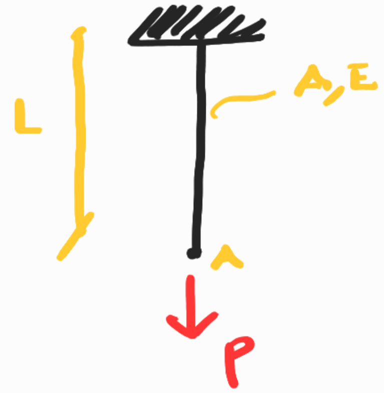
Solicitación Axil



$$\sigma = P/A$$

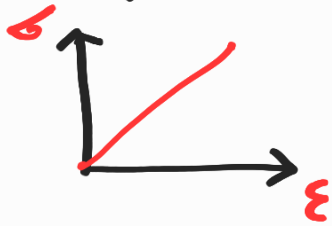
$$\varepsilon = \frac{P}{AE} \longrightarrow \text{deformación por unidad de L}$$

$$\Delta_A = \varepsilon . L$$

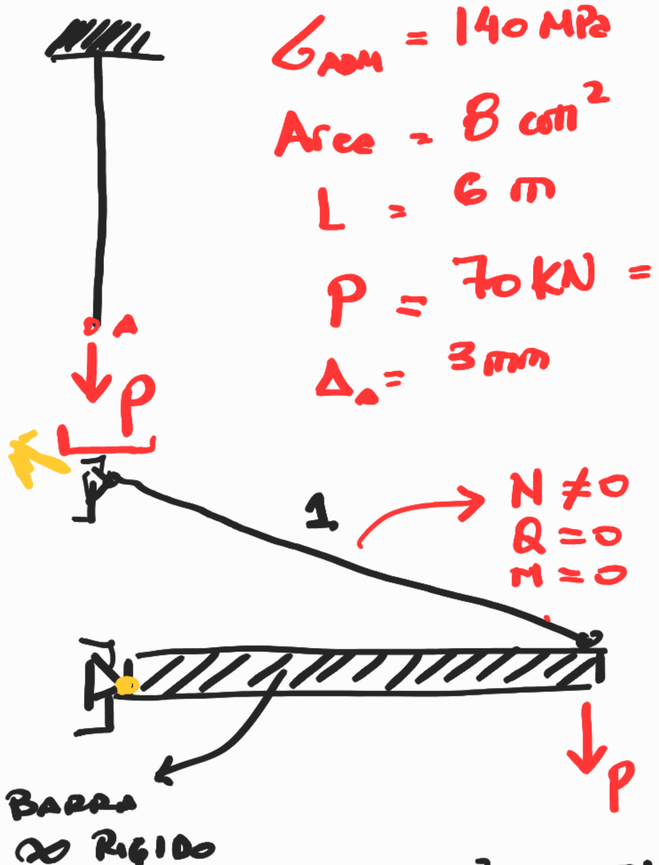
$$N = P = \int \sigma_x \, dA$$

$$\varepsilon_x = cte \, , \quad \sigma_x = cte$$

LM



$\sigma = \varepsilon E$



$\sigma_{ADM} = 140 \text{ MPa}$

$Area = 8 \text{ cm}^2$

$L = 6 \text{ m}$

$P = 70 \text{ kN} = 7t \longrightarrow 7$ poles

$\Delta_A = 3 \text{ mm}$

$N \neq 0$

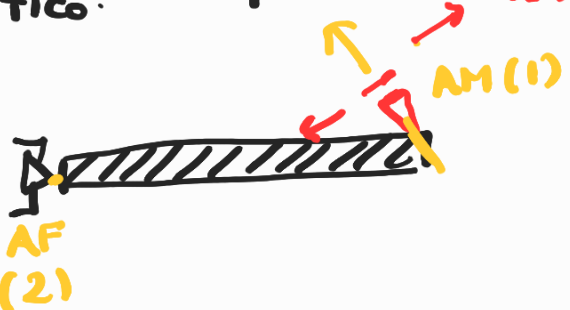
$Q = 0$

$M = 0$

WILLIOT

⟶ Cuanto es el $\Delta 1$

⟶ ¿Isostático? $GL = CV$



