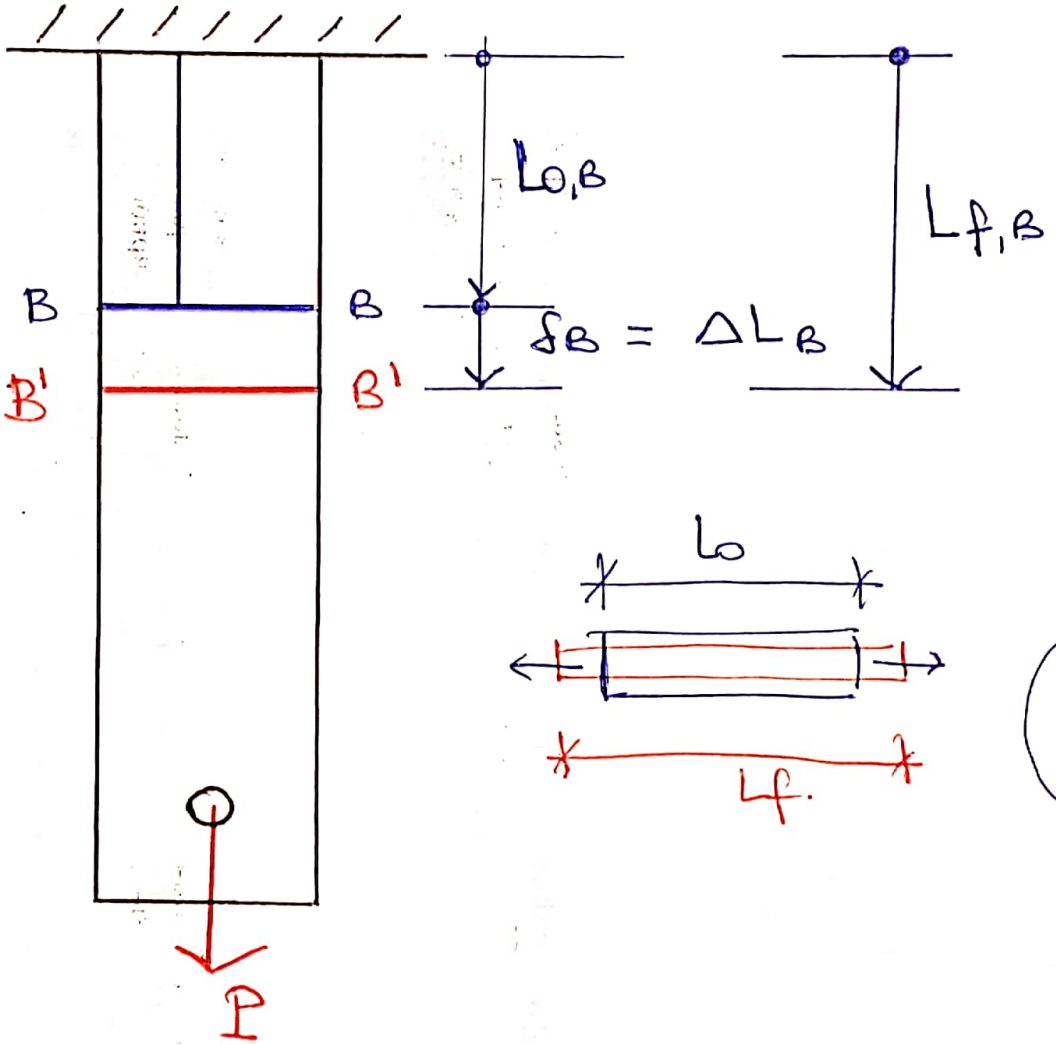


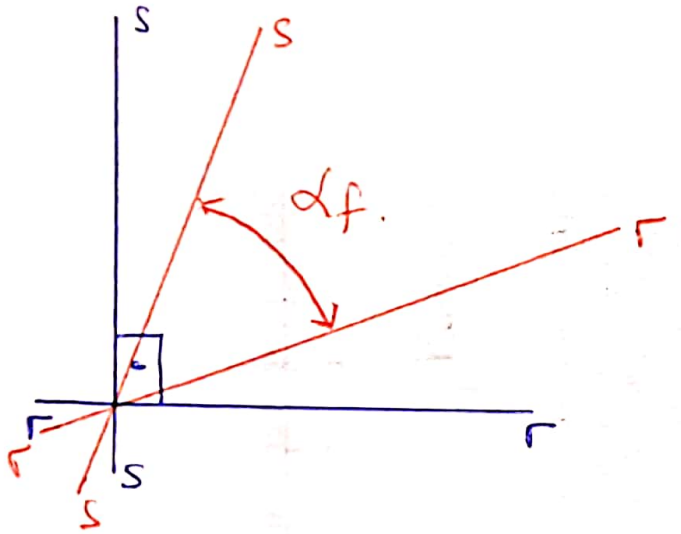
$$\Delta L_B = L_{fB} - L_{oB}$$

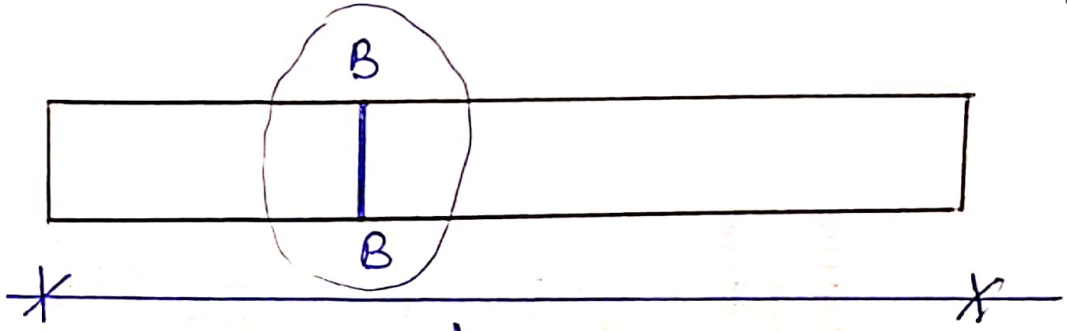
$$\frac{\Delta L_B}{L_{o,B}} = \varepsilon_{xx} = cte.$$

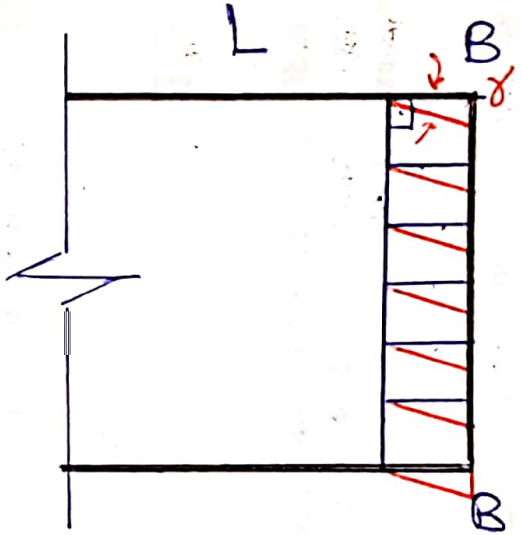
$$\frac{L_{fB} - L_{oB}}{L_{oB}} = \varepsilon_{xx}$$

$$\sigma_x(x) = \underbrace{E}_{cte} \cdot \underbrace{\varepsilon_{xx}(x)}_{cte}$$

$\sigma_x(x)$: cte.



