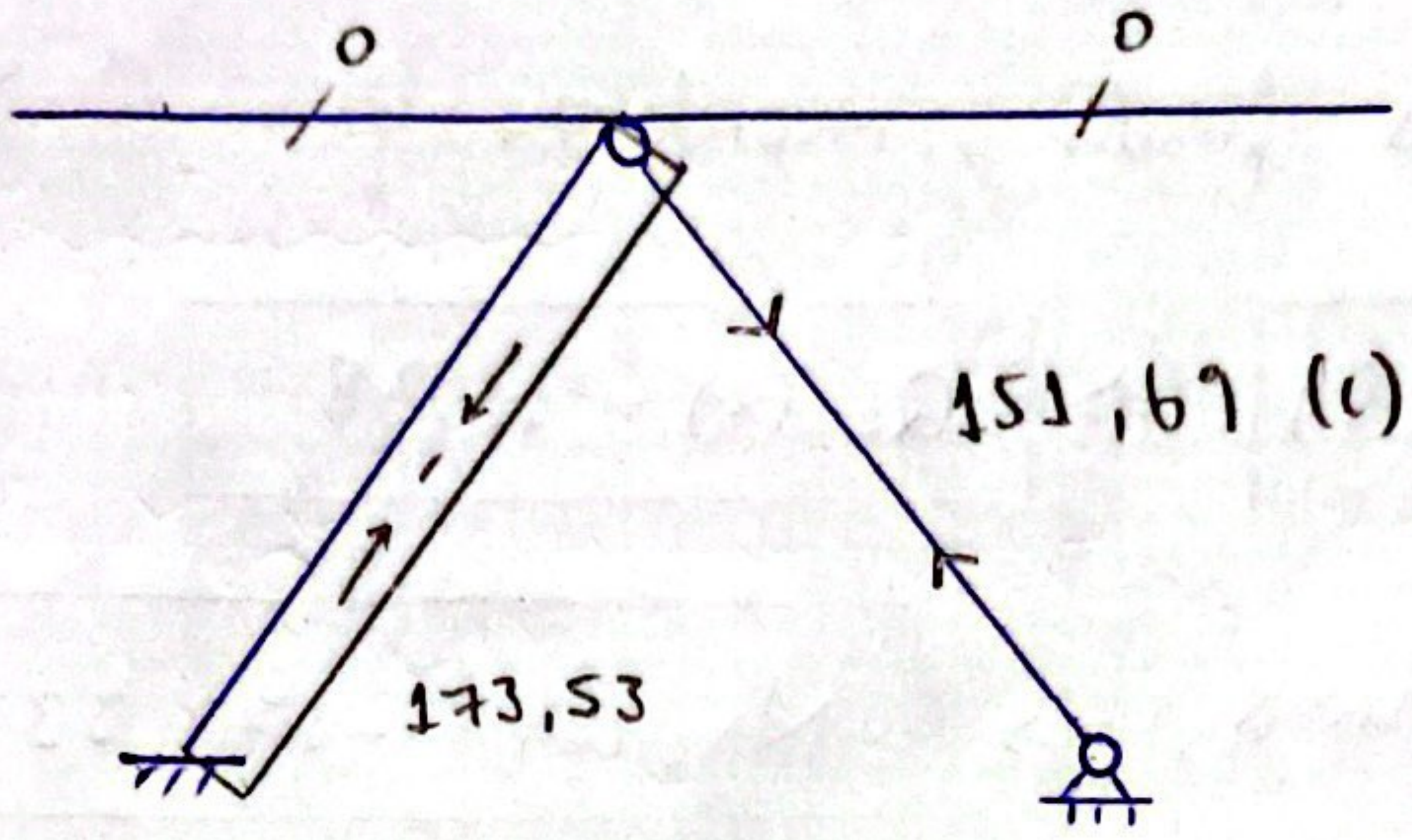
$\overleftarrow{x}$

$\underline{\underline{7^{mo}}}$: Dibujos.

