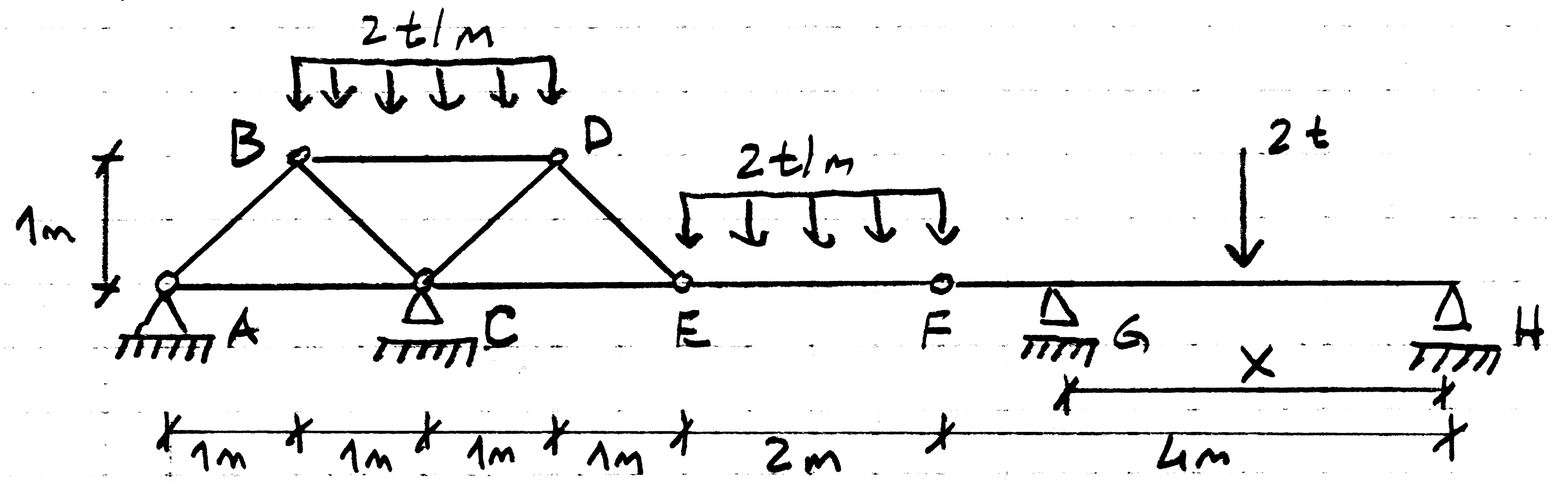
PLAN 97 - 04 de febrero de 2010

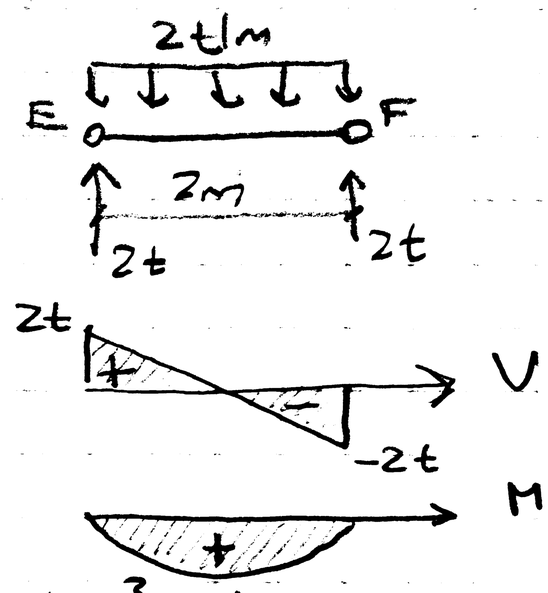
Examen de Resistencia de Materiales 1-n

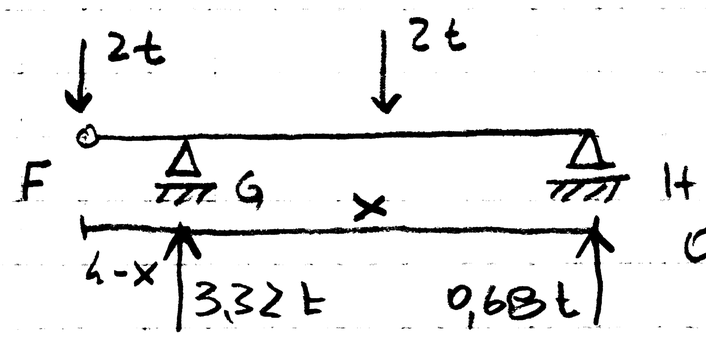
SOLUCION

EJERCICIO 1



EF – Tramo Flotante

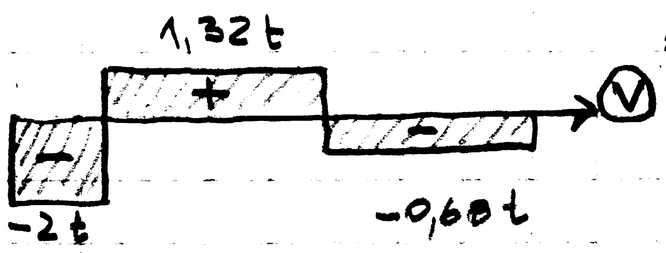




$$EI\,\theta_G = \frac{2x^2}{16} - \frac{2(4-x)}{3}x$$

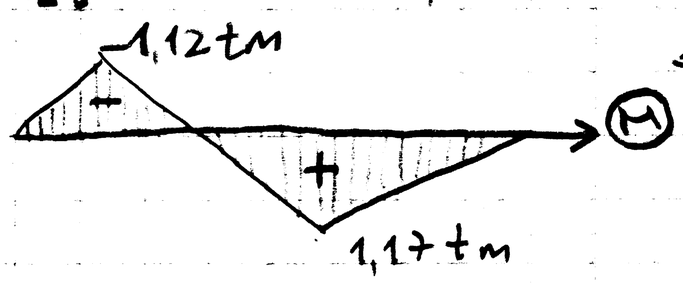