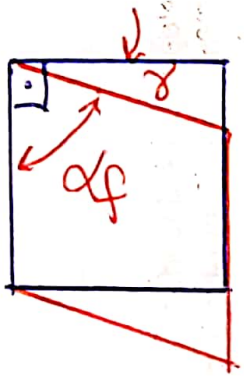




$\alpha_0 = 90°$

$\alpha_0 - \alpha_f = \gamma =$ Distorsión

$90°$



MLE	MC
σ_x	$= E \cdot \varepsilon_{xx}$
τ_{ij}	$= G \cdot \gamma_{ij}$

Si $\gamma = 0 \longrightarrow \tau = G \cdot \underbrace{\gamma}_{=0} = 0$

SI ≡ TENS

(2) $Q_y = 0 = \int_A \underbrace{\tau_{xy}}_{=0} \cdot dA = 0$ ✓

(3) $Q_z = 0 = \int_A \underbrace{\tau_{xz}}_{=0} dA = 0$ ✓

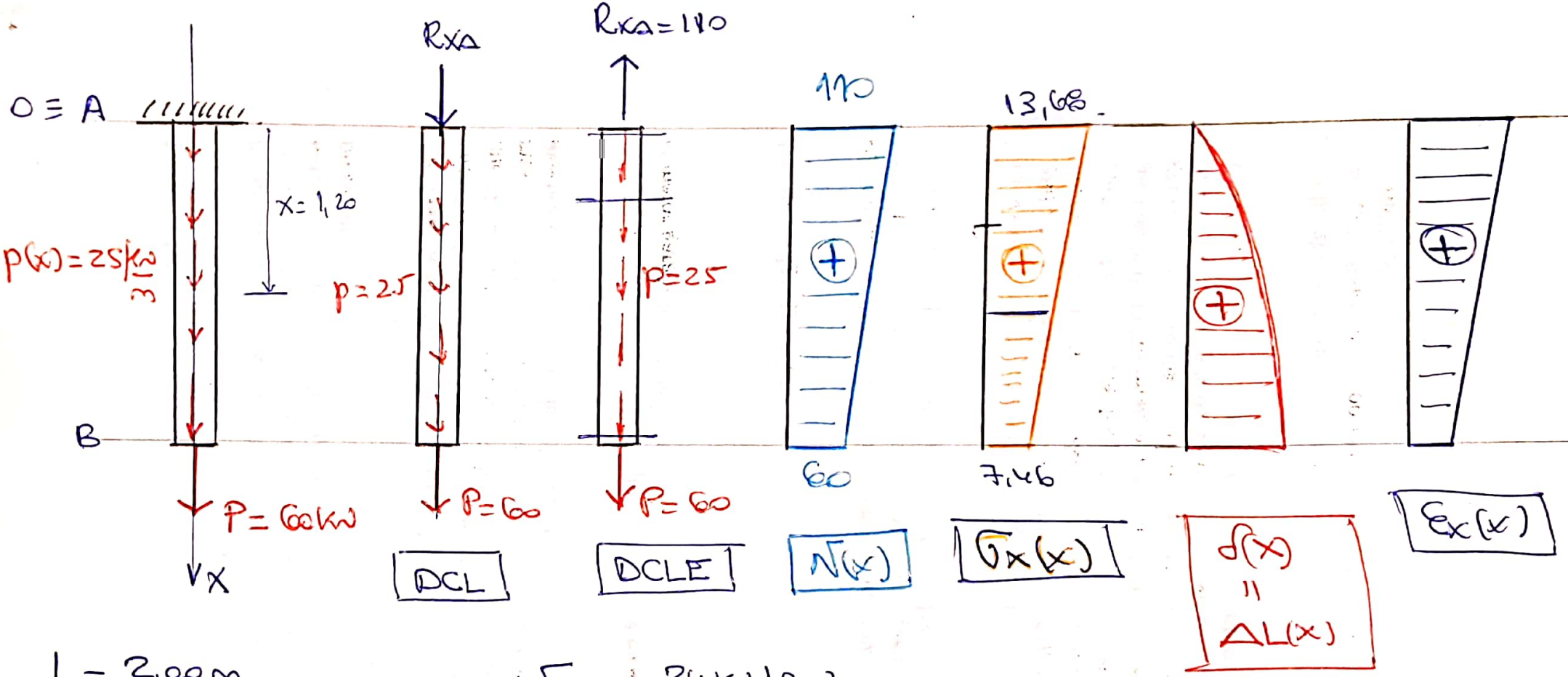
SI TENS

2º CASO: $\gamma = cte. \longrightarrow \tau = G \cdot \gamma = cte.$

(2) $Q_y = 0 = \int_A \tau_{xy}\, dA = \cancel{\tau_{xy}} \int_A dA = \int_A dA$

(3) $Q_z = 0 = \int_A \tau_{xz}\, dA = \cancel{\tau_{xz}} \int_A dA = \int_A dA.$

