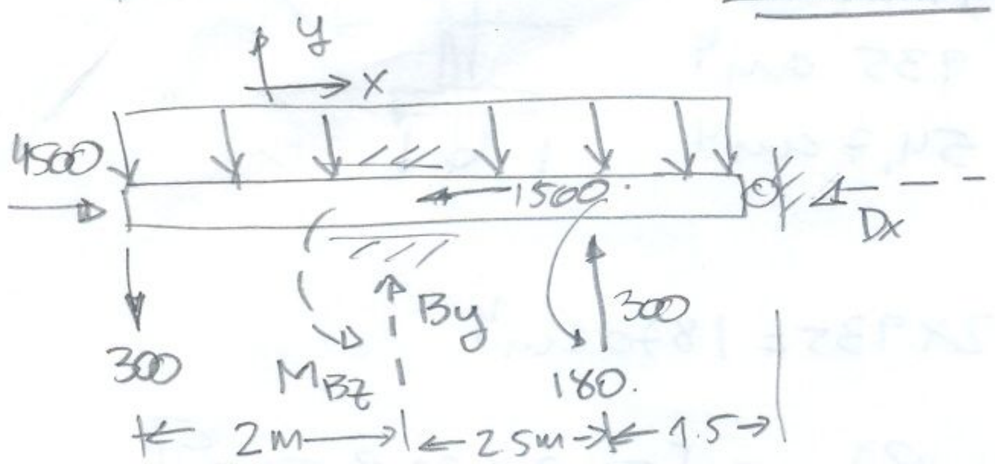
PROBLEMA 1

PLANO X-Y



$$\pm \rightarrow \sum F_x = 0 \rightsquigarrow 4500 - Dx - 1500 = 0 \rightarrow \boxed{Dx = 3000 \text{ kgf}}$$

$$+\uparrow \sum F_y = 0 \rightsquigarrow -300 - 550 \times 6 + By + 300 = 0$$

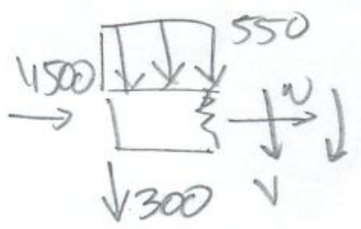
$$\boxed{By = 3300 \text{ Kgf}}$$

$$\circlearrowleft + \sum M_{Az} = 0$$

$$3300 \times 2.0 + 300 \times 4.5 - 550 \times 6 \times 3 + 180 + M_{Bz} = 0$$

$$\boxed{M_{Bz} = 1770 \text{ Kgf} \cdot m}$$

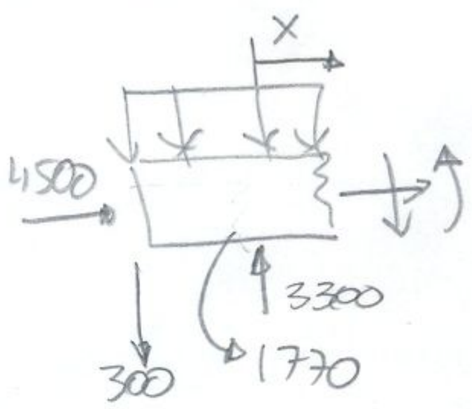
$0 \leq x \leq 2$



$$V + 300 + 550x = 0 \rightsquigarrow V = -550x + 300$$

$$M + 550x \cdot x/2 + 300x = 0 \rightsquigarrow M = -275x^2 - 300x$$

$0 \leq x \leq 2.5$



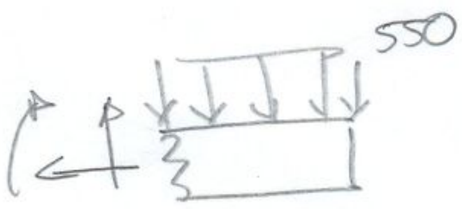
$$V = 3300 + 300 + 2 \times 550 + x \cdot 550 = 0$$