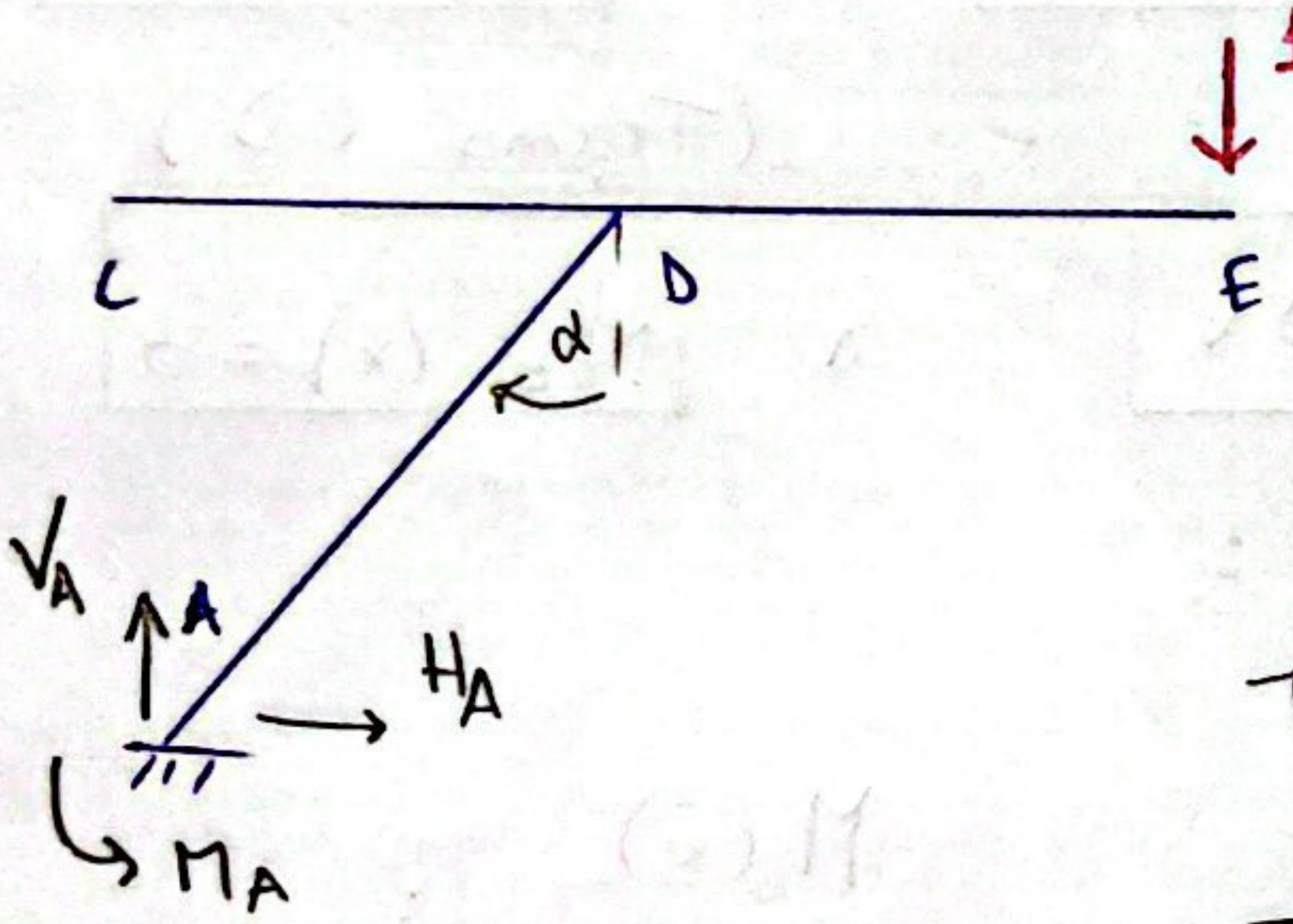


$\underline{\underline{M(x)}}$





$\underline{\underline{8^{vo}}}$: Δ_E => Carga Unitaria !!



Reacciones:

$V_A = 1$, $H_A = 0$, $M_A = 8$

Tramo AD : $\check{M}_{AD}(x) = -M_A + V_A x \operatorname{sen}\alpha = -8 + \frac{3x}{5}$