$$\boxed{\tau_{xy} = \tau_{xz} = 0.}$$



$L = 2{,}00\ m$

$D = 32\ mm$

$A =$

$E = 20000\ kN/cm^2$

$F = 24$ $\quad CS = 1{,}60.$

$\sigma_F = 24\ kN/cm^2$

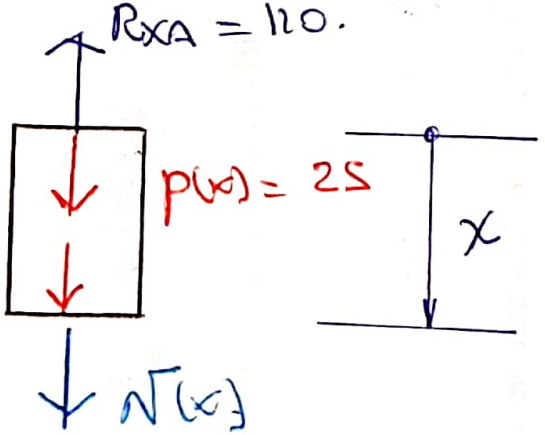
$\sigma_{adm} = \frac{\sigma_F}{CS} = \frac{24}{1{,}6} = 15\ \frac{kN}{cm^2}$

1º) **RVE**

$$\Sigma F_x = 0. \quad \underbrace{60\,kN}_{P} + \underbrace{25\,\frac{kN}{m} \cdot 2m}_{p \cdot L} + R_{xA} = 0$$

$$R_{xA} = -60 - 50 \rightarrow \boxed{R_{xA} = -110\,kN}$$

2º) **SI = N(x).**



$$N(x) + p(x) \cdot x - R_{xA} = 0.$$

$$N(x) + p(x)\,x - P - p(x)\,L = 0.$$

$$N = P + pL - px = P + p(L - x)$$

$$\boxed{N(x) = P + p(L - x)}$$

$$N(x=0) = P + pL = 110\,kN$$

$$N(x=L) = P = 60\,kN$$

3º) **$\sigma_x(x)$**

$$\sigma_x(x) = \frac{N(x)}{A(x)} = \frac{P + p(L-x)}{A}$$

$$A = \frac{\pi D^2}{4} = \frac{\pi\,(3{,}2\,cm)^2}{4} = 8{,}04\,cm^2$$

$$\boxed{\sigma_x(x) = \frac{P}{A} + \frac{p}{A}(L - x)}$$

$$\sigma_x(x=0) = 110\,kN / 8{,}04\,cm^2 = 13{,}68$$

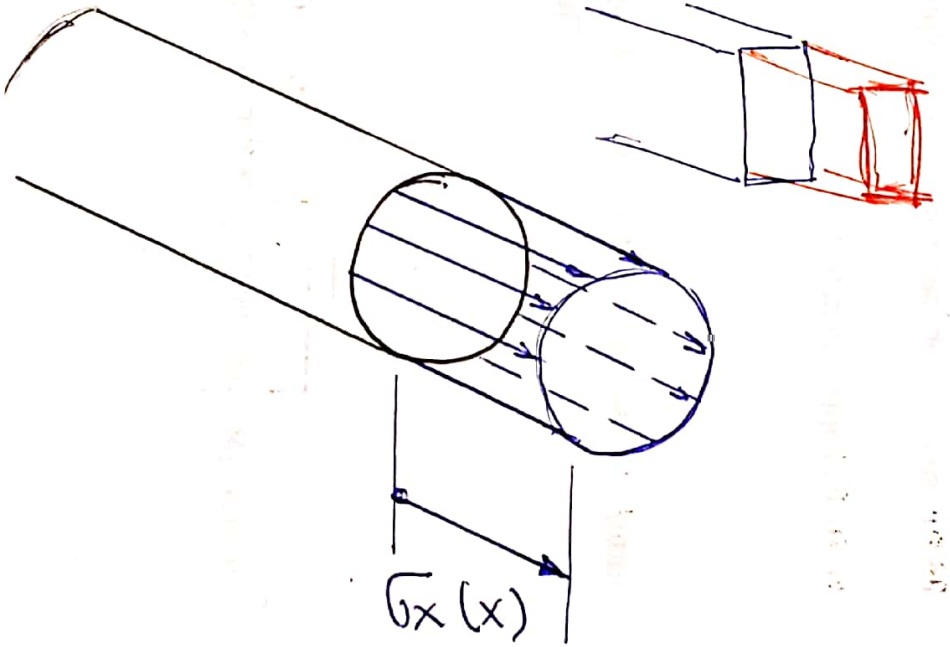
$$\sigma_x(x=L) = 60\,kN / 8{,}04\,cm^2 = 7{,}46\,\frac{kN}{cm^2}.$$

