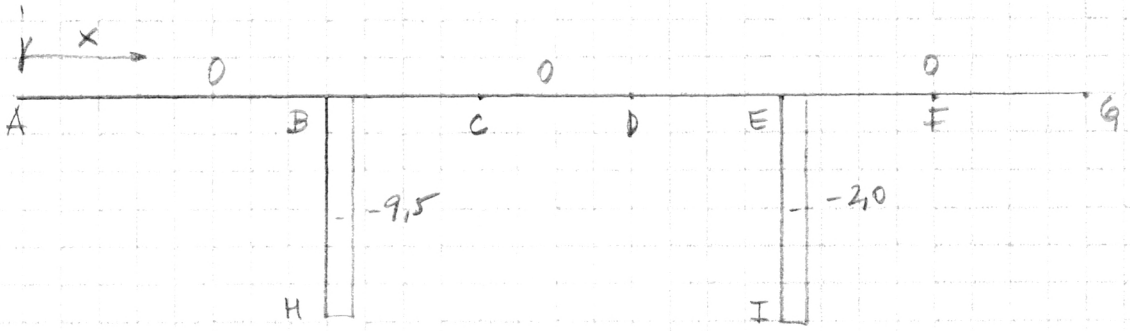
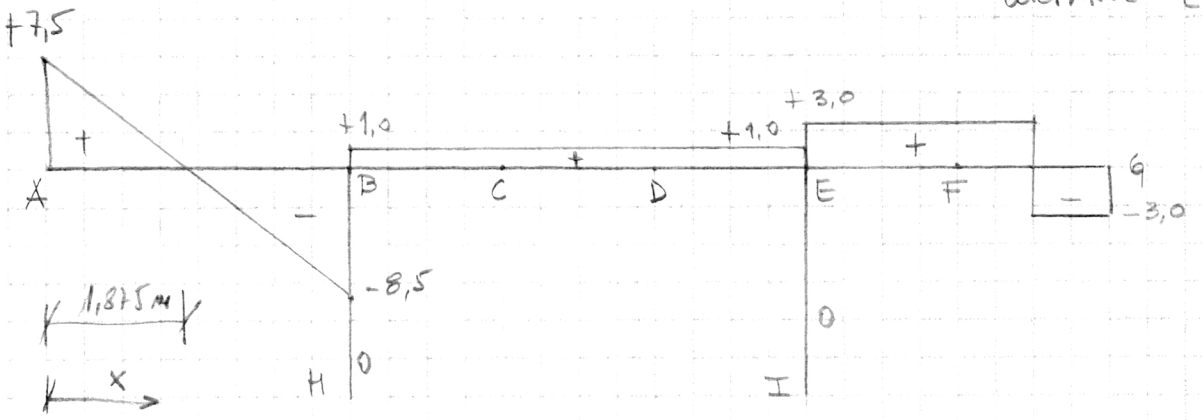
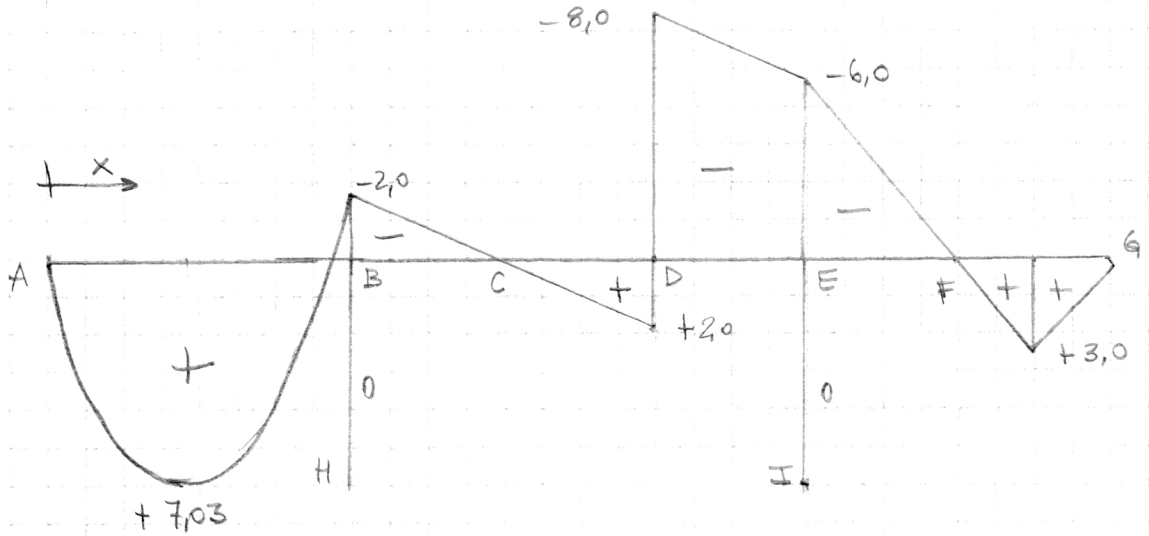
DIRECTA [kN]



