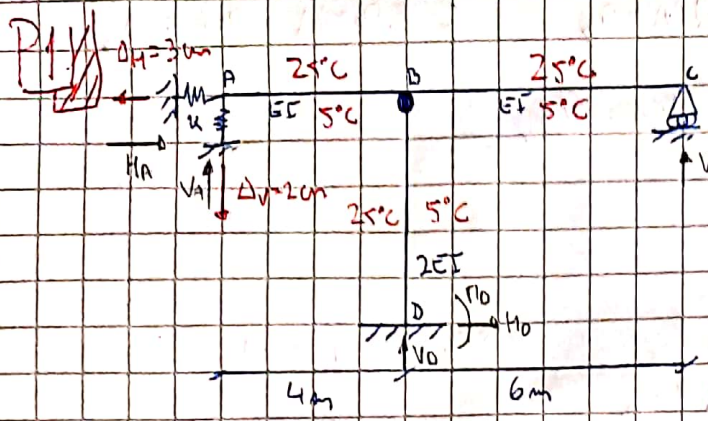
PAUTA P1 - C1

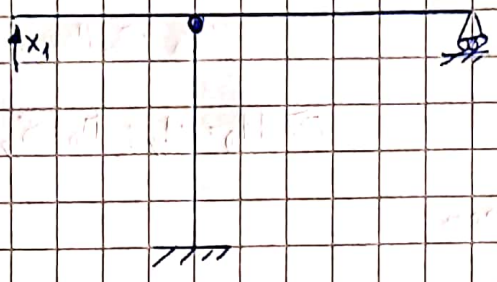
* BENJAMÍN ARMELLADA S.



* DATOS:
  - $\alpha = 10^{-5}\ [1/°C]$
  - $h = 0{,}2\ [m]$
  - $EI = 1000\ [TonF \cdot m^2]$
  - $k = 3EI/(3m)^3$
  - $EA = 6A_C = \infty$

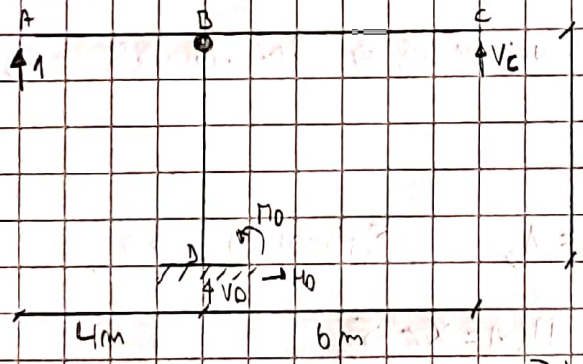
1ro: GE = Nº INCÓGNITAS − Nº ECUACIONES = $6 - (3+1)$ (nodo) $= 2$

2do: EIF:



3ro: CARGAS VIRTUALES:

5to: $X_1 = 1 \wedge X_2 = 0$



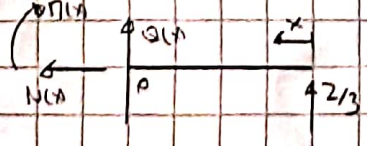
- $\Sigma F_x = 0 \mid H_D = 0$
- $\Sigma F_y = 0 \mid V_D + V_C = -1$
- $+\circlearrowleft_C \cdot \Sigma M_D = 0 \mid M_D + 6V_C - 4 = 0$
- $+\circlearrowleft_C \cdot \Sigma M_{RODILLA} = 0 \mid M_D + 5H_D = 0$

$\Rightarrow H_D = 0_{//};\ M_D = 0_{//};\ V_C = 4/3_{//};\ V_D = -5/3_{//}$

→ TRAMO AB: $x \in [0, 4m]$ IZQ → DER

- $\Sigma F_x = 0 \mid N(x) = 0_{//}$
- $\Sigma F_y = 0 \mid Q(x) = 1_{//}$
- $+\circlearrowleft_O \cdot \Sigma M_O = 0 \mid M(x) = x_{//}$

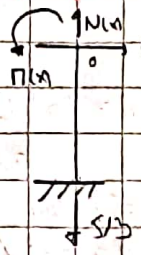
← TRAMO BC: $x \in [0, 6m]$ DER → IZQ



- $\Sigma F_x = 0 \mid N(x) = 0_{//}$
- $\Sigma F_y = 0 \mid Q(x) = -2/3_{//}$
- $+\circlearrowleft_O \cdot \Sigma M_O = 0 \mid M(x) = \frac{2}{3}x_{//}$