4º) VERIFICACIÓN POR RESISTENCIA

$$\sigma_{x,máx} \leq \sigma_{x,ADM}$$

$$13^{68}\ \frac{kN}{cm^2} < 15^{00}\ \frac{kN}{cm^2}$$ ✓

5º) VOLUMEN DE TENSIONES:



6º) FUNCIÓN DESPLAZAMIENTO:

$$\delta(x) = \int \frac{N(x)}{\underbrace{E\,A(x)}_{CTE}}\,dx = \frac{1}{EA}\int N(x)\,dx.$$

$$\delta(x) = \frac{1}{EA}\int [P + p(L-x)]\,dx$$

$$\delta(x) = \frac{1}{EA}\left[Px + pLx - p\frac{x^2}{2}\right]$$

$$\delta(x) = \frac{1}{EA}\left[(P+pL)x - \frac{p}{2}x^2\right]$$

7º) FUNCIÓN DEFORMACIÓN ESPECÍFICA

$$\varepsilon_x(x) = \frac{df(x)}{dx} = \frac{1}{EA}\left[(P + pL) - px\right]$$

$$\varepsilon_x(x=0) = \frac{1}{EA}(P + pL)$$

$$\varepsilon_x(x=L) = \frac{1}{EA}\left[P + \cancel{pL} - \cancel{pL}\right]$$

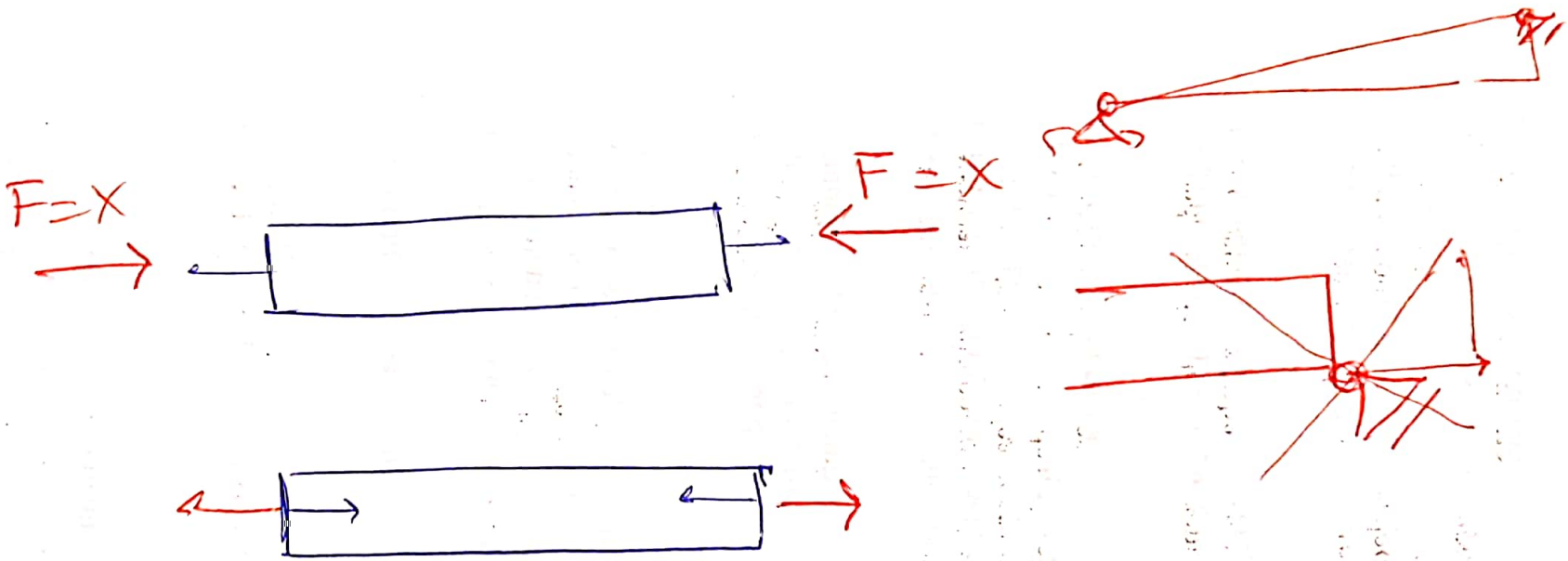
$$\boxed{\varepsilon_x(x=L) = \frac{P}{EA}}$$