Tramo CD : $\check{M}_{CD}(x) = 0$

Tramo ED : $\check{M}_{ED} = -1$

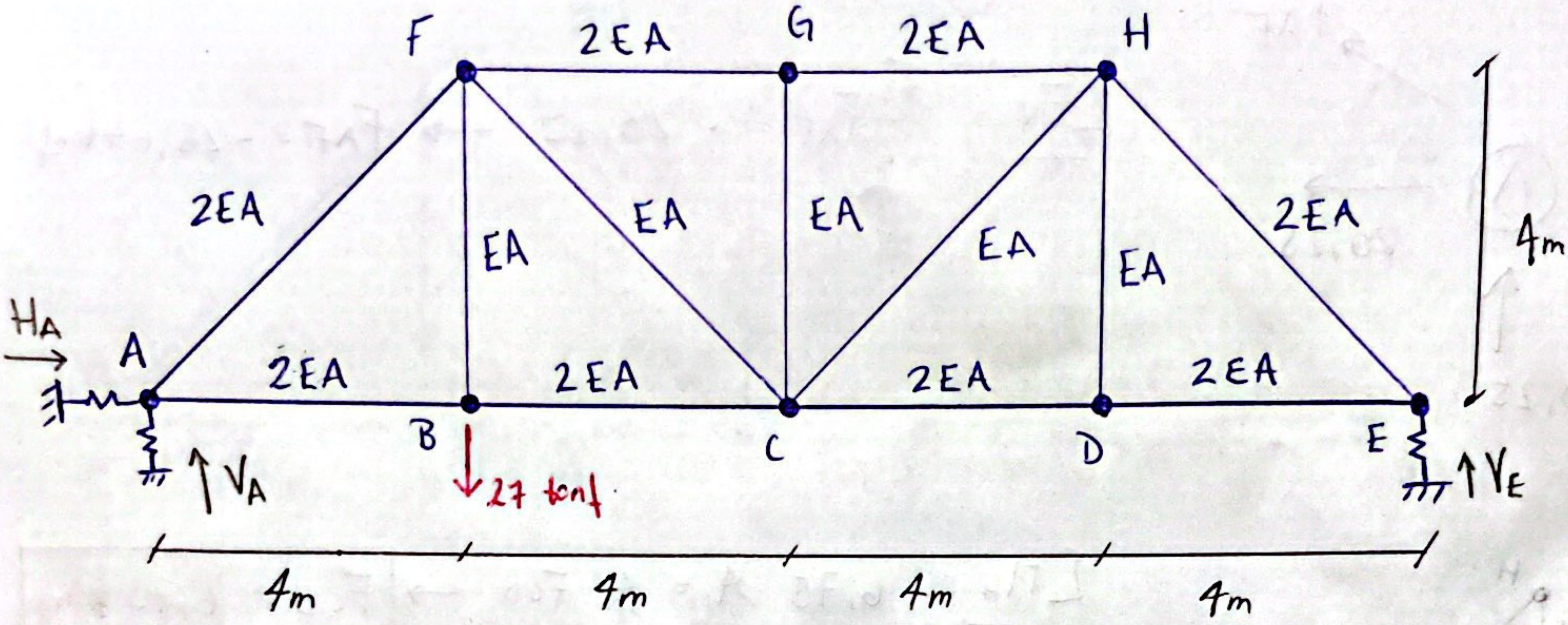
$U_{INT} = W_{EXT}$

$$\rightarrow \cancel{\tfrac{1}{2}}\left[\int_0^5 \frac{M_{AD}\check{M}_{AD}}{EI}dx + \int_0^5 \frac{M_{ED}\check{M}_{ED}}{EI}dx\right] = \cancel{\tfrac{1}{2}} \cdot \cancel{P}_{1} \cdot \Delta_E$$

$$\rightarrow \underline{\Delta_E = 0{,}27 \text{ m}}$$

Pauta Auxiliar 1 - P2

Luis Cárcamo Del Rio



$EA = 30000$ [tonf] , $f = 6[m]/EA$, $k = \frac{1}{f} = 5000 \frac{\text{tonf}}{m}$

1°: Resolver el enrejado ζ $IE = 0$.