(1)

- TRAMO DB: $x \in [0,5m]$ IZQ → DCH

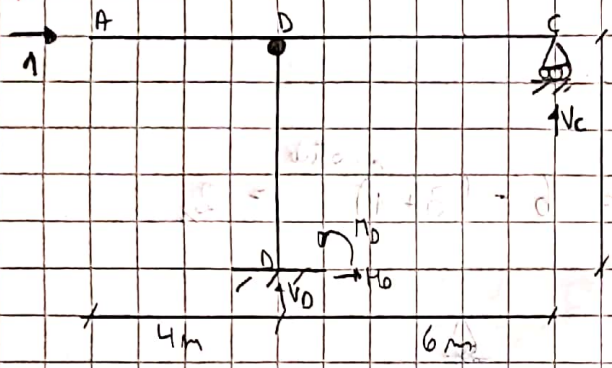


• $\Sigma F_x = 0 \Rightarrow Q(x) = 0$ //

• $\Sigma F_y = 0 \Rightarrow N(x) = 5/3$ //

+↺ • $\Sigma D_0 = 0 \Rightarrow M(x) = 0$ //

3.3 //: $X_1 = 0 \wedge X_2 = 1$



• $\Sigma F_x = 0 \Rightarrow H_D = -1$

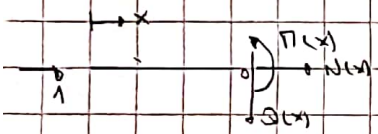
• $\Sigma F_y = 0 \Rightarrow V_D + V_C = 0$

+↺ • $\Sigma M_D = 0 \Rightarrow M_D + 6V_C - 5 = 0$

+↺ • $\Sigma M_{izq} = 0 \Rightarrow M_D + 5H_D = 0$

$\Rightarrow H_D = -1$ //; $M_D = 5$ //; $V_C = 0$ //; $V_D = 0$ //

- TRAMO AB: $x \in [0,4m]$ IZQ → DCH



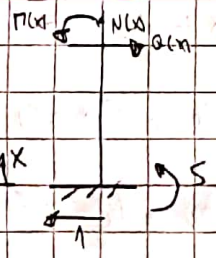
• $\Sigma F_y = 0 \Rightarrow Q(x) = 0$ //

• $\Sigma F_x = 0 \Rightarrow N(x) = -1$ //

+↺ • $\Sigma M_0 = 0 \Rightarrow M(x) = 0$ //

- TRAMO BC: $x \in [0,6m]$ $\Rightarrow$ NO TIENE CARGAS $\Rightarrow$ $Q(x) = N(x) = M(x) = 0$ //.

- TRAMO DB: $x \in [0,5m]$ IZQ → DCH



• $\Sigma F_x = 0 \Rightarrow Q(x) = 1$ //

• $\Sigma F_y = 0 \Rightarrow N(x) = 0$ //

+↺ • $\Sigma M_{(x)} = 0 \Rightarrow M(x) = x - 5$ //

4° //: $\{\Delta\}_H = ?$ $\quad \{\Delta_H\} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ [m]

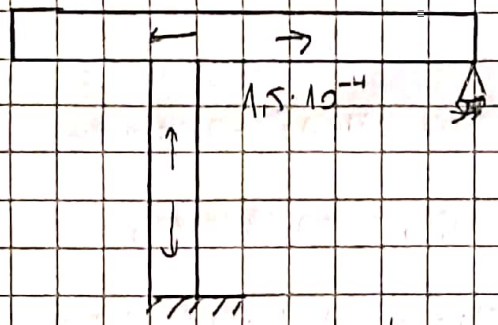
5° //: $\{\Delta\}_A$ //: $\quad \{\Delta\}_A = \begin{Bmatrix} -0,02 \\ -0,03 \end{Bmatrix}$ [m]

6° //: $\{\Delta\}_T$ //: → $\varepsilon = \dfrac{(T_1 + T_2)}{2} \cdot \alpha = \dfrac{10^{-5}(25+5)}{2} = 1,5 \cdot 10^{-4}$ //