FALTA VER:

- DESPLAZAMIENTOS RELATIVO
- VERIFICACIÓN POR DEFORMABILIDAD.

$$\delta_{max} = \frac{L}{a} = \frac{L}{400}$$

8º)

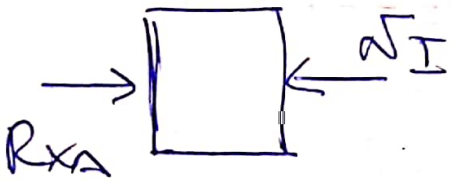


Si $\Delta T > 0 \rightarrow \sigma = X < 0$ (−) C

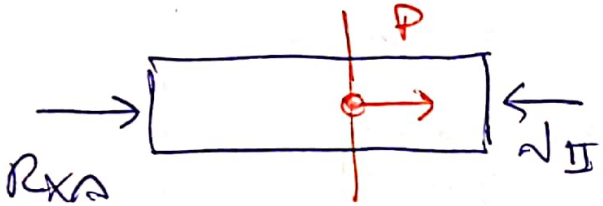
Si $\Delta T < 0 \rightarrow \sigma = X > 0$ (+) T

$$\Delta L_I = \frac{N_I \cdot L_I}{E_I A_I} \qquad \Delta L_{II} = \frac{N_{II} L_{II}}{E_{II} A_{II}}$$