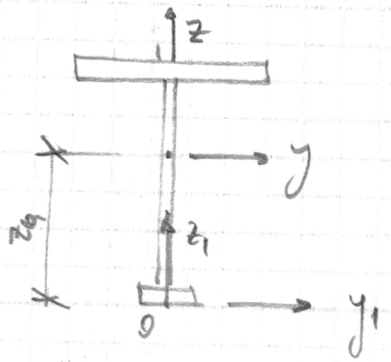
CORTANTE [kN]



FLECTOR [kNm]



b)



Obtengo z_G medido desde el sistema de ejes y_1, z_1:

$$z_G = \frac{5 \cdot 0{,}5 + 0{,}6 \cdot 18 \cdot 10 + 15 \cdot 19{,}5}{30{,}8}$$

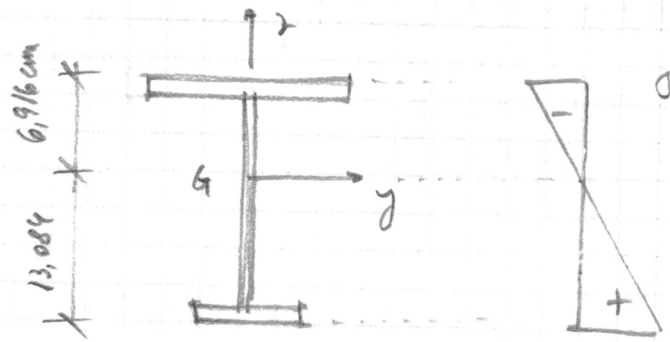
$$z_G = 13{,}084 \text{ cm}$$

(y, z) ejes baricéntricos:

$$I_y = \frac{0{,}6 \cdot 18^3}{12} + \frac{5}{12} + \frac{15}{12} + 0{,}6 \cdot 18 \cdot 3{,}084^2 + 5 \cdot 12{,}584^2 + 15 \cdot 6{,}416^2$$

$$I_y = 1805{,}25 \text{ cm}^4$$

MÁXIMO MOMENTO FLECTOR POSITIVO, $x = 1{,}875$ m, $M = 7{,}03$ kNm



$$\sigma_{sup} = -\frac{703 \cdot 6{,}916}{1805{,}25} = -2{,}693 \text{ kN/cm}^2$$

$$= -26{,}93 \text{ MPa}$$

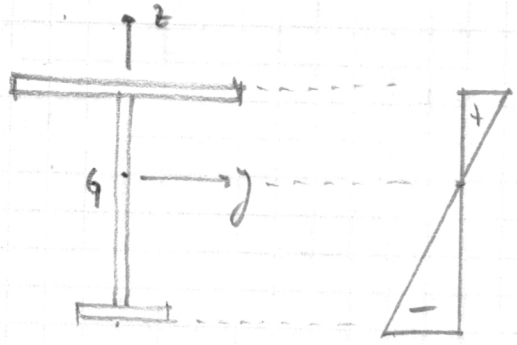
(compresión)

$$\sigma_{inf} = \frac{703 \cdot 13{,}084}{1805{,}25} = 5{,}095 \text{ kN/cm}^2$$

$$= 50{,}95 \text{ MPa}$$

(Tracción)

MÁXIMO MOMENTO FLECTOR NEGATIVO, $x = 8{,}0$ m, $M = -8{,}0$ kNm



$$\sigma_{sup} = 3{,}065 \text{ kN/cm}^2 = 30{,}65 \text{ MPa}$$

(Tracción)

$$\sigma_{inf} = -5{,}798 \text{ kN/cm}^2 = -57{,}98 \text{ MPa}$$

(Compresión)