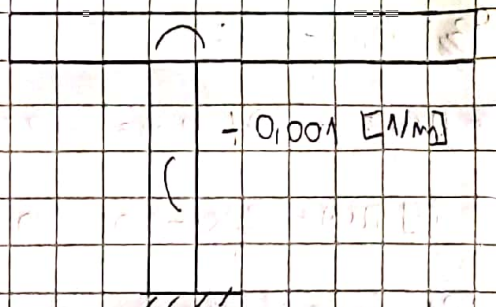
→ $\theta = \dfrac{\alpha(T_2 - T_1)}{h} = \dfrac{10^{-5} \cdot (25-5)}{0,2} = 0,001$ [1/m] //

} TODAS LAS BARRAS

• $\bar{\varepsilon}$:



• $\bar{\phi}$:



→ $\Delta_{T1} = -0{,}001 \cdot \left[\int_0^4 x\,dx + \int_0^6 \frac{2}{3}x\right] + 1{,}5\cdot10^{-4}\cdot\left[\int_0^5 \frac{5}{3}\,dx\right] = -0{,}0188$ m //

→ $\Delta_{T2} = -0{,}001 \cdot \left[\int_0^5 (x-5)\,dx\right] + 1{,}5\cdot10^{-4}\cdot\left[\int_0^4 -1\,dx\right] = 0{,}0119$ m //

$\therefore \{\Delta_T\} = \begin{Bmatrix} -0{,}0188 \\ 0{,}0119 \end{Bmatrix}$ m //

7mo //: $[F]$ //: → $f_{11} = \int_0^4 \frac{x^2}{EI}\,dx + \int_0^6 \left(\frac{2}{3}x\right)^2 \cdot \frac{1}{EI}\,dx + \frac{1^2}{K} = 0{,}0623$ m/tonF //

– $f_{22} = \int_0^5 \frac{(x-5)^2}{2EI}\,dx + \frac{1^2}{K} = 0{,}0298$ m/tonF //

→ $f_{12} = f_{21} = 0$ m/tonF // ⇒ $[F] = \begin{bmatrix} 0{,}0623 & 0 \\ 0 & 0{,}0298 \end{bmatrix}$ m/tonF

8vo //: RESOLVEM FLEXIBILIDAD: $\{\Delta\}_H + \{\Delta\}_A = \{\Delta\}_T + [F]\cdot\{r\}$

$\Rightarrow \begin{Bmatrix} -0{,}02 \\ -0{,}03 \end{Bmatrix} = \begin{Bmatrix} -0{,}0188 \\ 0{,}0119 \end{Bmatrix} + \begin{bmatrix} 0{,}0623 & 0 \\ 0 & 0{,}0298 \end{bmatrix} \cdot \begin{Bmatrix} X_1 \\ X_2 \end{Bmatrix}$

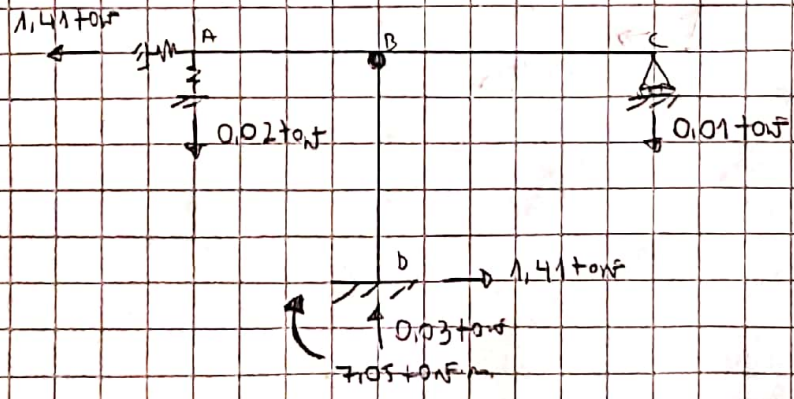
$\Rightarrow X_1 = -0{,}02$ tonF // ∧ $X_2 = -1{,}41$ tonF //

9no //: Principio de superposición:

9.1 //: Reacciones: → $V_A = X_1 = -0{,}02$ tonF // → $H_A = X_2 = -1{,}41$ tonF //

→ $V_D = -5/3 \cdot -0{,}02 = 0{,}03$ tonF // → $H_D = -1 \cdot -1{,}41 = 1{,}41$ tonF

→ $M_D = 5 \cdot -1{,}41 = -7{,}05$ tonF·m → $V_C = 2/3 \cdot -0{,}02 = -0{,}01$ tonF //