$$E_I = E_{II} = E \qquad A_I = A_{II} = A$$



$$\Delta L_I = -\frac{R_{xa}\, a}{EA}$$



$$\Delta L_2 = -\frac{(R_{xa}+P)\, b}{EA}$$

$$-\frac{R_{xa}\, a}{EA} - \frac{(R_{xa}+P)\, b}{EA} = 0$$

EC. DE COMPATIBILIDAD DE LOS DESPLAZAMIENTOS

$$\Delta L_{\Delta T} + \Delta L_N = 0.$$

$$\alpha \Delta T L_{x0} + \frac{N L_{x0}}{EA} = 0$$

$$\varepsilon_{xx,\Delta T} + \varepsilon_{xx,N} = 0$$

$\sum F_x = 0.$

$R_{xA} + P + R_{xC} = 0$

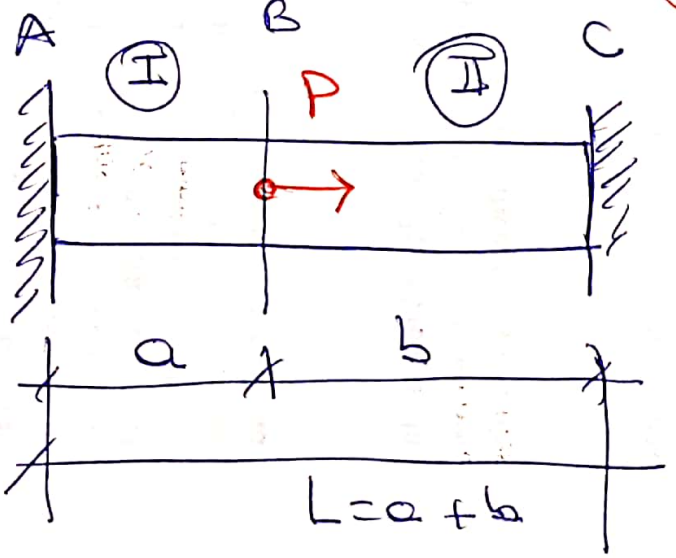
$L_f = L_0$

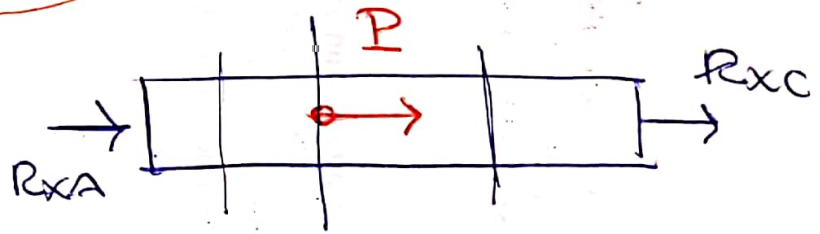
$L_f - L_0 = 0$

{ ESTRUCTURAS HIPERESTÁTICAS }

I) POR INSPECCIÓN

II) POR MIE

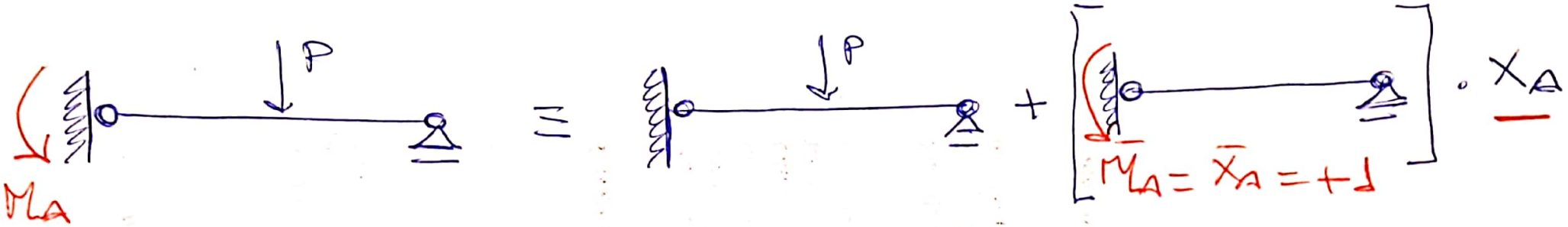




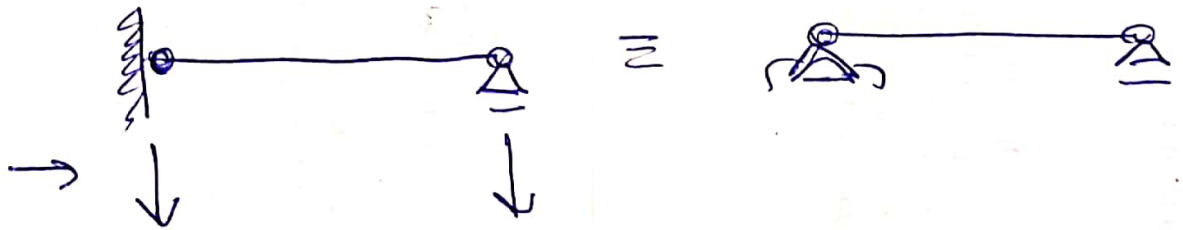
$\Delta L = 0$

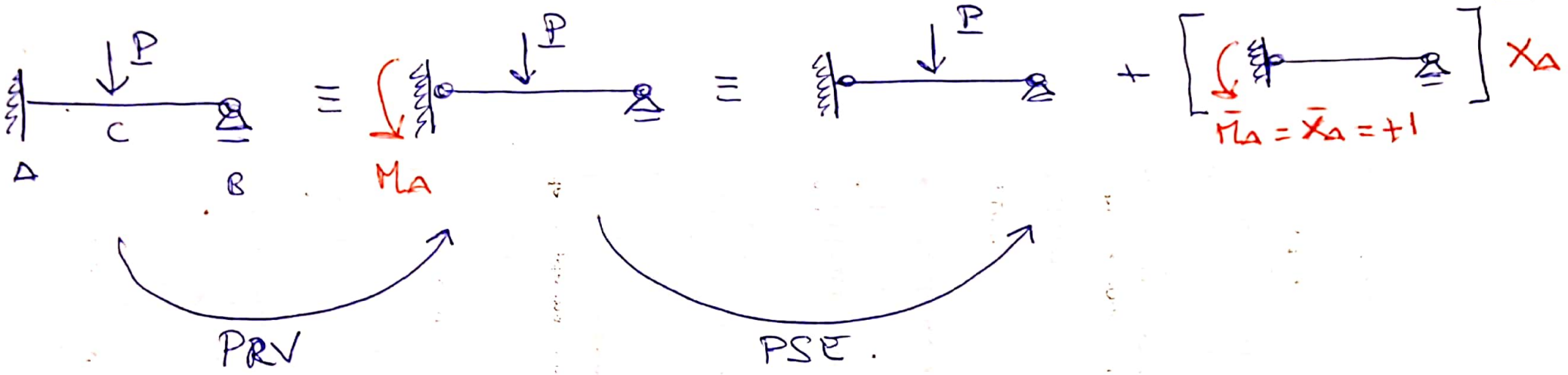