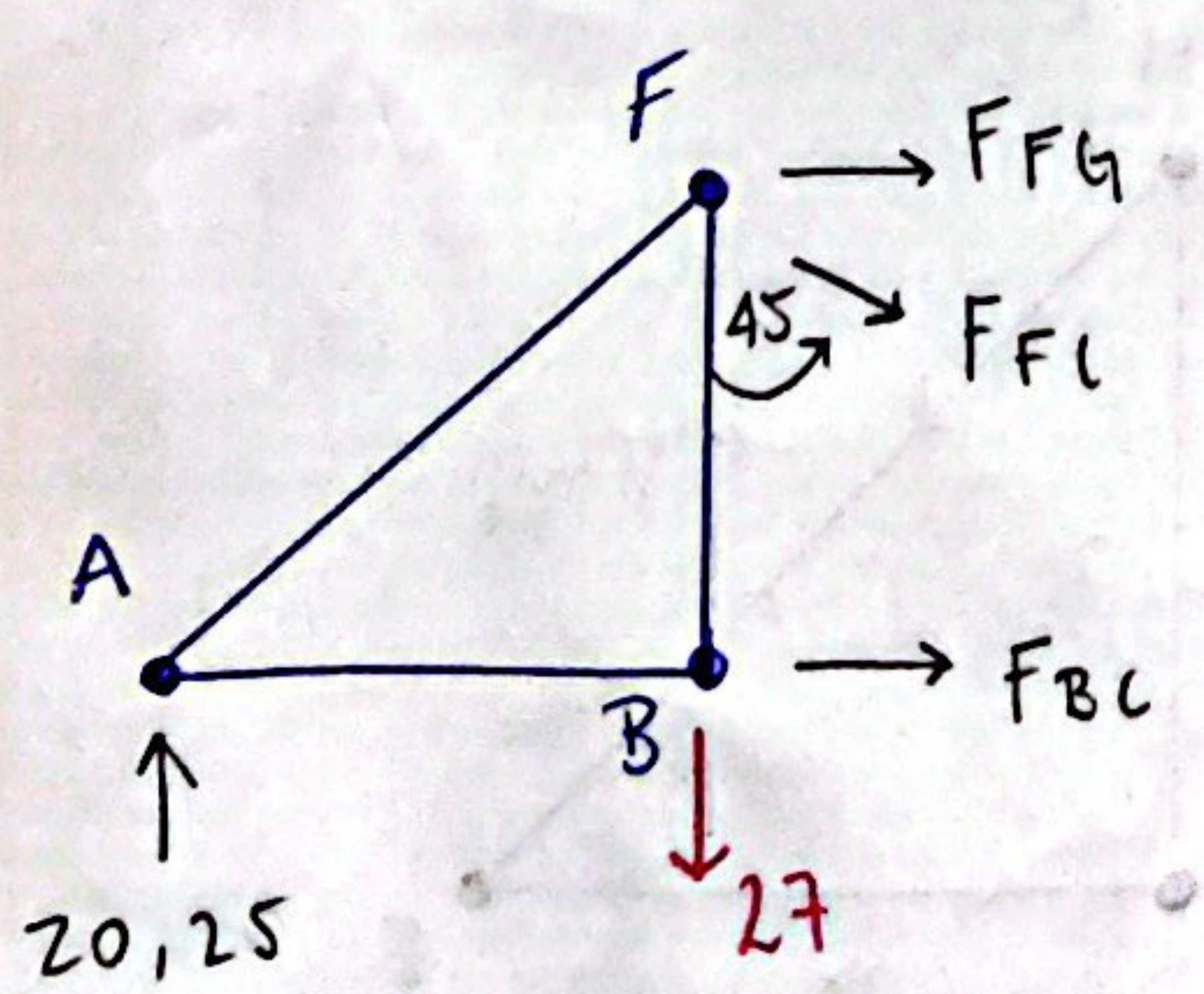
$\Sigma F_x = 0: \quad H_A = 0$

$\Sigma F_y = 0: \quad V_A + V_E = 27$

$\Sigma M_A = 0: \quad 16 V_E = 27 \cdot 4$

$H_A = 0$ tonf	$V_A = 20{,}25$ tonf	$V_E = 6{,}75$ tonf

⊛ Método de las secciones (conveniente).