$$0 = EI\,\delta_F = \left(\frac{x^2}{8} - \frac{2(4-x)}{3}x\right)(4-x) - \frac{2(4-x)^3}{3}$$

$$\Rightarrow 3x^2 + 64x - 256 = 0 \Rightarrow \boxed{x = 3{,}44\ m}$$

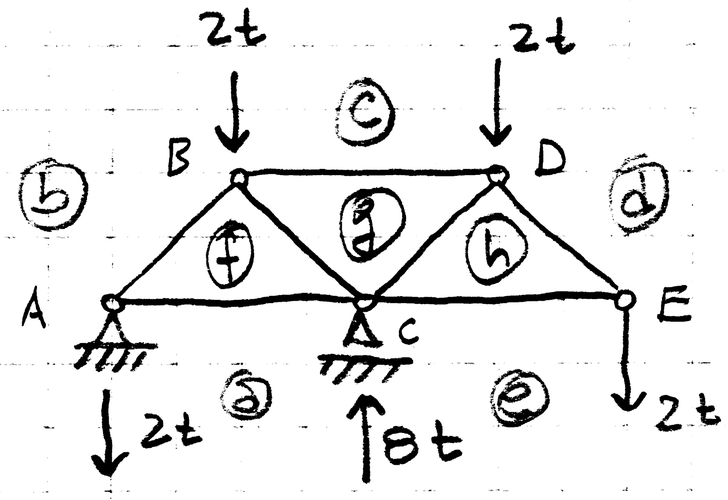


$$\Rightarrow R_G \cdot 3{,}44 = 2 \cdot 4 + \frac{2 \cdot 3{,}44}{2} = 3{,}32\ t$$

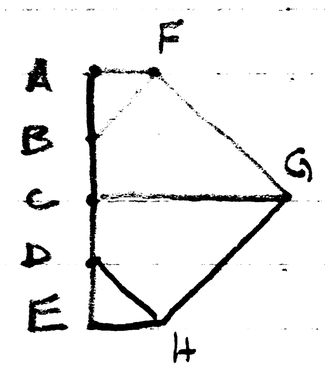
$$\Rightarrow \boxed{R_G = 3{,}32\ t} \Rightarrow \boxed{R_H = 0{,}68\ t}$$