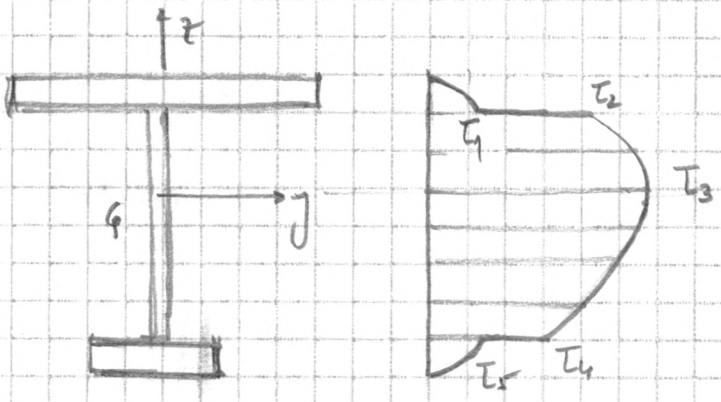
c) LA TENSIÓN RASANTE MÁXIMA SE DA EN LA SECCIÓN $x = 4{,}0$ m y $V = -8{,}5$ kN

$$\mu(z = 5{,}916\ \text{cm}) = \int_{5{,}916}^{6{,}916} 15 \cdot z\, dz = 96{,}24\ \text{cm}^3$$

$$\mu(z = -12{,}084\ \text{cm}) = -\int_{-13{,}084}^{-12{,}084} 5 \cdot z\, dz = 62{,}92\ \text{cm}^3$$

$$\mu(z = 0) = \mu_G = \int_{0}^{5{,}916} 0{,}6 \cdot z\, dz + 96{,}24 = 106{,}74\ \text{cm}^3$$

$$\tau = \frac{V \mu}{I b}$$



$$\tau_1 = \frac{-8{,}5 \cdot 96{,}24}{1805{,}24 \cdot 15} = -3{,}02 \cdot 10^{-2}\ \text{kN/cm}^2 = -0{,}302\ \text{MPa}$$

$\tau_2 = -7{,}55$ MPa

$\tau_3 = -8{,}38$ MPa (τ3 es el MÁXIMO y ocurre en G)

$\tau_4 = -4{,}949$ MPa

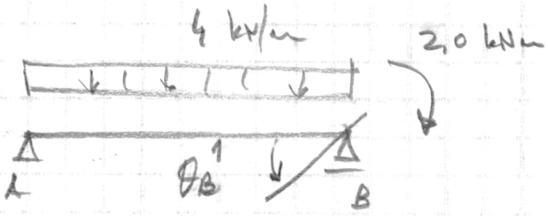
$\tau_5 = -0{,}593$ MPa

EL SIGNO ES A LOS EFECTOS DE INDICAR EL SENTIDO.

d)

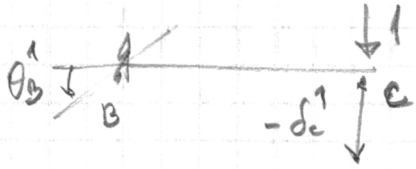
$$A = \frac{\pi}{4}(10^2 - 9^2) = 14{,}923 \text{ cm}^2$$

$E_a = 20000 \text{ kN/cm}^2$ (módulo de elasticidad



$$\theta_B^1 = \frac{4 \cdot 4 \cdot 400^2}{24 E_a I_y} - \frac{200 \cdot 400}{3 \cdot E_a I_y}$$

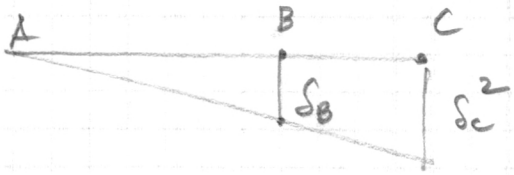
$$\theta_B^1 = +2{,}216 \times 10^{-3} \text{ rad}$$



$$\delta_c^1 = -\frac{1 \cdot 200^3}{3 E_a I_y} + 2{,}216 \times 10^{-3} \cdot 200$$

$$\delta_c^1 = +0{,}3693 \text{ cm}$$

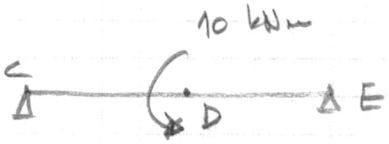
(positivo hacia arriba)