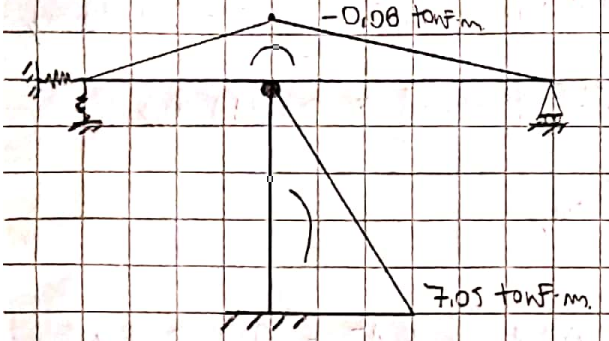


9.2) Diagramas:

* $\Pi(x)$: → AD) $\Pi(x) = -0,02x \Rightarrow \Pi(0) = 0 \wedge \Pi(4) = -0,08$ tonF·m

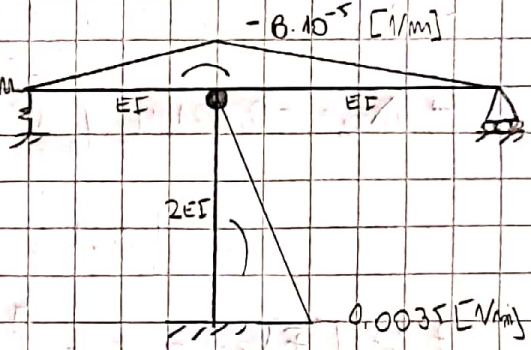
BC) $\Pi(x) = \frac{2}{3}x \cdot -0,02 \Rightarrow \Pi(0) = 0 \wedge \Pi(6) = -0,08$ tonF·m

DB) $\Pi(x) = -1,41(x-5) \Rightarrow \Pi(0) = 7,05$ tonF·m $\wedge \Pi(5) = 0$ tonF·m.

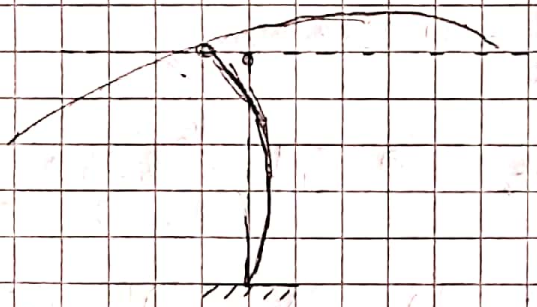


$\Rightarrow \theta$:

$\theta = \Pi / EI$

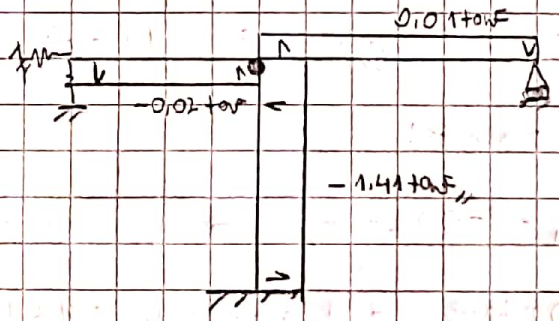


$\Rightarrow$ DEFORMADA:

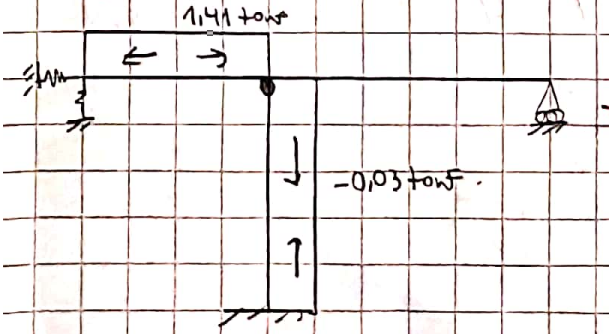


* $Q(x)$: → AD) $\frac{\partial \Pi(x)}{\partial x} = Q(x) = -0,02$ tonF → BC) $\frac{-\partial \Pi}{\partial x} = Q(x) = 0,013$ tonF

→ DB) $\frac{\partial \Pi(x)}{\partial x} = Q(x) = -1,41$ tonF



* $N(x)$: → AD) $N(x) = 1,41$ tonF → BC) $N(x) = 0$ tonF → DB) $N(x) = -0,03$ tonF



ε:

$\varepsilon = N / EA$