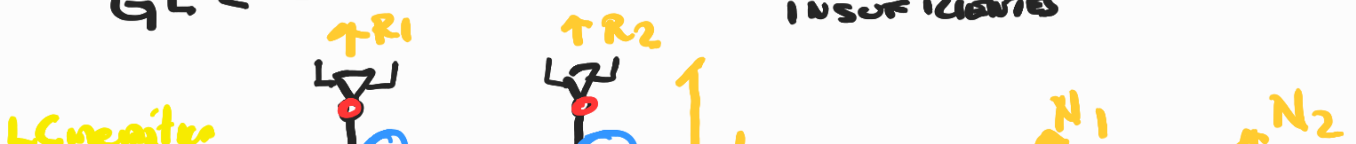
$\Sigma F_V = 0$

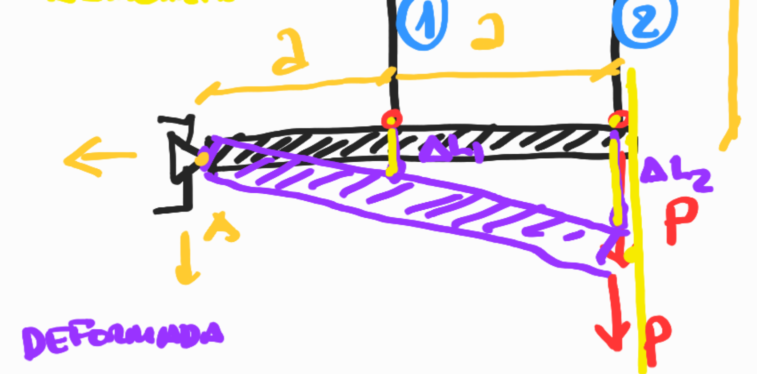
$\Sigma F_H = 0$

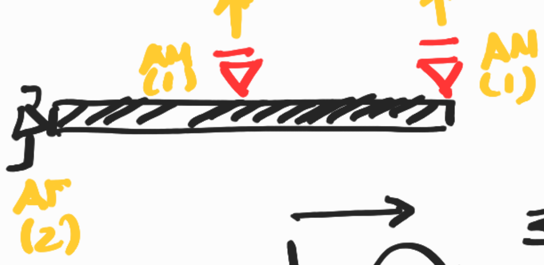
$\Sigma M = 0$

ESTRUCTURAS HIPERESTÁTICAS

$GL < CV \longrightarrow$ Ecuaciones de equilibrio son insuficientes







3GL

$\boxed{GL < CV}$

· Ecuaciones de compatibilidad

$\Delta L_1 \;, \; \Delta L_2 \longrightarrow$

$$\boxed{\Delta L_2 = 2 \Delta L_1}$$

$$\Sigma M_A = 0 = N_1 \cancel{a} + N_2 \, 2\cancel{a} - P \cdot 2\cancel{a} = 0$$

$$① \quad N_1 + 2 N_2 = 2P$$

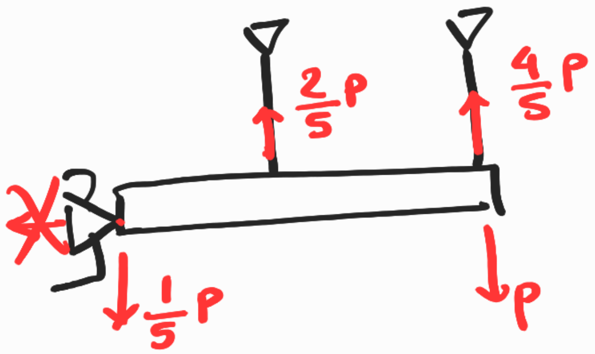
$$\Delta L_2 = 2 \Delta L_1 \quad ② \quad \frac{N_2 \cdot \cancel{L}}{\cancel{EA}} = \frac{2 N_1 \cancel{L}}{\cancel{EA}}$$