$$\hookrightarrow V = 1900 - x \cdot 550$$

$$M + 300(x+2) - 300x + 1770 + 550 \times 2(x+1) + 275x^2 = 0$$

$$M = -3470 + 1900x - 275x^2$$

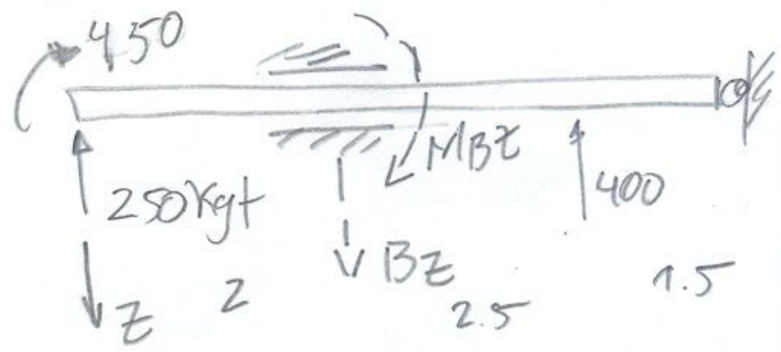
$0 \leq x \leq 1.5$



$$V = 550x$$

$$M = -275x^2$$

PLANO X-Z



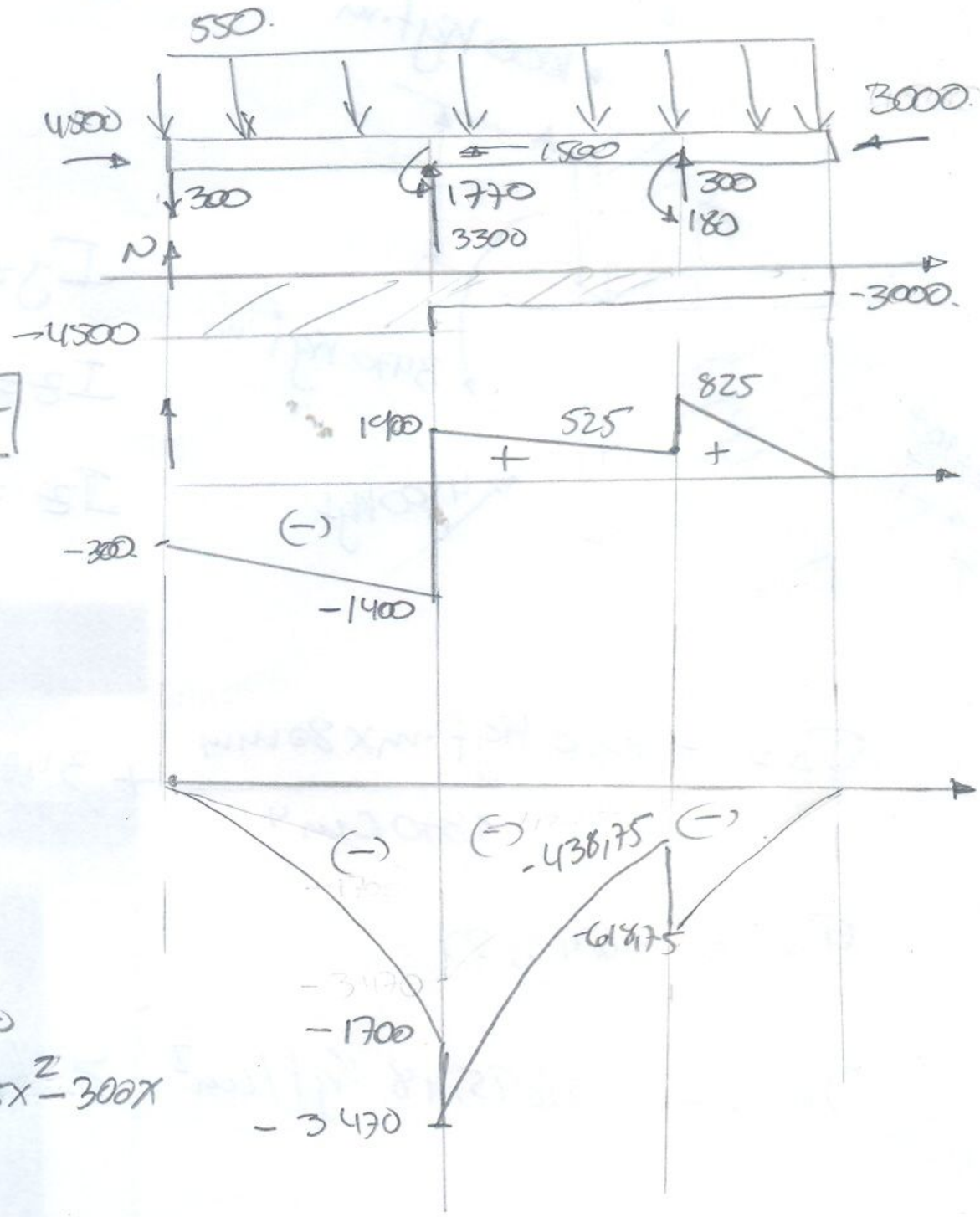
$$+\uparrow \sum F_z = 0 \rightsquigarrow 250 - Bz + 400 = 0$$