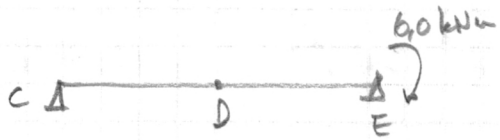
$$\delta_c^2 = -\frac{3}{2}\delta_B = -\frac{3}{2} \cdot \frac{9{,}5 \cdot 300}{E_a \cdot 14{,}923}$$

$$\delta_c^2 = -1{,}432 \times 10^{-2} \text{ cm}$$

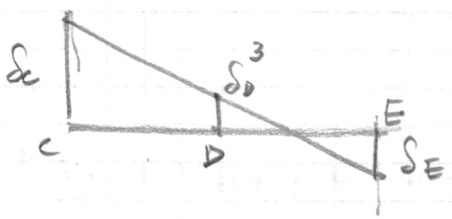
$$\delta_c = \delta_c^1 + \delta_c^2 = +0{,}3550 \text{ cm} \quad (\text{hacia arriba})$$



$$\delta_D^1 = 0$$



$$\delta_D^2 = \frac{600 \cdot 400^2}{16 E_a I_y} = +0{,}1662 \text{ cm}$$

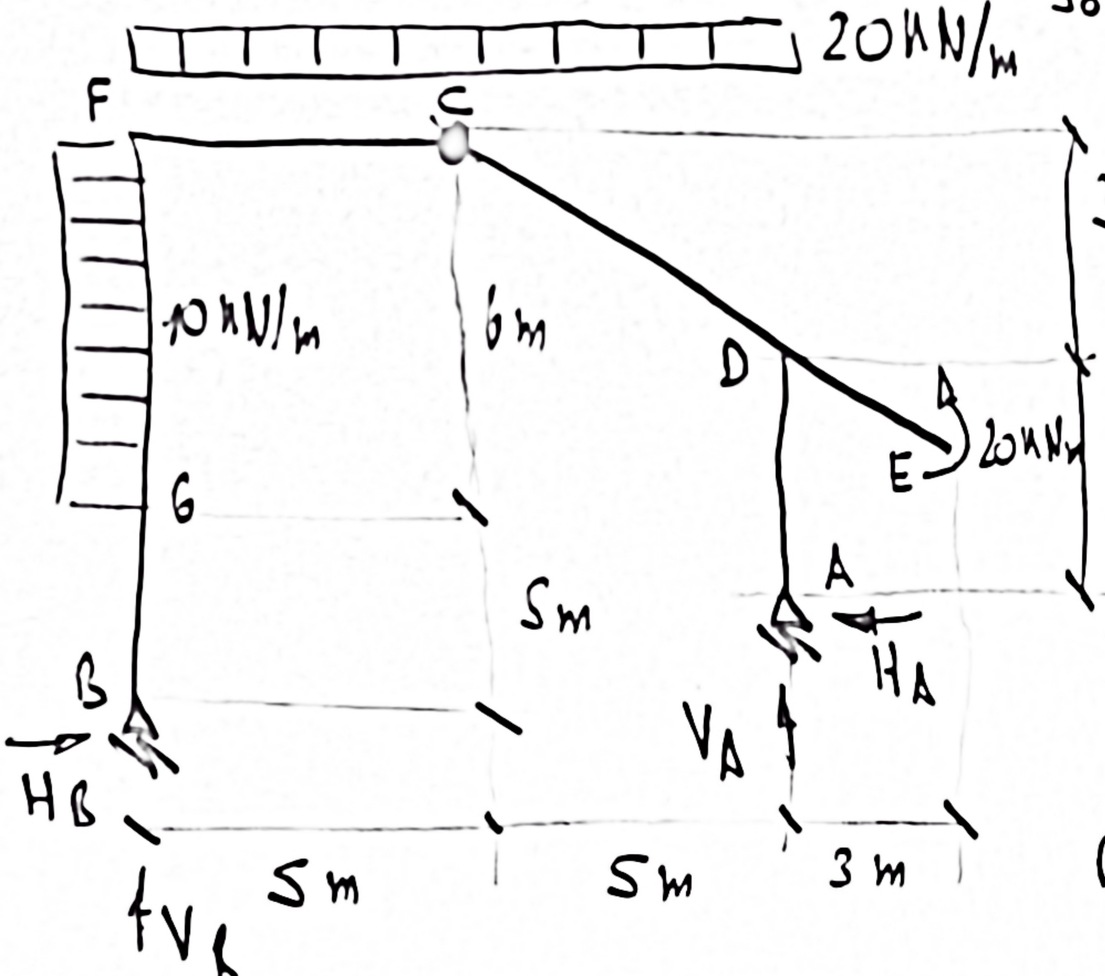


$$\delta_E = \frac{-2 \cdot 300}{E_a \cdot 14{,}923} = -2{,}01 \times 10^{-3} \text{ cm}$$

$$\delta_D^3 = +0{,}1765 \text{ cm}$$

$$\delta_D = \delta_D^1 + \delta_D^2 + \delta_D^3 = +0{,}3427 \text{ cm}$$

EL PUNTO D SE DESPLAZA HACIA ARRIBA 0,3427 cm.