· E, A de 1 y 2 son iguales

$$N_1 + 2 \cdot 2 N_1 = 2P$$

$$5 N_1 = 2P \Longrightarrow \boxed{N_1 = \frac{2}{5} P}$$

$$\boxed{N_2 = \frac{4}{5} P}$$



¿ $N_1 + N_2 = P$?

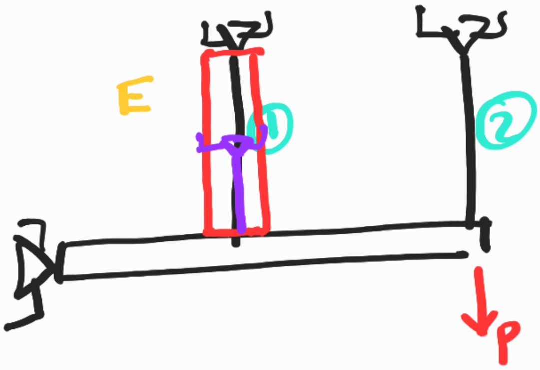
$$N_1 \longrightarrow \Delta L_1$$
$$N_2 \longrightarrow \Delta L_2$$
$$\Longrightarrow \Delta L_2 = 2 \Delta L_1 \hookrightarrow N_2 = 2 N_1$$