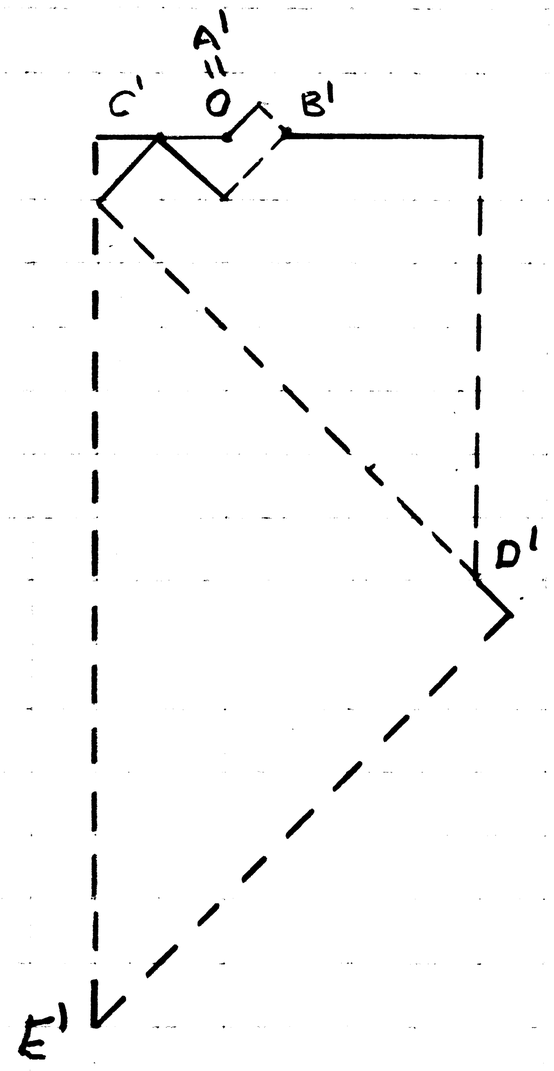
Directa en la viga EFGH = 0



CREMONA



WILLIOT



BARRA	FUERZA	L	Area	ΔL
AC	−2	2	Ω	−4/EΩ
CE	−2	2	Ω	−4/EΩ
BD	+6	2	Ω	+12/EΩ
AB	+2√2	√2	√2 Ω	+2√2/EΩ
BC	−4√2	√2	√2 Ω	−4√2/EΩ
CD	−4√2	√2	√2 Ω	−4√2/EΩ
DE	+2√2	√2	√2 Ω	+2√2/EΩ

	$\delta_H \rightarrow$ EΩ	$\delta_V \downarrow$ EΩ
A	0	0
B	+4	0
C	−4	0
D	+16	+28
E	−8	+56

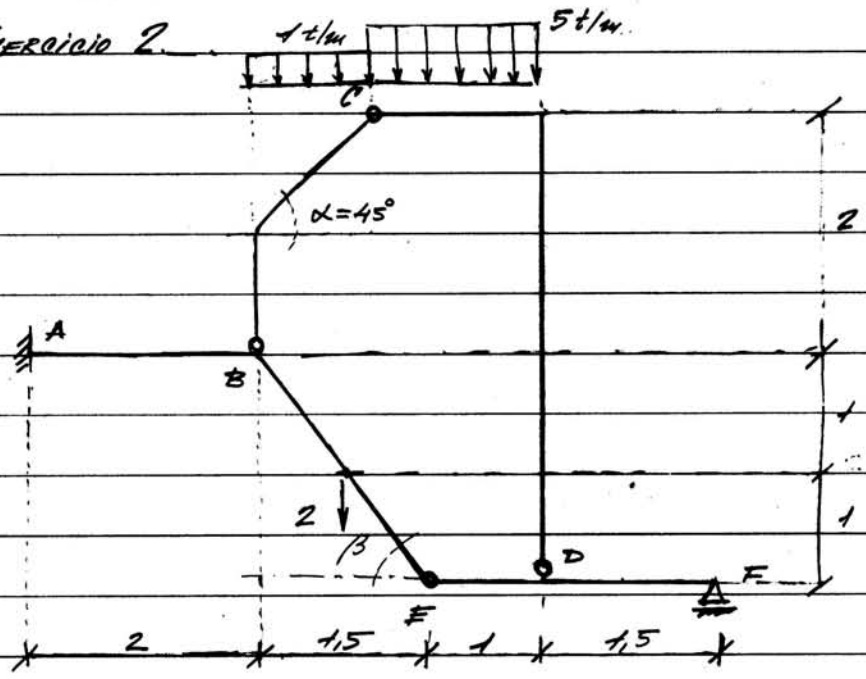
$$M_{máx} = 1.17\ tm \Rightarrow W \geq \frac{1{,}17 \times 1000 \times 100}{1400}$$