Solución EJ Examen Resistencia 16 dic 2

$\Sigma M_A = 0 \rightarrow 20 \times 10 \times 5 - \frac{10 \times 6 \times 5}{2} + 20 - 10 V_B + V_B \cdot \frac{5}{10} = 0$

$72 - V_B + \frac{3}{10} H_B = 0$ (1)

Aislo CDEA:

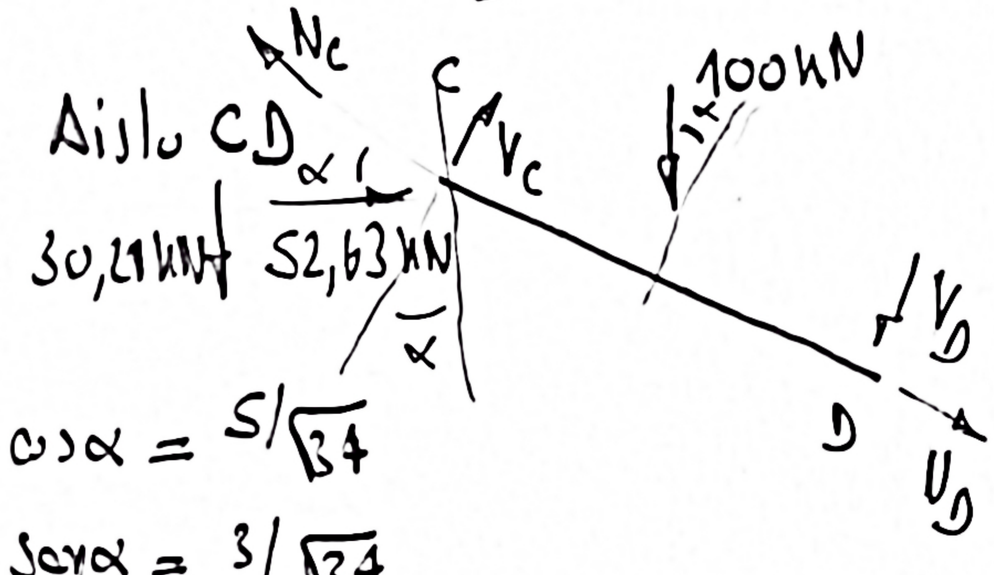
$\Sigma M_C = 0 \rightarrow -20 \times 5 \times \frac{5}{2} + 6 \times \frac{10}{5} \times 3 + \frac{11}{5} \times H_B - V_B \times 5 = 0$

$84 - V_B + \frac{11}{5} H_B = 0$ (2)

(1) - (2) $-14 + H_B \left(\frac{3}{10} - \frac{11}{5} \right) = 0 \rightarrow H_B = \frac{-140}{19} \rightarrow \boxed{H_B = -7,37\,kN}$

(2) $\rightarrow \boxed{V_B = 69,79\,kN}$

$\Sigma V_{ert} = 0 \Rightarrow \boxed{V_A = 130,21\,kN}$; $\Sigma H_{or} = 0 \rightarrow \boxed{H_A = 52,63\,kN}$