$L_1 = L_2$
$E_1 = E_2$
$A_1 = A_2$

$$\frac{N_2 \cdot L_2}{E_2 A_2} = \frac{2 N_1 L_1}{E_1 A_1}$$

① $A_1 \rightarrow 2A_2$ $E_1 = E_2$ $L_2 = L_1$ $\longrightarrow N_2 = N_1$

$$\boxed{\frac{E \cdot A}{L}}$$ RIGIDEZ AXIL DE LA BARRA

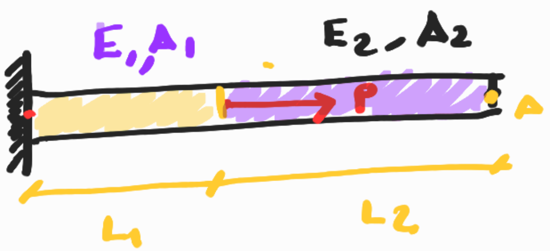


$\Delta L_2 = 2\Delta L_1$

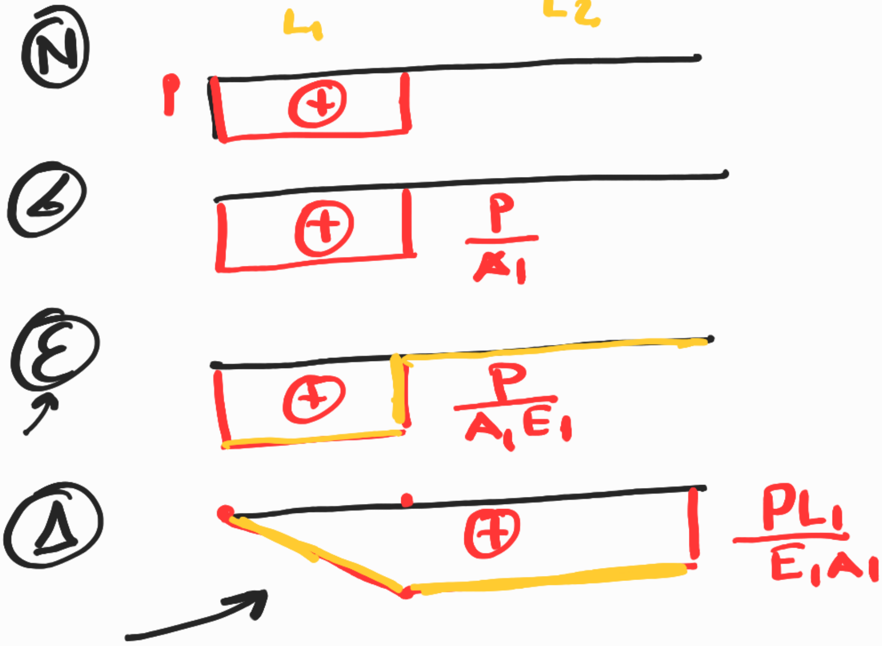
1) Area ↑

2) L ↓

3) E ↑

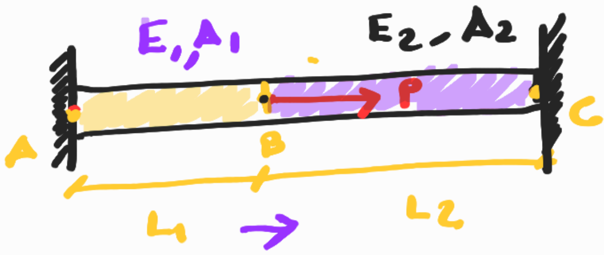


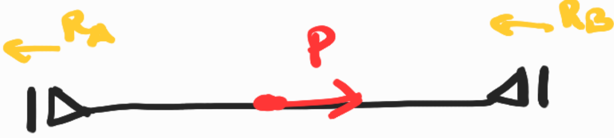
$$\Delta L_A = \frac{P \cdot L_1}{E_1 A_1}$$