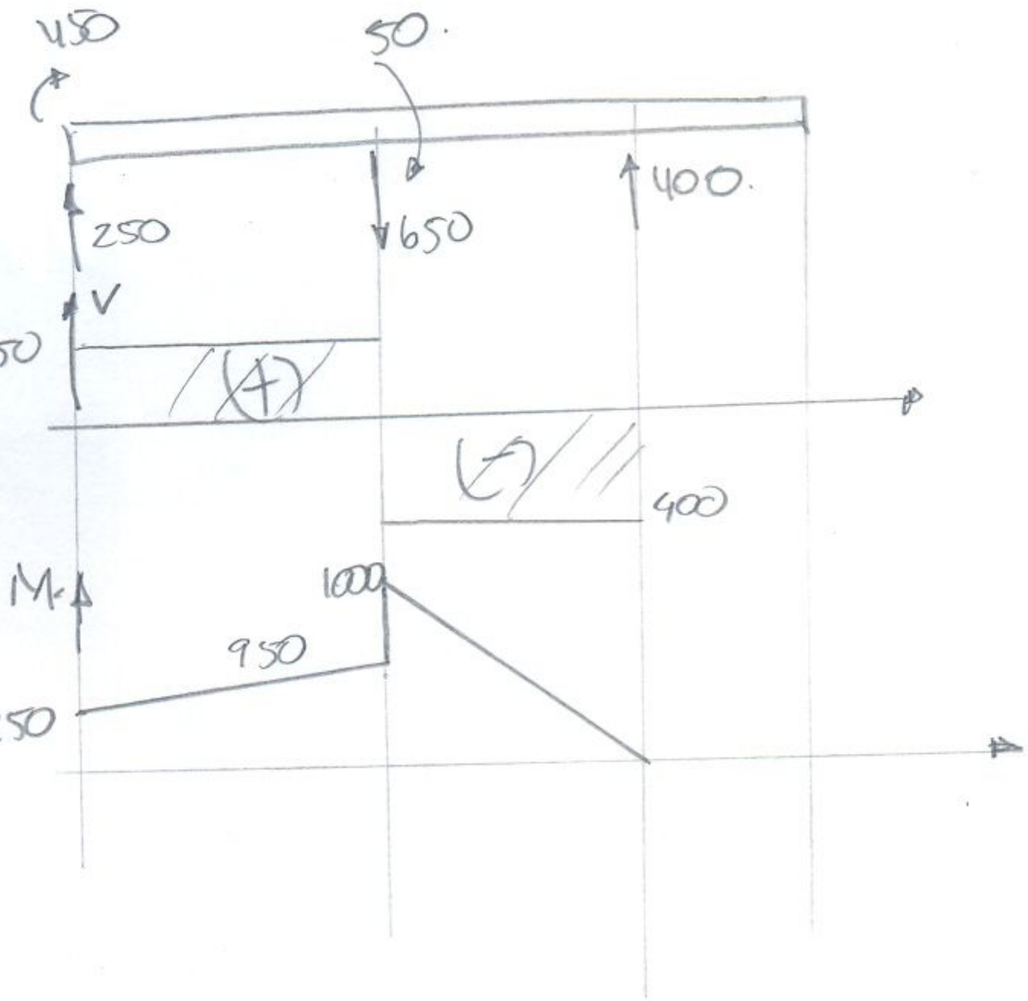
$$\boxed{Bz = 650 \text{ Kgf}}$$

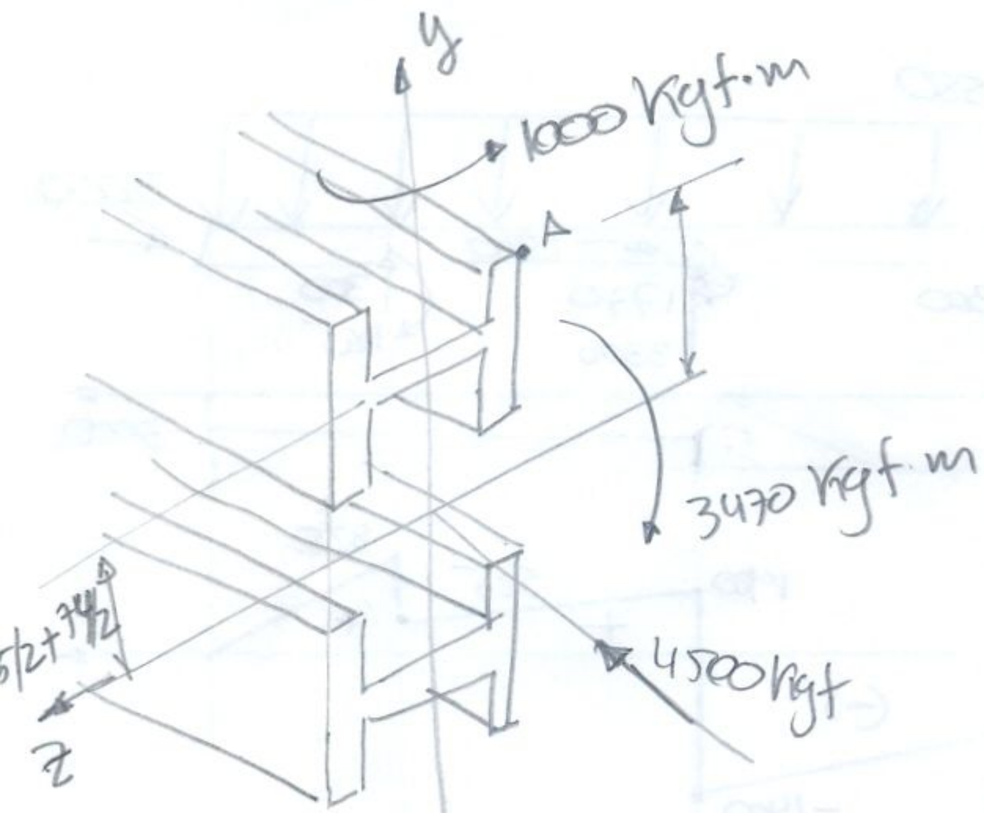
$$\circlearrowleft + \sum M_{Ay} = 0$$

$$-450 - 650 \times 2 - M_{By} + 400 \times 4.5 = 0$$

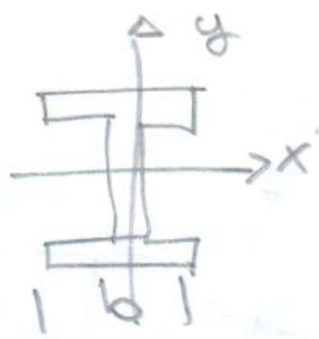
$$\boxed{M_{By} = 50 \text{ Kgf} \cdot m}$$