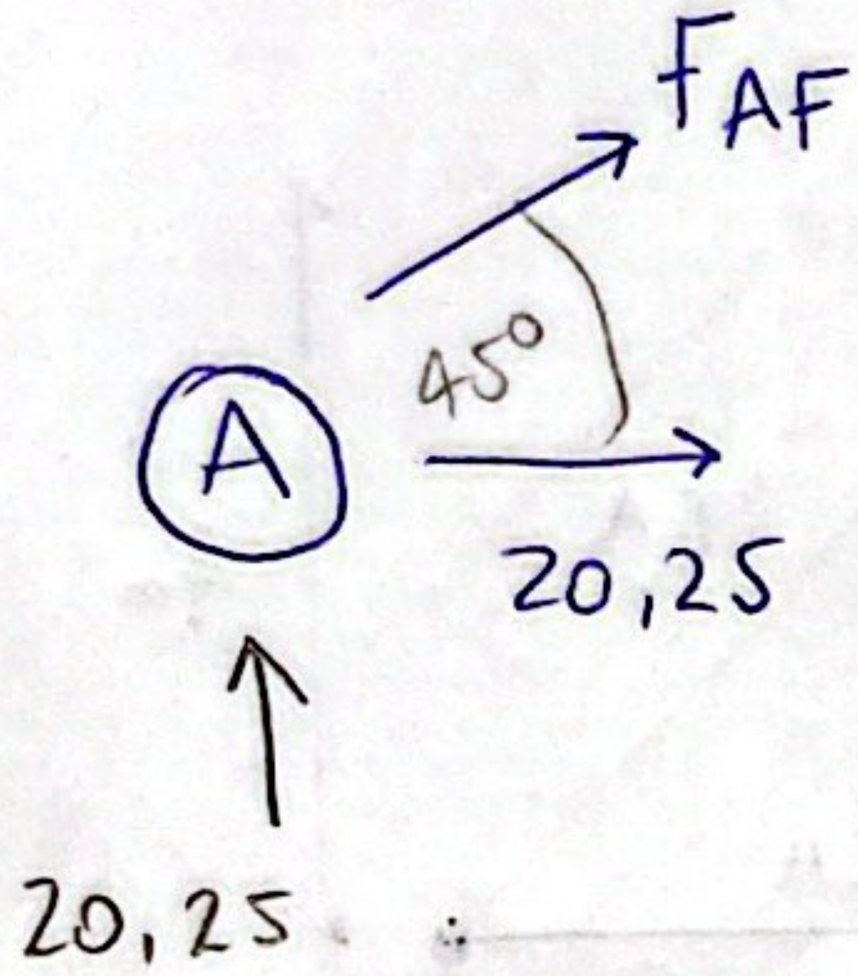
$\Sigma M_F: \cancel{4} F_{BC} = \cancel{4} \cdot 20{,}25 \longrightarrow \boxed{F_{BC} = 20{,}25 \text{ tonf}}$

$\Sigma F_x: \quad F_{FG} + 20{,}25 + \frac{\sqrt{2}}{2} F_{FC} = 0$

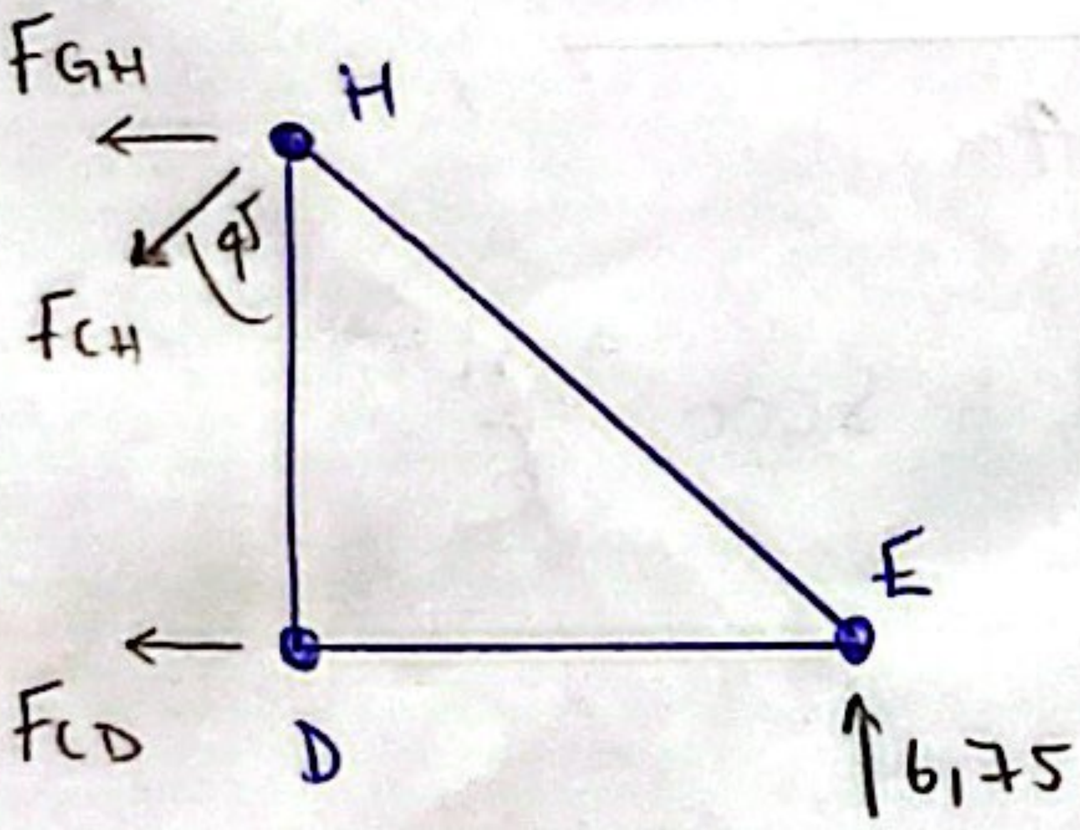
$\Sigma F_y: \quad 20{,}25 - 27 = \frac{\sqrt{2}}{2} F_{FC}$