$$\varepsilon = \frac{dU}{dx}$$

HIPERESTATICO





① $\sum F_H = 0$ ✓

$\delta_A = 0$

$\delta_C = 0$

② $|\Delta L_1| = |\Delta L_2|$ ✓

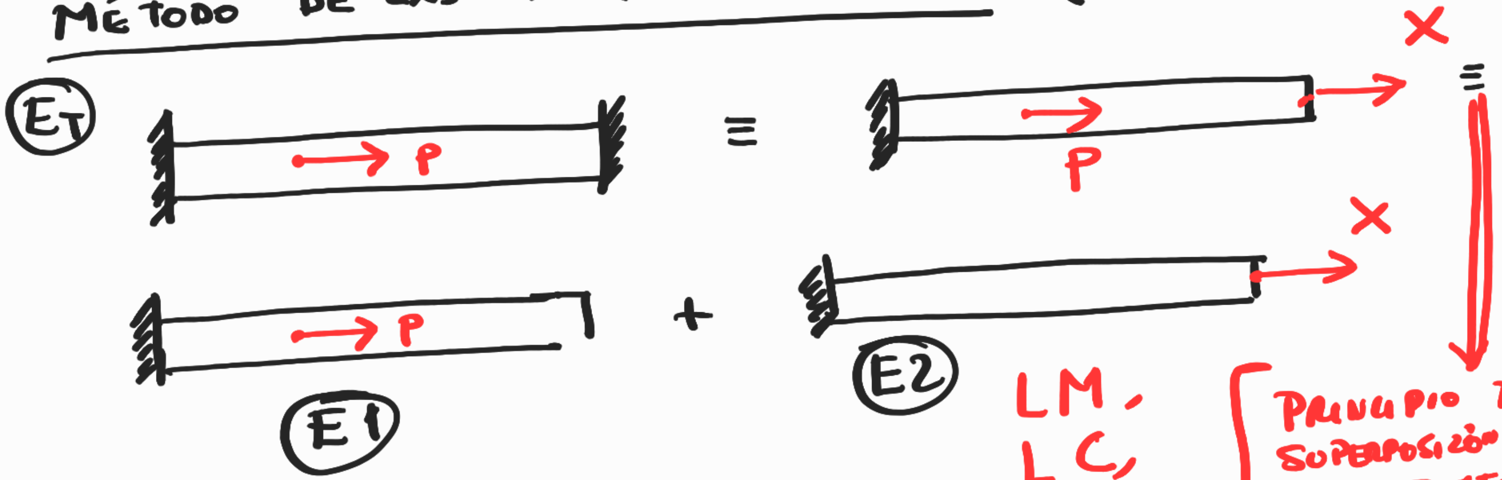
LA RIGIDEZ AXIL DE LA BARRA

$N_1 >> N_2$

$\frac{EA}{L}$

$N_1 >> N_2$

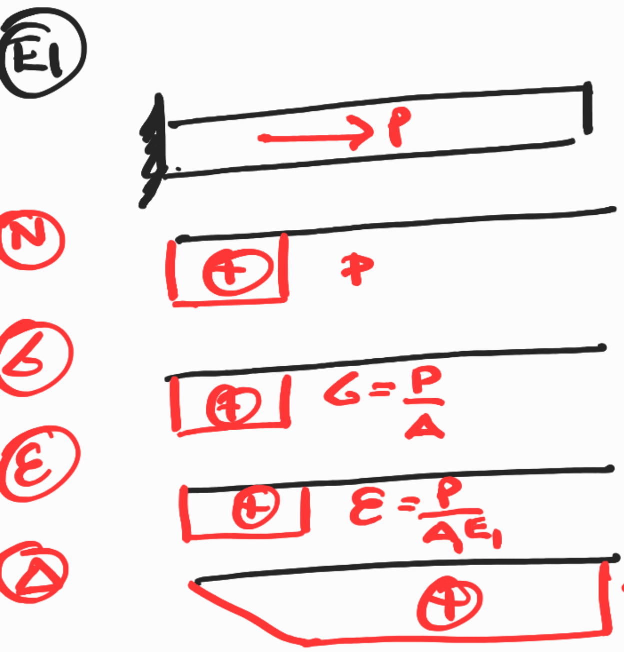
MÉTODO DE LAS INCÓGNITAS ESTÁTICAS (MIE)