$\cos\alpha = 5/\sqrt{34}$

$\text{sen}\alpha = 3/\sqrt{34}$

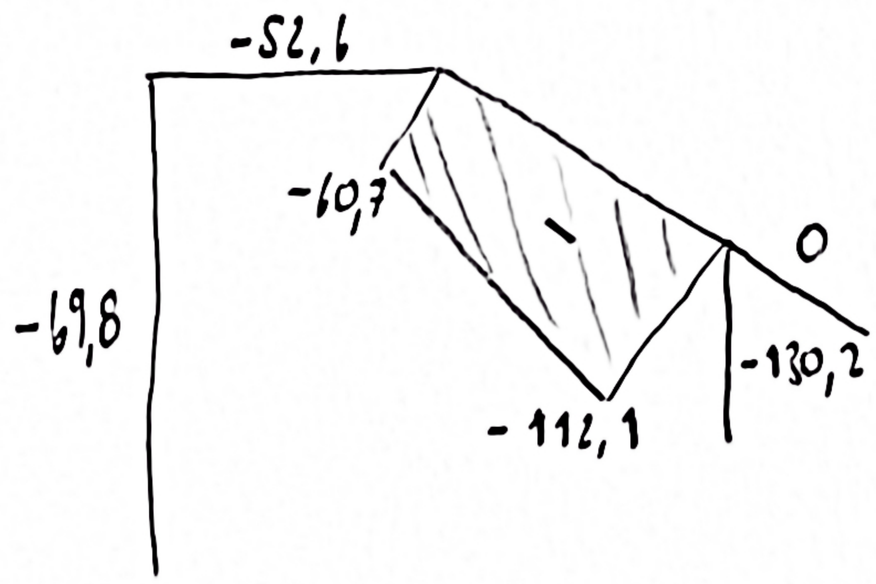
$N_C = -52,63 \cos\alpha - 30,21 \,\text{sen}\alpha = -60,67\,kN$

$V_C = 52,63 \,\text{sen}\alpha - 30,21 \cos\alpha = 1,17\,kN$

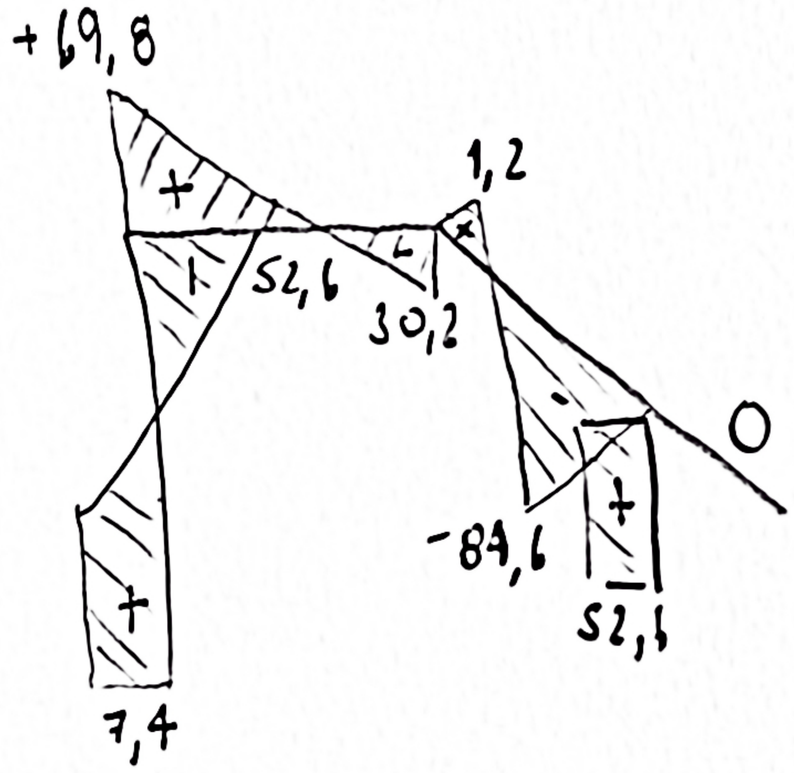
$N_D = -60,67 - 100 \,\text{sen}\alpha = -112,12\,kN$