I-160 { A = 22,80 cm²
b = 74 mm
Ix = 935 cm⁴
Iy = 54,7 cm⁴



$$I_y = 2I_{x_I} = 2 \times 935 = 1870\ cm^4$$

$$I_z = 2\left[I_{y_I} + A d^2\right] = 2\left[54,7 + 22,8 \cdot 5,45^2\right]$$

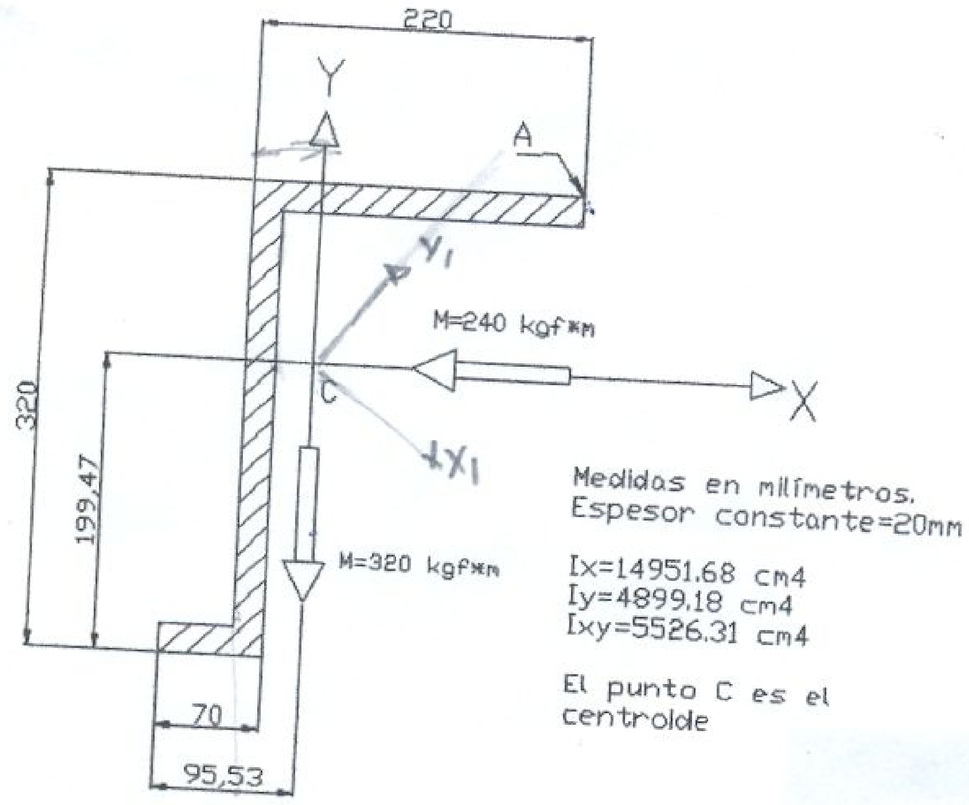
$$I_z = 1463,834\ cm^4.$$

$$\sigma_A = \frac{-1000\ Kgf \cdot m \times 80\ mm}{1870\ cm^4} + \frac{3470\ Kgf \cdot m \times (74+35/2)\ mm}{1463,834\ cm^4} - \frac{4500\ Kgf}{2 \times 22,8\ cm^2}$$

$$\sigma_A = 1642,50$$

$$\sigma_{max} = -2695,48\ Kgf/cm^2 > Rp/\varphi \quad \text{FALLA.}$$

PROBLEMA 2



Medidas en milímetros.
Espesor constante=20mm

Ix=14951.68 cm4
Iy=4899.18 cm4
Ixy=5526.31 cm4

El punto C es el centroide

ÁNGULO DE ROTACIÓN

$$\tan 2\theta_p = \frac{-2I_{xy}}{I_x - I_y} = \frac{-2 \cdot 5526,31}{14951,68 - 4899,1}$$

$$2\theta_p = -47,713$$

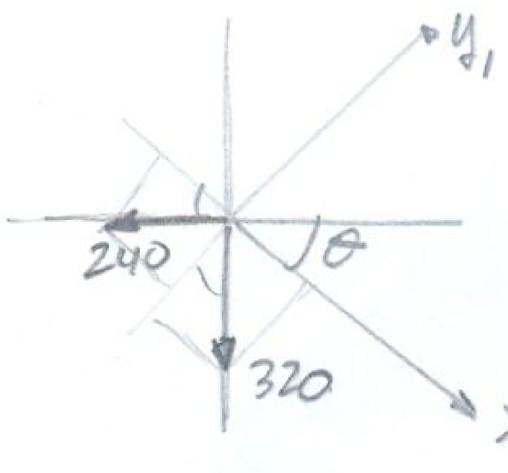
$$\theta_p = -23,85^\circ$$

- Describiendo Sist x_1-y_1 en x-y.

$$X_1 = \cos\theta\,\hat{i} - \text{sen}\theta\,\hat{j} \rightsquigarrow \boxed{X_1 = 0,914\,\hat{i} - 0,4}$$

$$Y_1 = \text{sen}\theta\,\hat{i} + \cos\theta\,\hat{j} \rightsquigarrow \boxed{Y_1 = 0,404\,\hat{i} + 0,9}$$