LM,
LC,
LE

[PRINCIPIO DE SUPERPOSICIÓN DE EFECTOS

$A_1 > A_2$
$E_1 = E_2$

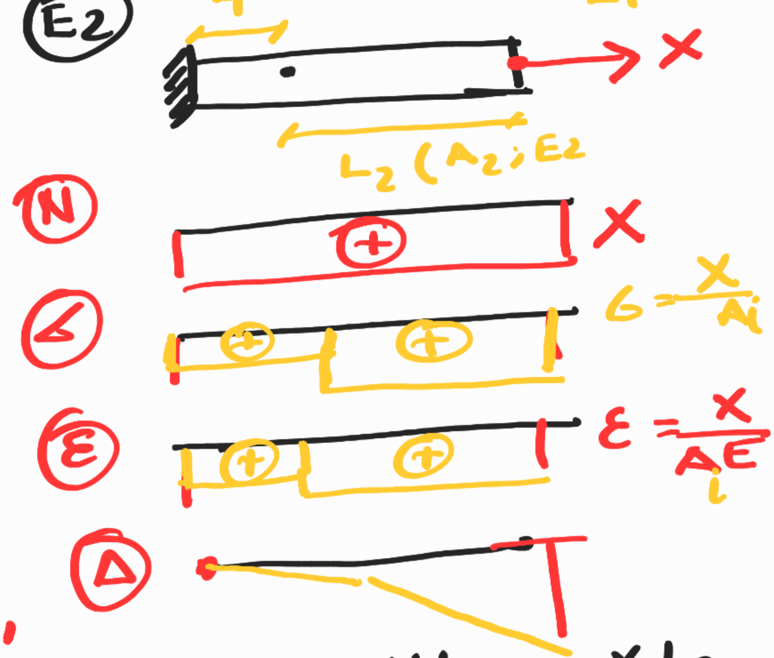


P

$\sigma = \frac{P}{A}$

$\varepsilon = \frac{P}{AE_1}$

$\Delta 1 = \frac{PL_1}{E_1 A_1}$



$\sigma = \frac{X}{A_i}$

$\varepsilon = \frac{X}{A_i E}$

$$\Delta 2 = \frac{X L_1}{E_1 A_1} + \frac{X L_2}{E_2 A_2}$$

$$\delta_c = 0 \Longrightarrow \Delta_1 + \Delta_2 = \delta_c = 0$$

$$\frac{PL_1}{E_1A_1} + X\left(\frac{L_1}{E_1A_1} + \frac{L_2}{E_2A_2}\right) = 0$$

$$\boxed{X = -\frac{\frac{PL_1}{E_1A_1}}{\frac{L_1}{E_1A_1} + \frac{L_2}{E_2A_2}}}$$