$V_D = 1,17 - 100 \cos\alpha = -84,58\,kN$

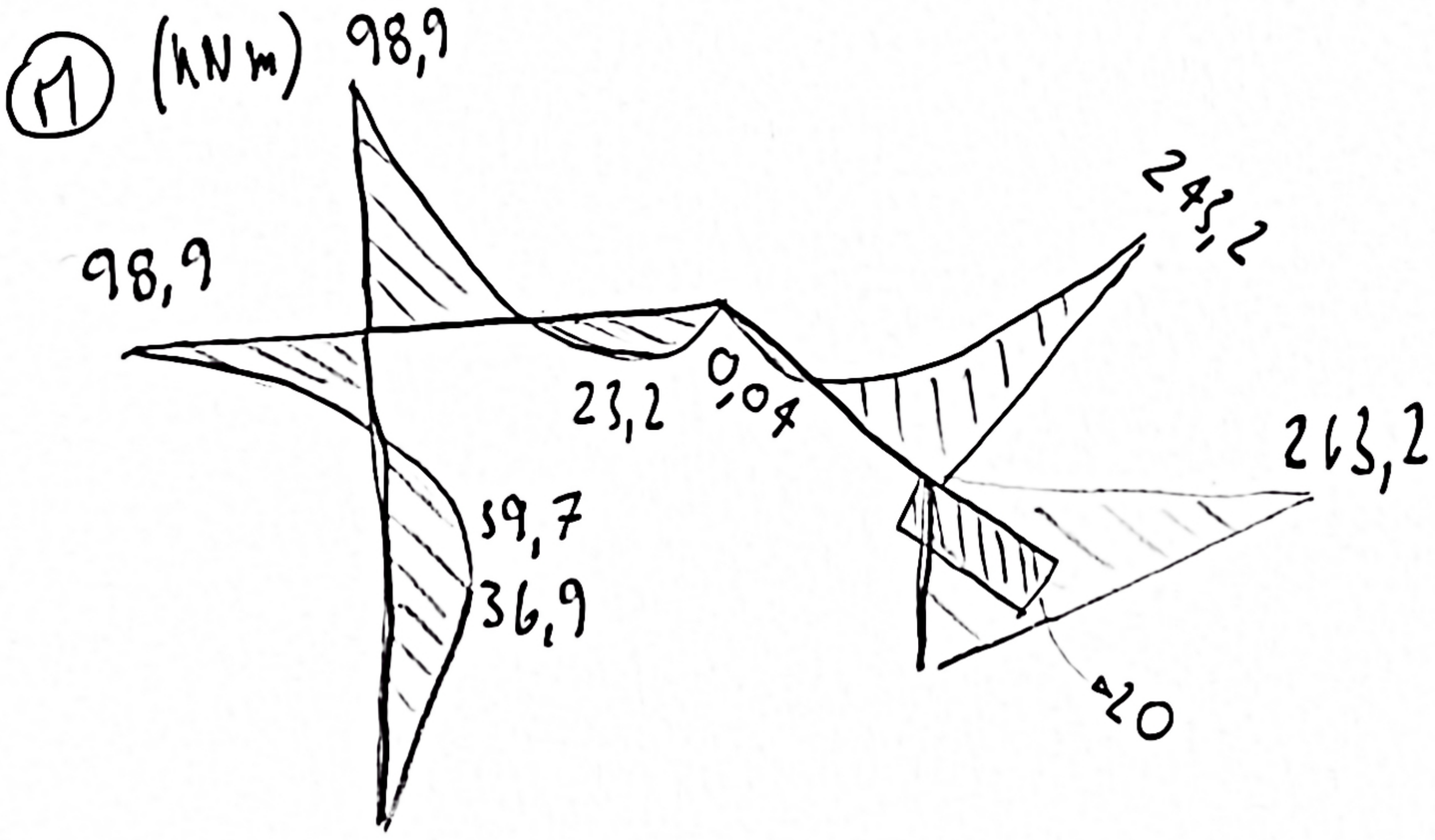
(N) (kN)



(V) (kN)