$\Delta L_I + \Delta L_{II} = 0$

$(L_{fI} - L_{0I}) + (L_{fII} - L_{0II}) = 0$

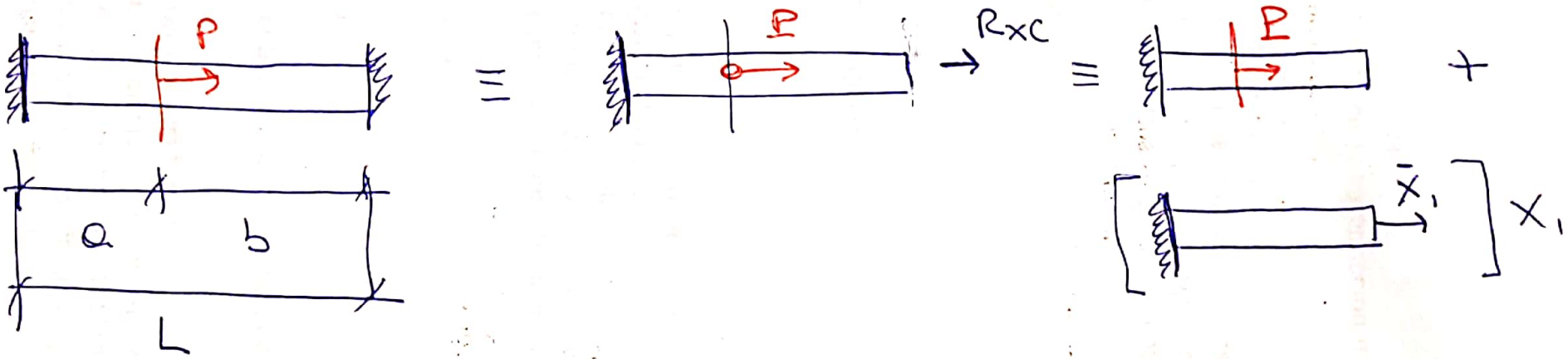

P
MA
P
MA = X̄A = +1
XA


P
M
P
M

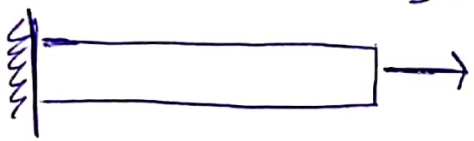




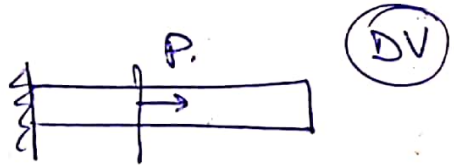
$$\theta^{SH}_{A,P} \equiv \theta^{0}_{A,P} + \theta^{0}_{A,\bar{X}_A} \cdot X_A \; \boxed{= 0}$$

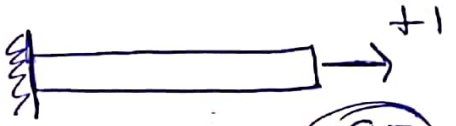


$$\xi^{H}_{c,P} = 0 = \underbrace{\xi^{0}_{c,P}}_{\text{TERMINOS DE CARGA}} + \underbrace{\xi_{c,\bar{x}_1}}_{\text{FLEXIBILIDAD}} \cdot X_1$$



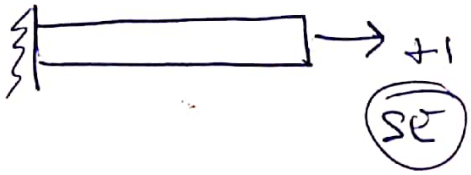
$\xi^{0}_{c,P}$





$$\xi^{0}_{c,P} = \int \frac{N^{DV} N^{SE}}{EA} dx$$

$\xi^{0}_{c,\bar{x}_1}$



$$\xi^{0}_{c,\bar{x}_1} = \int \frac{N^{DV} \cdot N^{SE}}{EA} dx$$