- Describiendo momentos en $x_1 - y_1$



$$M_{x_1} = -240 \cdot \cos\theta + 320 \cdot \text{sen}\theta \rightsquigarrow \boxed{M_{x_1} = -90,11 \text{ Kgf}\cdot\text{m}}$$

$$M_{y_1} = -240\,\text{sen}\theta - 320\cos\theta \rightsquigarrow \boxed{M_{y_1} = -389,71 \text{ Kgf}\cdot\text{m}}$$

- Posición del punto A en sist x-y.

$$\overline{CA}_{xy} = [220 - 20 - (95,53 - 70)]\,\hat{i} + (320 - 199,47)\,\hat{j} \rightsquigarrow \boxed{\overline{CA}_{xy} = 174,47\,\hat{i} + 120,53\,\hat{j}}$$

$$X_{A_1} = \overline{CA}_{xy} \cdot x' = (174,47\hat{i} + 120,53\hat{j})(\cos 23,85\,\hat{i} - \text{sen}\,23,85\,\hat{j}) =$$

$$\boxed{X_{A_1} = 110,835 \text{ mm}}$$

$$Y_{A_1} = \overline{CA}_{xy} \cdot y' = (174,47\,\hat{i} + 120,53\,\hat{j})(\text{sen}\,23,85\,\hat{i} + \cos 23,85\,\hat{j})$$

$$\boxed{Y_{A_1} = 180,78 \text{ mm}}$$

- Cálculo de inercias en sist x_1-y_1

$$I_{x_1} = \left(\frac{I_x + I_y}{2}\right) + \left(\frac{I_x - I_y}{2}\right)\cos 2\theta - I_{xy}\,\text{sen}\,2\theta$$

$$= \left(\frac{14951,68 + 4899,18}{2}\right) + \left(\frac{14951,68 - 4899,18}{2}\right)\cos(-47,713) - 5526,31\,\text{sen}(-47,713)$$

$$\boxed{I_{x_1} = 17395,59 \text{ cm}^4}$$

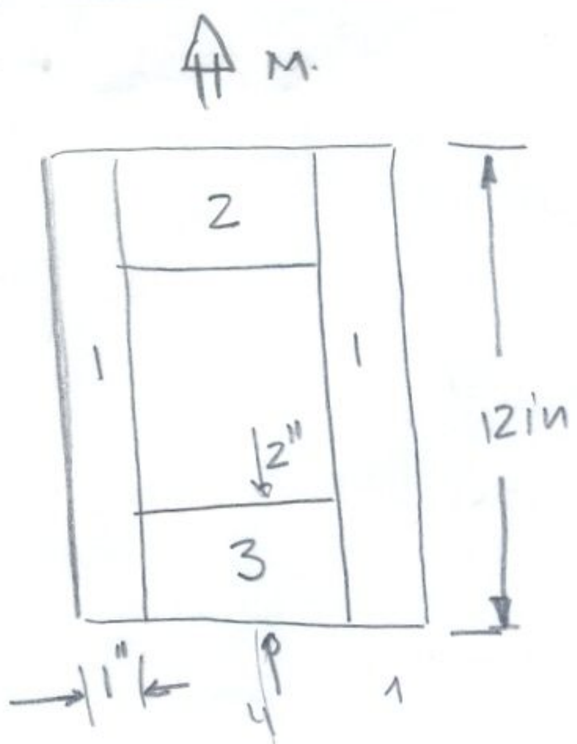
$$I_{x_1} + I_{y_1} = I_x + I_y \rightarrow I_{y_1} = I_x + I_y - I_{x_1}$$

$$\boxed{I_{y_1} = 2455,43}$$

$$\sigma_A = \frac{(-90,11 \text{ kgf}\cdot\text{m}) \cdot 180,78 \text{ mm}}{17395,59 \text{ cm}^4} + \frac{(389,71 \text{ kgf}\cdot\text{m})\,110,835}{2455,43 \text{ cm}^4}$$