$$\Rightarrow W \geq 83{,}6\ cm^3 \Rightarrow \boxed{PNI\ 16}$$

Diagramas t (V) y (M) de barra BD iguales que los de barra EF

Resistencia de Materiales 1N.
Ej. 04/FES/2010.

Ejercicio 2.

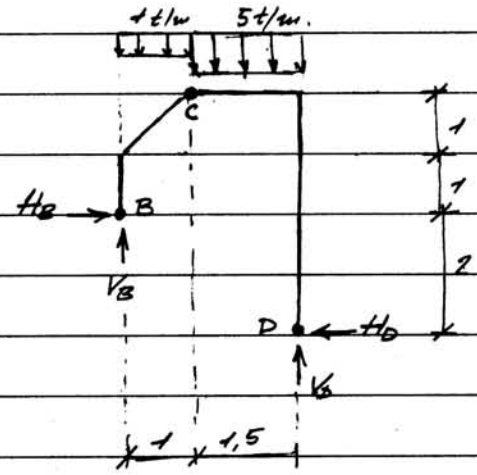


$\operatorname{sen}\alpha = \cos\alpha = \frac{\sqrt{2}}{2}$

$\operatorname{sen}\beta = 0{,}8$

$\cos\beta = 0{,}6$

* Arco $\widehat{BCD}$:



$\Sigma F_V = 0: \quad V_B + V_D = 8{,}5 \qquad (1)$

$\Sigma F_H = 0: \quad H_B = H_D \qquad (2)$

$M_C^i = 0: \quad 2H_B + 0{,}5 = V_B \qquad (3)$

$M_C^d = 0: \quad 4H_D + 5{,}625 = 1{,}5\,V_D \qquad (4)$

$(1)\times(2): \quad 2H_D + 0{,}5 = V_B \qquad (5)$

$2\times(5): \quad 4H_D + 1 = 2V_B \qquad (6)$

$(4)\times(6): \quad 1{,}5\,V_D - 5{,}625 = 2V_B - 1$

$V_B - 0{,}75\,V_D = -2{,}3125 \qquad (7)$

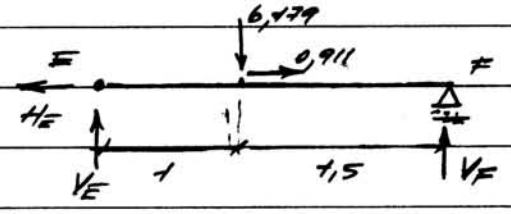
$(1)\times(7): \quad 8{,}5 - V_D = 0{,}75\,V_D - 2{,}3125$

$1{,}75\,V_D = 10{,}8125 \rightarrow \boxed{V_D = 6{,}179\ t}$

$(1): \boxed{V_B = 2{,}321\ t}$

$(3): \quad H_B = \frac{V_B - 0{,}5}{2} = \frac{2{,}321 - 0{,}5}{2} \rightarrow \boxed{H_B = H_D = 0{,}911\ t}$

* tramo EF:

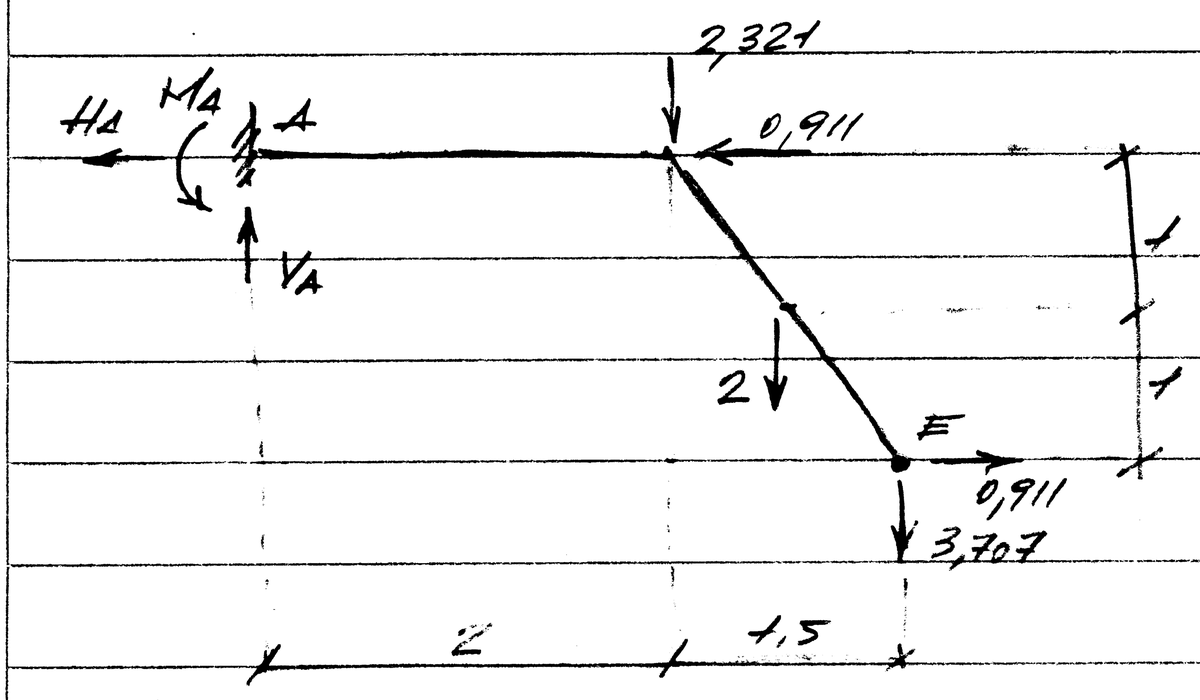


$M_E = 0: \quad 6{,}179 = 2{,}5\,V_F \rightarrow \boxed{V_F = 2{,}472\ t}$

$\Sigma F_V = 0: \quad V_E + V_F = 6{,}179 \rightarrow \boxed{V_E = 3{,}707\ t}$

$\Sigma F_H = 0: \quad \boxed{H_E = 0{,}911\ t}$

* tramo ABE:



$\sum F_H = 0$: $\boxed{H_A = 0}$

$\sum F_V = 0$: $V_A = 2{,}321 + 2 + 3{,}707$

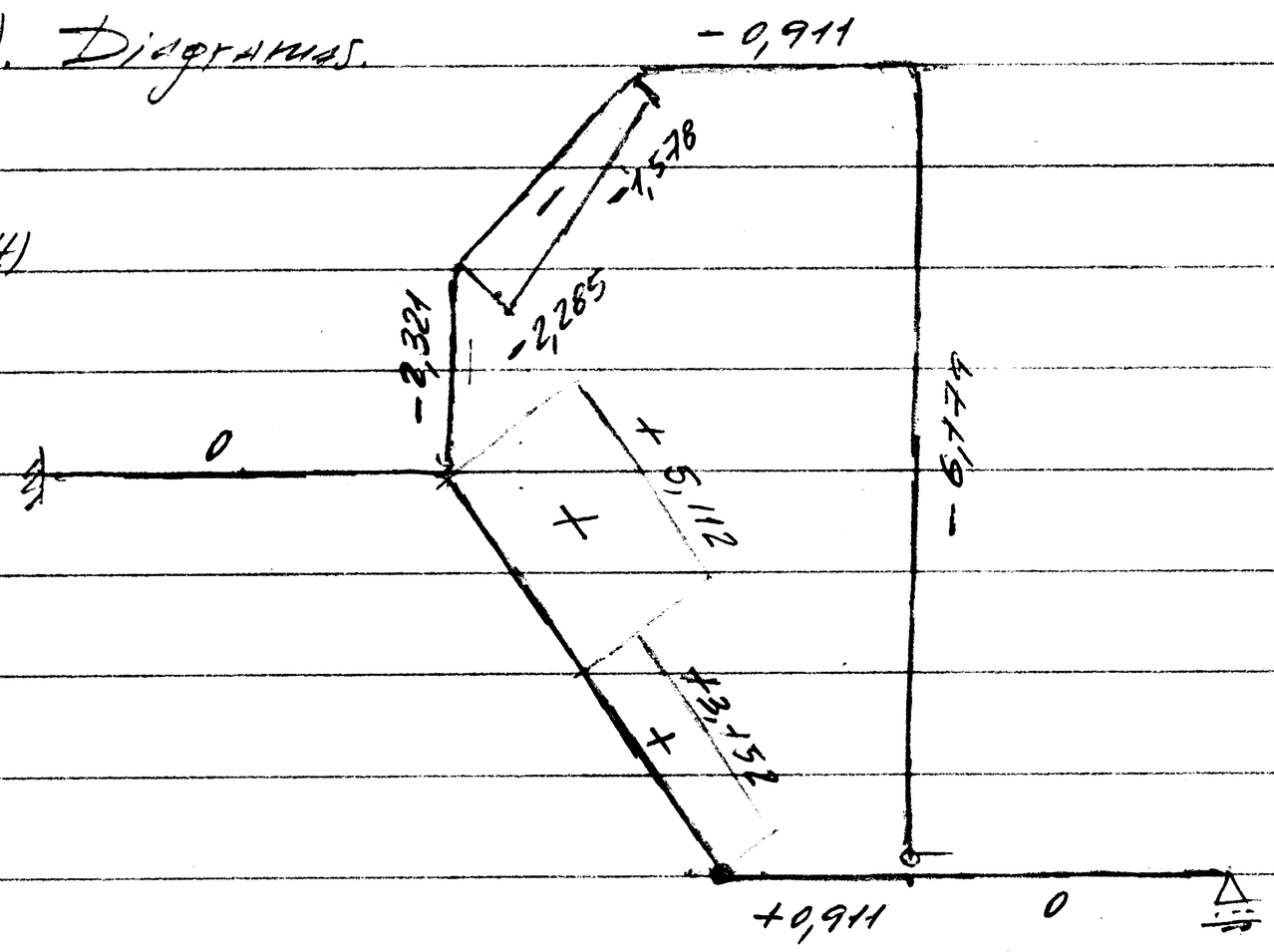
$\rightarrow \boxed{V_A = 8{,}028\ t}$

$\sum M_A = 0$: $M_A = 2 \times 2{,}75 + 2{,}321 \times 2 + 3{,}707 \times 3{,}5 - 0{,}911 \times 2$