(M) (kNm)



b) Tomo $M_{max} = 263,2\,kNm$

$\frac{M_{max}}{\sigma_{adm}} \leq W \Rightarrow W \geq 1880\,cm^3$

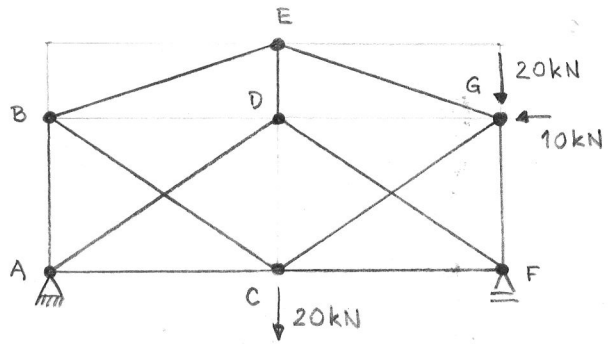
$\Rightarrow$ PNI 45

Ahora verifico con N en esa sección $N = -130,2\,kN$

$\sigma = 137,9 \leq 140$

PNI 45 $W = 2040\,cm^3$

$A = 147\,cm^2$

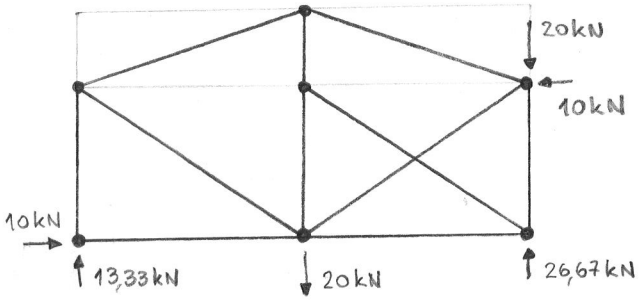


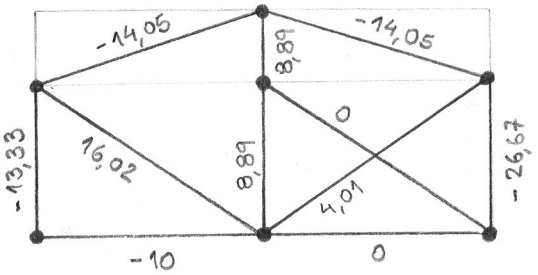
7 articulaciones → 14 GDL ✓

11 barras + 3 vínculos a tierra

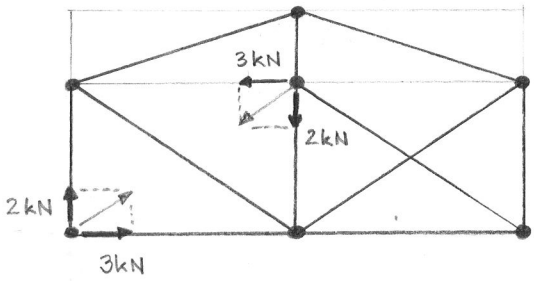
Uso método de Henneberg

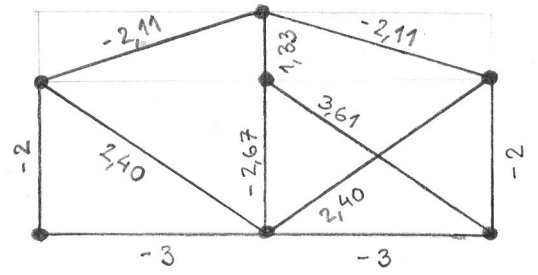
N[kN]





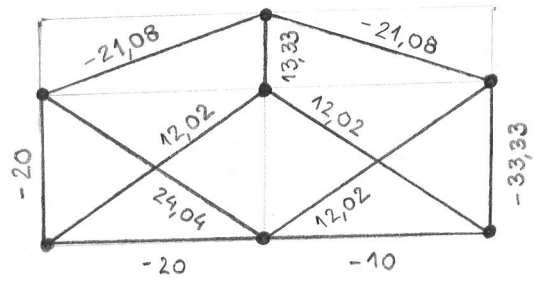
E1





E2

$$N_{CD} = N_{CD}^{E1} + N_{CD}^{E2} \cdot x = 0 \longrightarrow x = -\frac{N_{CD}^{E1}}{N_{CD}^{E2}} = \frac{8,89}{2,67} = \frac{10}{3}$$



N[kN]

$N^{+}_{max} = 24,04$ kN

$N^{-}_{max} = -33,33$ kN

$$Anec = \frac{|N^{-}_{max}|}{\sigma^{comp}_{adm}} = \frac{33,33 \cdot 10^3 N}{100 MPa}$$

$Anec = 333\ mm^2 \longrightarrow$ PNI 80