$$\boxed{\sigma_A = +166,54 \text{ kgf/cm}^2}$$

PROBLEMA 3



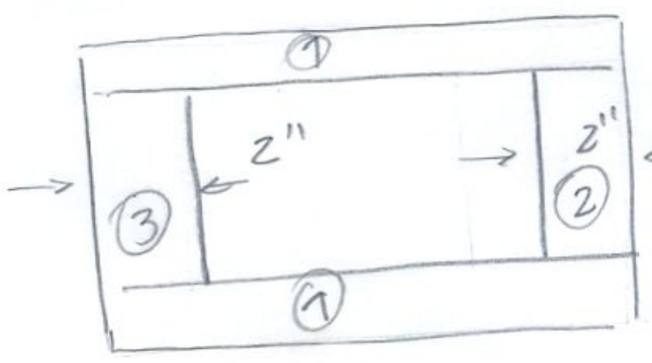
$E_1 = 1.6 \times 10^6$ psi° $\quad R_{p_1} = 2000$ psi

$E_2 = 1.2 \times 10^6$ psi° $\quad R_{p_2} = 1700$ psi

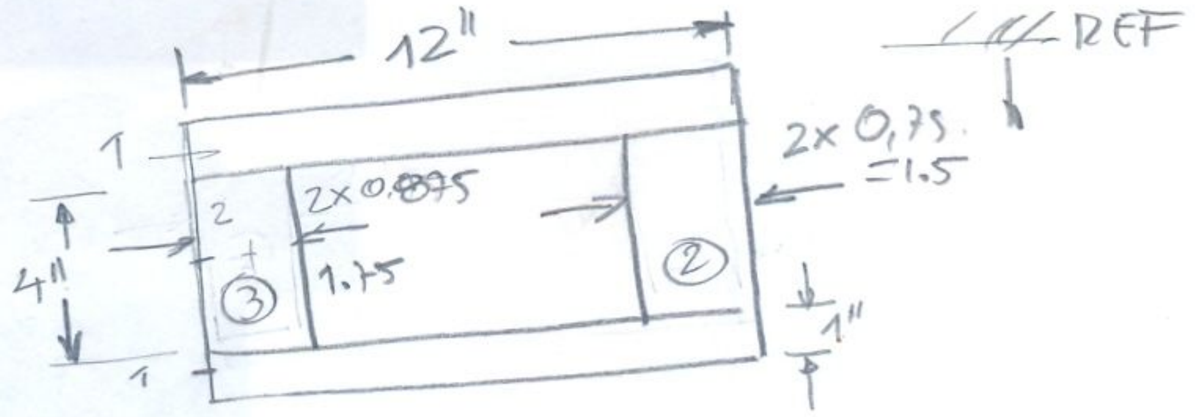
$E_3 = 1.4 \times 10^6$ psi° $\quad R_{p_3} = 1850$ psi°

TRANSFORMANDO A MATERIAL (1)

$$n_{2\to1} = \frac{1.2}{1.6} = 0{,}75 \qquad n_{3\to1} = \frac{1.4}{1.6} = 0{,}875$$



M ⇒



$$Y_G = \frac{(12\times1\times1/2) + (4''\times1.75)\times3 + (1{,}5''\times4'')\cdot3 + (12\times1\times5.5)}{(12\times1) + (12\times1) + 1.75\times4 + 1.5\times4} = \underline{3.1}$$

$$I = \frac{1}{12}\,1.75\cdot4^3 + \frac{1}{12}\cdot1.5\times4^3 + 2\left[\frac{1}{12}\cdot12\cdot1^3 + 12\times1\cdot2{,}5^2\right]$$

$$I = 169{,}33\ in^4$$

$$\sigma_1 = \frac{M_1\cdot3''}{I} \angle R_{p_1} \Rightarrow M_1 = \frac{2000\,psi^\circ\cdot169{,}33\,in^4}{3''} = 112886{,}66\ lbf\cdot in$$

$$\sigma_2 = \frac{M_2\,1''}{I}\cdot n_{2-1} \angle R_{p2} \Rightarrow M_2 = \frac{1700\,psi^\circ\cdot169{,}33\,in^4}{2''\cdot0{,}75} = 191907{,}33\ lbf\cdot in$$

$$\sigma_3 = \frac{M_3\,1''}{I}\cdot n_{3-1} \angle R_{p_3} \Rightarrow M_3 = \frac{1850\,psi\cdot169{,}33\,in^4}{2''\times0{,}875} = 179006\ lbf\cdot in$$