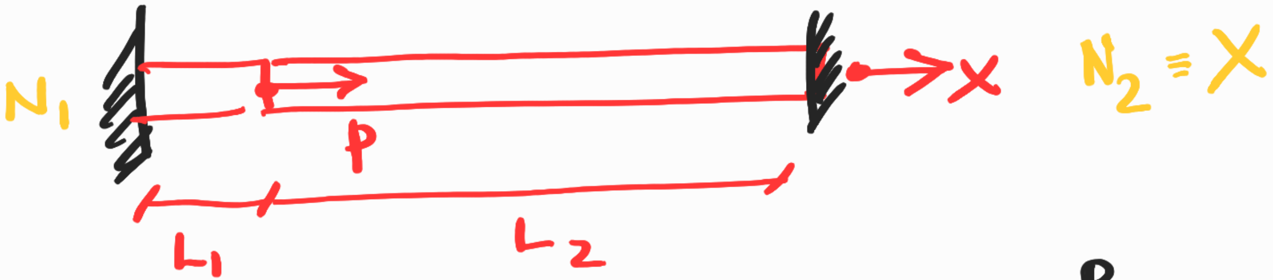
$$\boxed{R_A + R_C = P}$$

$$E_1 = E_2$$
$$A_1 = A_2 \Longrightarrow$$

$$\frac{PL_1}{\cancel{E_1A_1}} + \frac{X}{\cancel{E_1A_1}}(L_1 + L_2) = 0$$

L_2

$$X = \frac{-PL_1}{(L_1 + L_2)}$$



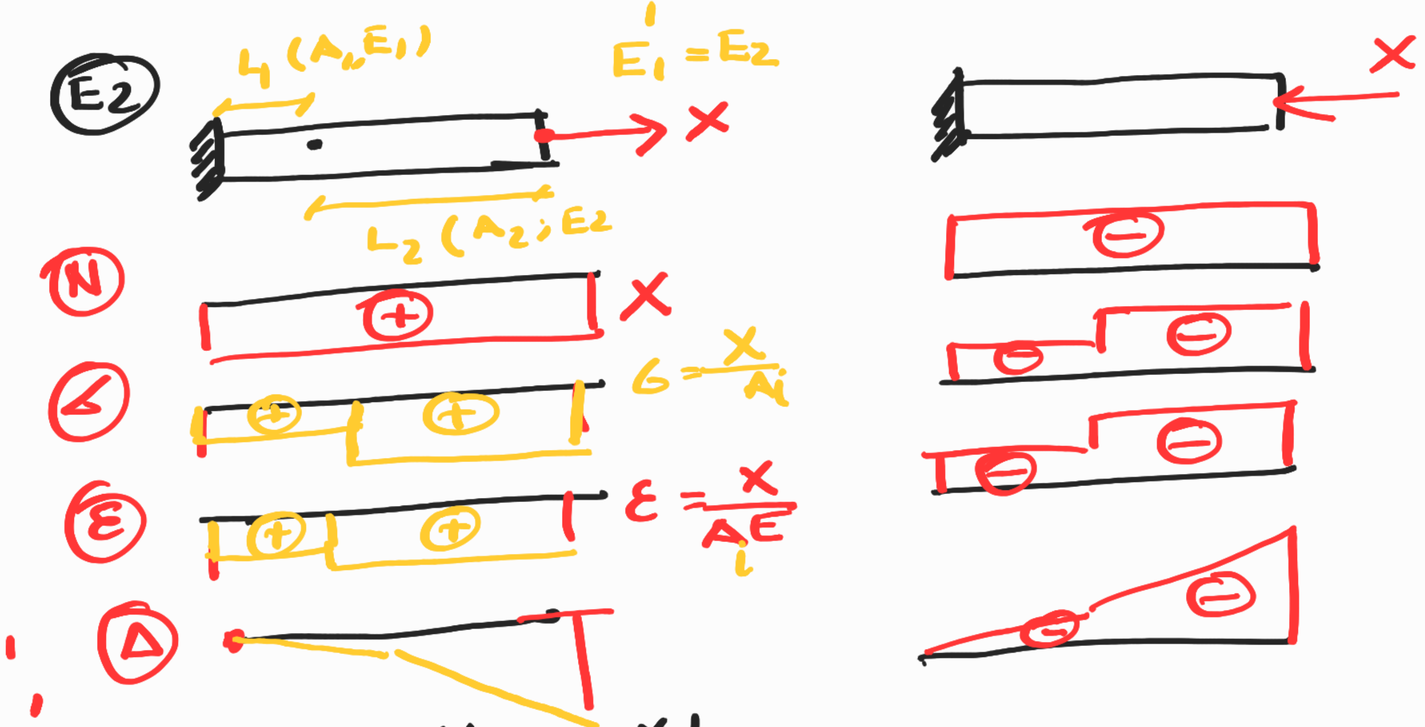
$$N_1 + N_2 = P$$

$$N_1 = \frac{-PL_2}{(L_1 + L_2)}$$

$$\frac{PL_2}{(L_1 + L_2)} + \frac{PL_1}{(L_1 + L_2)} = P$$

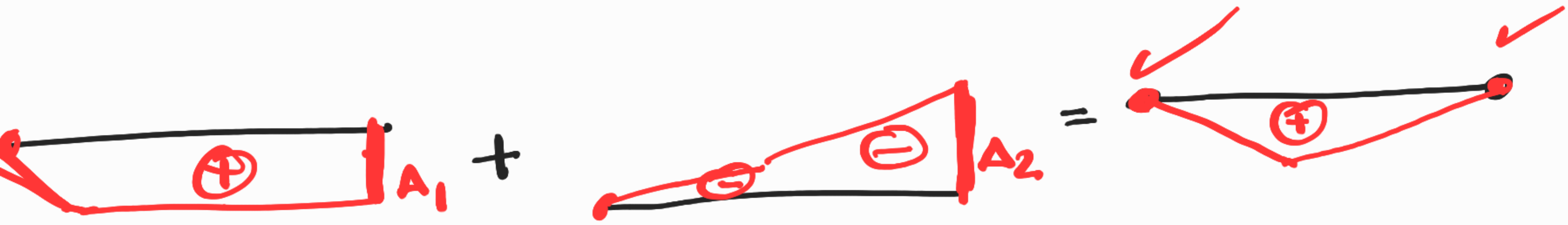
$$\frac{PL_2 + PL_1}{(L_1 + L_2)} = P$$

$$P\,\cancel{\frac{(L_2 + L_1)}{(L_1 + L_2)}} = P$$



$$\Delta 2 = \frac{X L_1}{E_1 A_1} + \frac{X L_2}{E_2 A_2}$$

$X \longrightarrow$ negativo



$$\Delta_1 + \Delta_2 = 0$$