$\boxed{F_{FG} = -13{,}5 \text{ tonf} \quad , \quad F_{FC} = -9{,}55 \text{ tonf}}$

Nodo A



$$\sum F_V : \frac{\sqrt{2}}{2} F_{AF} = -20{,}25 \longrightarrow F_{AF} = -28{,}64 \text{ tonf}$$



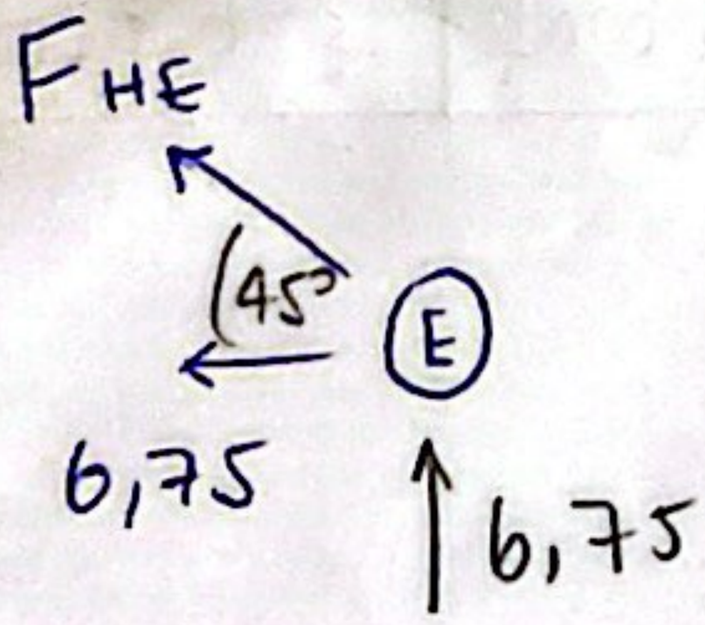
$$\sum M_H : 6{,}75 \cdot \cancel{4} = \cancel{4} \cdot F_{CD} \longrightarrow \boxed{F_{CD} = 6{,}75 \text{ tonf}}$$

$$\sum F_y : 6{,}75 = \frac{\sqrt{2}}{2} F_{CH} \longrightarrow \boxed{F_{CH} = 9{,}55 \text{ tonf}}$$