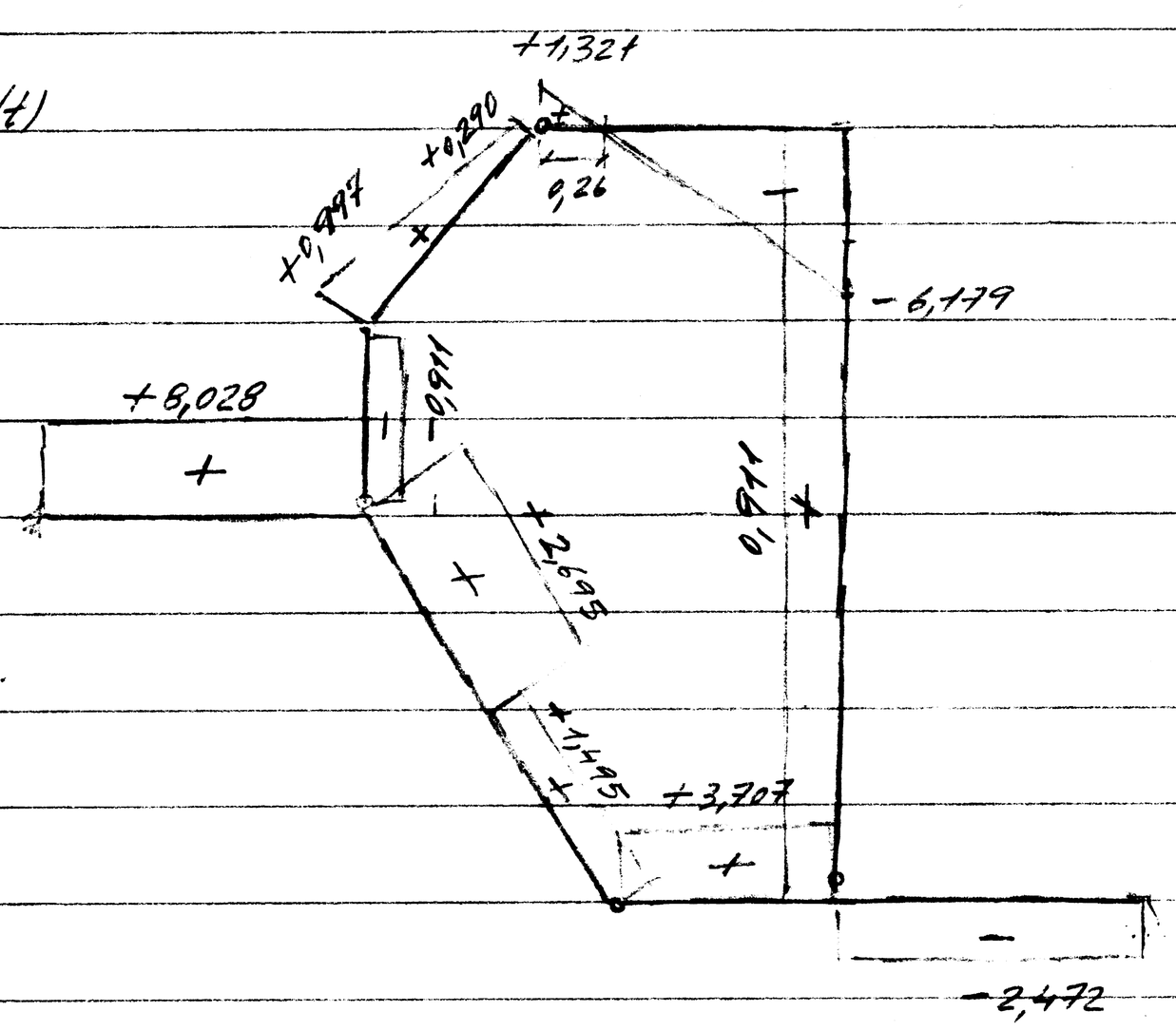
$\rightarrow \boxed{M_A = 21{,}295\ t.m}$

1). Diagramas.

(N) (t)

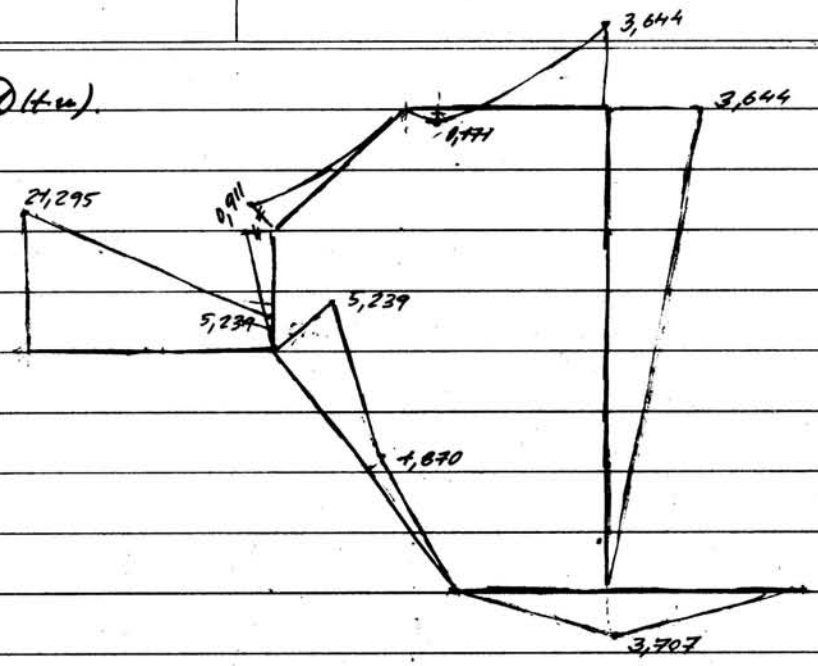


(V) (t)



Ej. 2. Ex. 1/Fb/2010.

