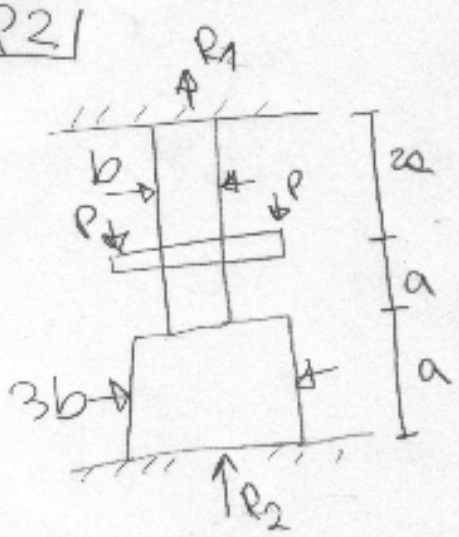
$\sigma_{tracción} = \sigma_{compresión} = \sigma$, b?

P2/

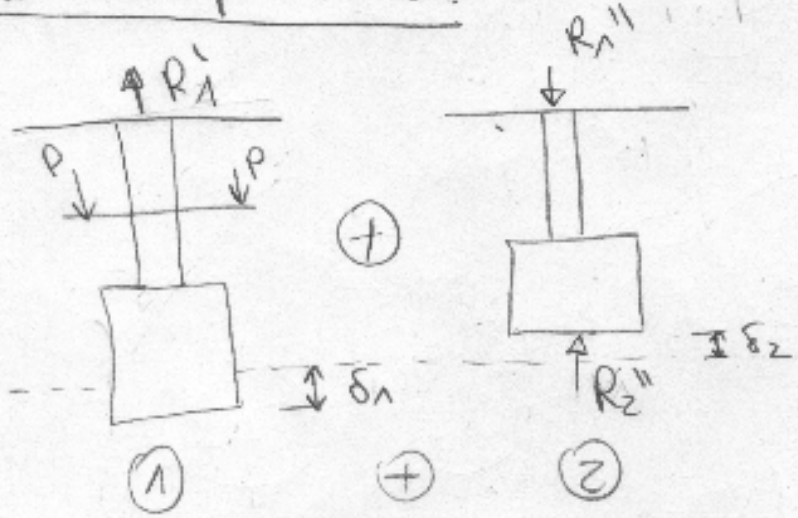


$\sum F_y = 0$

$R_1 + R_2 = 2P$ (1)

0,5

Problema hiperestático:



$\delta_1 = \delta_2$ (2)

1

① : $\sum F_y = 0 \Rightarrow R'_1 = 2P$ (3)

$\sigma = \varepsilon E$

$\varepsilon = \frac{l_f - l_0}{l_0} = \frac{\delta_1}{2a}$

$\Rightarrow \frac{2P}{(\frac{\pi b^2}{4})} = \frac{\delta_1}{2a} \cdot E$

$\Rightarrow \boxed{\delta_1 = \frac{16aP}{\pi b^2 E}}$

1

② :

$$\sum F_y = 0 \Rightarrow \boxed{R_1'' = R_2''} \quad (4)$$

$$\frac{R_1''}{\frac{\pi b^2}{4}} = \frac{\Delta_1}{3a} E \Rightarrow \Delta_1 = \frac{12 a R_1''}{\pi b^2 E}$$

$$\frac{R_2''}{\frac{\pi (3b)^2}{4}} = \frac{\Delta_2}{a} E \Rightarrow \Delta_2 = \frac{4}{9} \frac{R_2'' a}{\pi b^2 E}$$

(1)

$$\boxed{\delta_2 = \Delta_1 + \Delta_2 = \delta_1} \quad (5)$$

$$\frac{a}{\pi b^2 E}\left(12 R_1'' + \frac{4}{9} R_2''\right) = \frac{16 a P}{\pi b^2 E}$$

$$\boxed{12 R_1'' + \frac{4}{9} R_2'' = 16 P} \quad (6)$$

Del problema original

$$\boxed{R_1' - R_1'' = R_1} \quad (7) \qquad \boxed{R_2'' = R_2} \quad (8)$$

(3) $R_1'' = 2P - R_1$

reemplazando en (6)

$$12(2P - R_1) + \frac{4}{9} R_2 = 16 P$$

$$\frac{4}{9}R_2 - 12R_1 = -8P \quad (4)$$

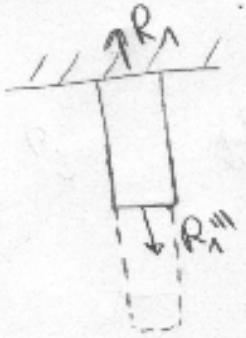
Con (1) tenemos que

$$R_1 = \frac{5P}{7}$$

$$R_2 = \frac{9P}{7}$$

(1)

Tracción:

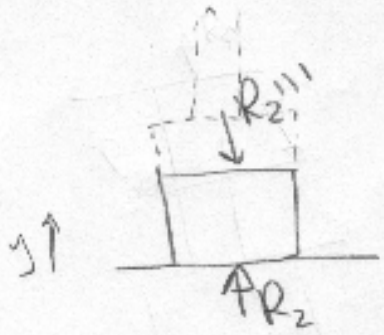


$R_1 = R_1'''$

$$\sigma_t = \frac{R_1}{\frac{\pi b^2}{4}} = \frac{20}{7}\frac{P}{\pi b^2} = \sigma$$

$$\Rightarrow \boxed{b_1^2 = \frac{20}{7}\frac{P}{\pi\sigma}}$$

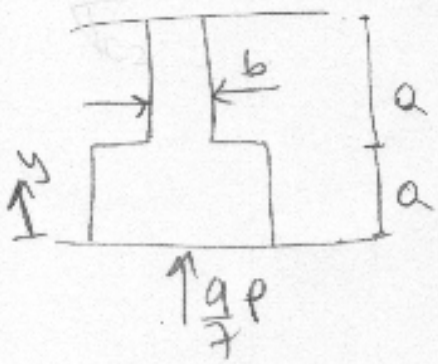
σ Compresión $y \in [0, a]$



$$\sigma_c = \frac{R_2}{\frac{\pi(3b)^2}{4}} = \frac{4}{7}\frac{P}{\pi b^2} = \sigma$$

$$\Rightarrow \boxed{b_2^2 = \frac{4}{7}\frac{P}{\pi\sigma}}$$

Σ_2 compresión, $y \in [a, 2a]$



$$\sigma_{c_2} = \frac{\frac{9}{7}P}{\frac{\pi b^2}{4}} = \frac{36P}{7\pi b^2} = \sigma$$

$$\Rightarrow \boxed{b_3^2 = \frac{36}{7}\frac{P}{\sigma}}$$

Se elige b mayor

$$\Rightarrow \boxed{b = b_3}$$

(15)