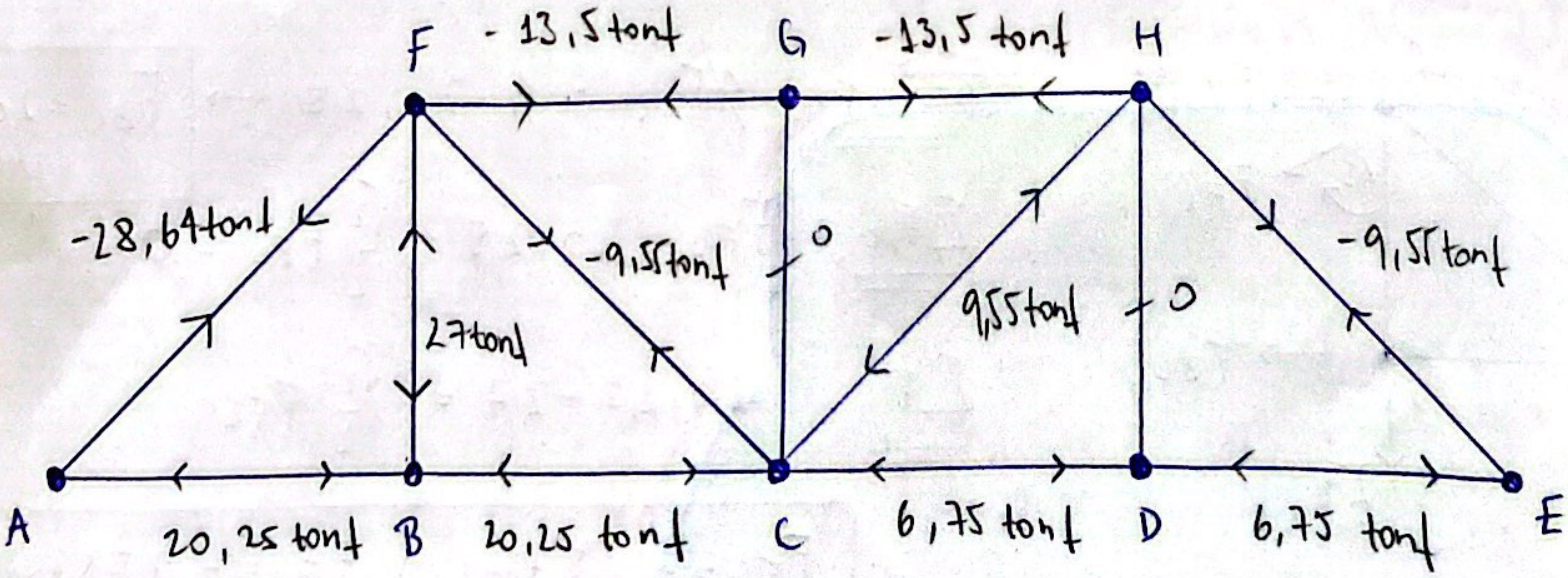
$$\sum F_x : F_{GH} - \frac{\sqrt{2}}{2} F_{CH} - 6{,}75 = 0$$