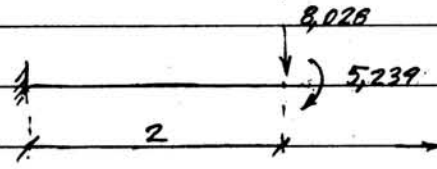
Ⓜ (t·m).



2). DESPLAZAMIENTOS.

EI = cte.

* Desplazamiento pto. B:



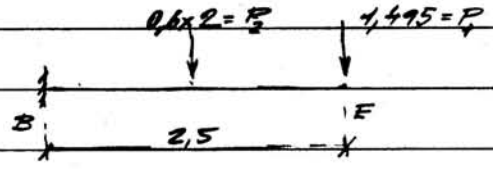
$$\delta_B^{\downarrow} = \frac{8{,}028 \times 2^3}{3EI} + \frac{5{,}239 \times 2^2}{2EI} = \frac{21{,}41}{EI} + \frac{10{,}48}{EI}$$

$$\rightarrow \boxed{\delta_B^{\downarrow} = \frac{31{,}89}{EI}}$$

$$\theta_B^{\curvearrowright} = \frac{8{,}028 \times 2^2}{2EI} + \frac{5{,}239 \times 2}{EI} = \frac{16{,}06}{EI} + \frac{10{,}48}{EI}$$

$$\rightarrow \boxed{\theta_B^{\curvearrowright} = \frac{26{,}54}{EI}}$$

* Desplazamiento pto. E:



$$\delta_{E_{P_1}}^{\perp BE} = \frac{1{,}495 \times 2{,}5^3}{3EI} = \frac{7{,}79}{EI}$$

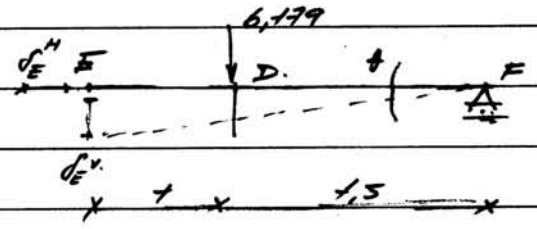
$$\delta_{E_{P_2}}^{\perp BE} = \frac{1{,}2 \times 1{,}25^2}{6EI} \cdot (3 \times 2{,}5 - 1{,}25) = \frac{1{,}95}{EI}$$

$$\delta_{E_{\theta_B}}^{\perp BE} = \frac{26{,}54 \times 2{,}5}{EI} = \frac{66{,}35}{EI}$$

$$\delta_E^{\downarrow} = \left(\frac{7{,}79}{EI} + \frac{1{,}95}{EI} + \frac{66{,}35}{EI}\right) \times 0{,}6 + \frac{31{,}89}{EI} \rightarrow \boxed{\delta_E^{\downarrow} = \frac{72{,}54}{EI}}$$

$$\delta_E^{\rightarrow} = -\left(\frac{7{,}79}{EI} + \frac{1{,}95}{EI} + \frac{66{,}35}{EI}\right) \times 0{,}8 \rightarrow \boxed{\delta_E^{\leftarrow} = \frac{60{,}87}{EI}}$$

* Desplazamiento - pto. D:



$$\phi = \frac{\delta_E^V}{2,5}$$

$$\delta_D^{\downarrow} = \frac{6,179 \times 1,5 \times 1 \cdot (2,5^2 - 1,5^2 - 1^2)}{6 \times 2,5 \times EI} + 1,5 \times \frac{77,54}{2,5\,EI}$$

$$= \frac{1,85}{EI} + \frac{46,52}{EI} \longrightarrow \boxed{\delta_D^{\downarrow} = \frac{48,37}{EI}}$$

$$\boxed{\overleftarrow{\delta_D} = \overleftarrow{\delta_E} = \frac{60,87}{EI}}$$