$$\boxed{F_{GH} = -13{,}5 \text{ tonf}}$$

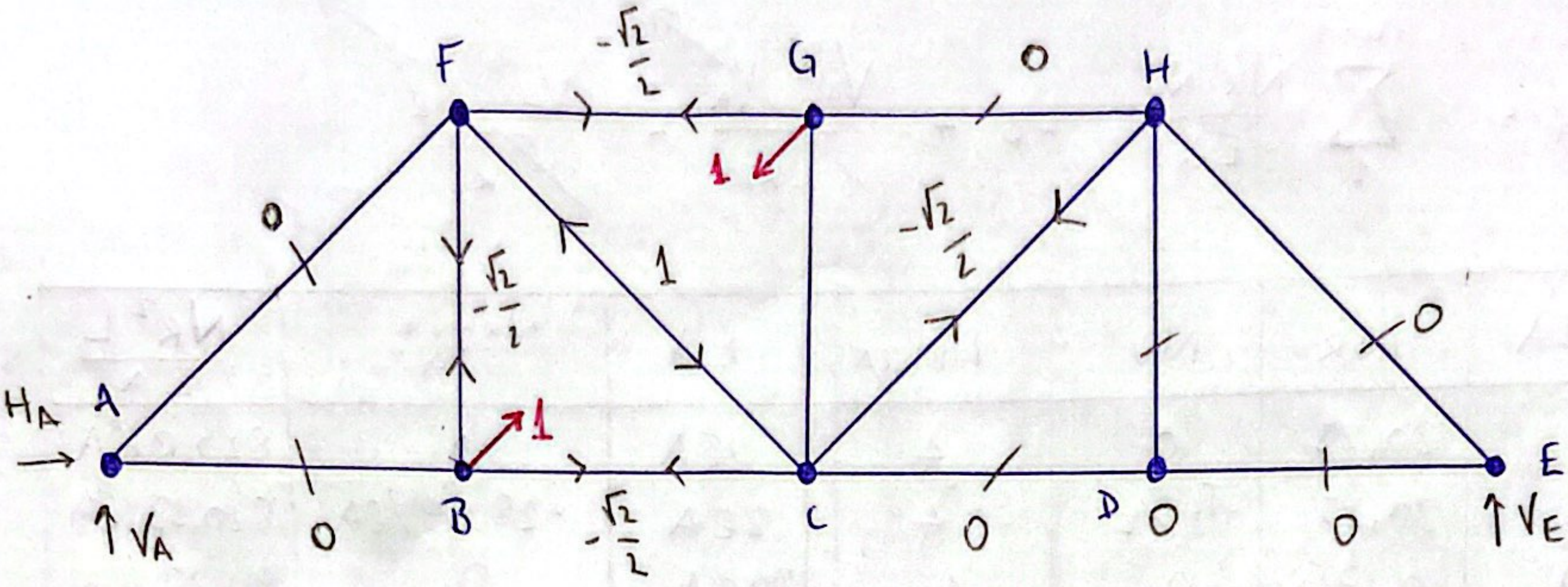
Nodo E



$$\sum F_y : \frac{\sqrt{2}}{2} F_{HE} = -6{,}75 \longrightarrow \boxed{F_{HE} = -9{,}55 \text{ tonf}}$$



$\underline{\underline{2^{do}}}$: Determinar Δ_{BG} $\rightarrow$ carga unitaria.



Reacciones:

$$\sum F_x = 0 : \quad H_A = 0$$

$$\sum F_y = 0 : \quad V_A + V_E = 0$$

$$\sum M_A = 0 : \quad V_E = 0$$

$$H_A = V_A = V_E = 0$$

Nodo B

$$\boxed{F_{BC} = F_{FB} = -\frac{\sqrt{2}}{2}}$$

Nodo F

$$\sum F_x : \; F_{FG} + \frac{\sqrt{2}}{2} F_{FC} = 0 \rightarrow \boxed{F_{FG} = -\frac{\sqrt{2}}{2}}$$

$$\sum F_y : \; \boxed{F_{FC} = 1}$$

Nodo G

$$\sum F_y = 0 : \; \boxed{F_{GC} = -\frac{\sqrt{2}}{2}}$$

$$\sum F_x = 0 : \; F_{GH} + \frac{\sqrt{2}}{2} - \frac{\sqrt{2}}{2} = 0$$

$$\boxed{F_{GH} = 0}$$

Aplicamos TTV:

$$\Delta_{BG} = \sum_{1}^{\#barras} \frac{N_R \cdot N_V}{EA} \cdot L_B + \cancel{\frac{V_A^R \cdot V_A^V}{k}}^{0} + \cancel{\frac{V_E^R \cdot V_E^V}{k}}^{0}$$

BIELA	N_R	N_V	L_{BIELA}	EA	$\frac{N_R N_V L}{EA}$	$\frac{N_R^2 L}{EA}$
AB	20,25	0	4	2EA	0	820,13/EA
BC	20,25	$-\sqrt{2}/2$	4	2EA	-28,64/EA	820,13/EA
CD	6,75	0	4	2EA	0	91,13/EA
DE	6,75	0	4	2EA	0	91,13/EA
FG	-13,5	$-\sqrt{2}/2$	4	2EA	19,09/EA	364,5/EA
GH	-13,5	0	4	2EA	0	364,5/EA
FB	27	$-\sqrt{2}/2$	4	EA	$-54\sqrt{2}$/EA	2916/EA
GC	0	$-\sqrt{2}/2$	4	EA	0	0
HD	0	0	4	EA	0	0
AF	-28,64	0	$4\sqrt{2}$	2EA	0	2320,02/EA
FC	-9,55	1	$4\sqrt{2}$	EA	-54,02/EA	515,92/EA
CH	9,55	0	$4\sqrt{2}$	EA	0	515,92/EA
HE	-9,55	0	$4\sqrt{2}$	2EA	0	257,96/EA

$$\Sigma = \frac{-139{,}938}{EA} \qquad \frac{9077{,}34}{EA}$$

$\therefore$ $\boxed{\Delta_{BG} = -0{,}0047 \text{ m}}$ (se acercan !!)

3ro: Determinar Δ_B (Aprovechando P=27 tonf, usamos Clayperon).

- $U_{INT} = U_{BARRA} + U_{RESORTE} = \left(\frac{9077{,}34}{EA} + \frac{20{,}25^2}{5000} + \frac{6{,}75^2}{5000}\right) \cdot \frac{1}{2}$

- $W_{EXT} = \frac{1}{2} \cdot 27 \cdot \Delta_B \overset{U_{INT}=W_{EXT}}{\Longrightarrow} \boxed{\Delta_B = 0{,}015 \text{ m}}$