→ 1er PARCIAL - RESISTENCIA de MATERIALES 1 - AÑO 2018.

→ SOLUCIÓN EJERCICIO 3 - RETICULADO.

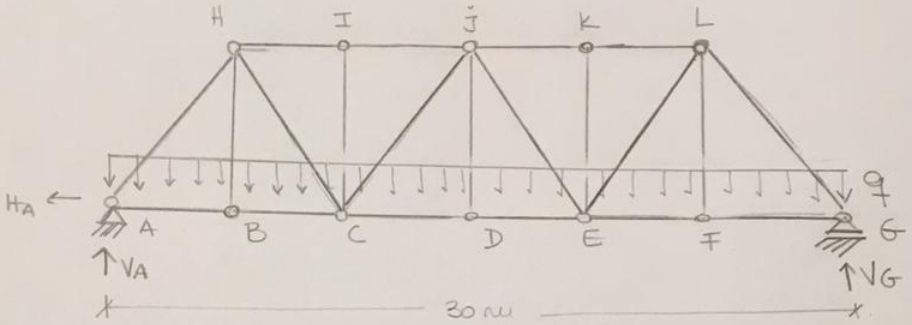
a) Reacciones en apoyos y directa en las barras.

• **Reacciones**

$\Sigma M_A = 0) \quad V_G = 15q$

$\Sigma V = 0) \quad V_A = 15q$

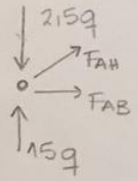
$\Sigma H = 0) \quad H_A = 0$



OBS.: Barras IC y KE inactivas. Estructura Simétrica

• **Fuerzas en las barras**

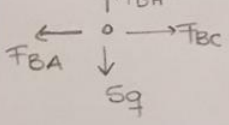
★ **Nudo A**



• $\Sigma V = 0) \quad \frac{\sqrt{3}}{2} F_{AH} + 15q - 2{,}5q = 0 \rightarrow \boxed{F_{AH} = -\frac{25}{\sqrt{3}} q}$

• $\Sigma H = 0) \quad F_{AB} + \frac{F_{AH}}{2} = 0 \rightarrow F_{AB} = -\frac{F_{AH}}{2} \rightarrow \boxed{F_{AB} = \frac{12{,}5}{\sqrt{3}} q}$

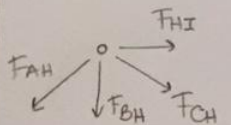
★ **Nudo B**



• $\Sigma H = 0) \quad F_{BC} = F_{BA} \rightarrow \boxed{F_{BC} = \frac{12{,}5}{\sqrt{3}} q}$

• $\Sigma V = 0) \quad \boxed{F_{BH} = 5q}$

★ **Nudo H**



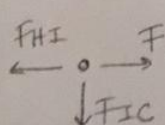
• $\Sigma V = 0) \quad F_{AH}\frac{\sqrt{3}}{2} + F_{CH}\frac{\sqrt{3}}{2} + F_{BH} = 0 \rightarrow F_{CH} = -F_{AH} - \frac{2}{\sqrt{3}} F_{BH}$

$\rightarrow F_{CH} = \frac{25}{\sqrt{3}} q - \frac{2}{\sqrt{3}} 5q \rightarrow \boxed{F_{CH} = \frac{15}{\sqrt{3}} q}$

• $\Sigma H = 0) \quad F_{HI} + \frac{F_{CH}}{2} - \frac{F_{AH}}{2} = 0 \rightarrow F_{HI} = \frac{F_{AH} - F_{CH}}{2} = \frac{1}{2}\left(-\frac{25}{\sqrt{3}} q - \frac{15}{\sqrt{3}} q\right)$

$$\boxed{F_{HI} = -\frac{20}{\sqrt{3}} q}$$

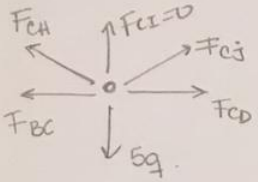
★ **Nudo I**



$\Sigma H = 0) \quad F_{IJ} = F_{HI} \rightarrow \boxed{F_{IJ} = -\frac{20}{\sqrt{3}} q}$

$\Sigma V = 0) \quad \boxed{F_{CI} = 0}$

* Nudo C



- $F_{CJ}\frac{\sqrt{3}}{2} + F_{CH}\frac{\sqrt{3}}{2} = 5q \rightarrow F_{CJ} = 5q\frac{2}{\sqrt{3}} - F_{CH} = \frac{10}{\sqrt{3}}q - \frac{15}{\sqrt{3}}q +$

$\rightarrow \boxed{F_{CI} = \frac{-5}{\sqrt{3}}q}$

- $F_{CD} + \frac{F_{CJ}}{2} - F_{BC} - \frac{F_{CH}}{2} = 0 \rightarrow F_{CD} = \frac{F_{CH}}{2} + F_{BC} - \frac{F_{CJ}}{2} =$

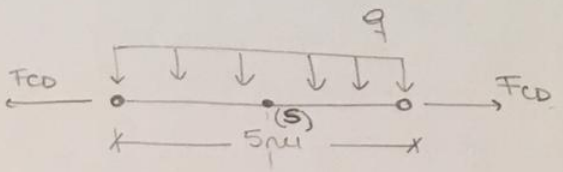
$= \frac{7,5}{\sqrt{3}}q + \frac{12,5}{\sqrt{3}}q + \frac{2,5}{\sqrt{3}}q \rightarrow \boxed{F_{CD} = \frac{22,5}{\sqrt{3}}q}$

Resumen

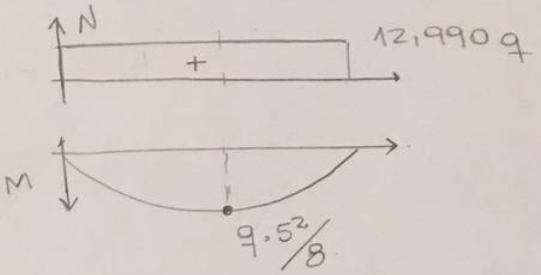
BARRA	FUERZA			
AH = GL	$(-25/\sqrt{3})q$	$\approx$	$-14,434q$	← DIAG.
AB = FG	$(12,5/\sqrt{3})q$	$\approx$	$7,217q$	← C. INF
BH = LF	$5q$	$=$	$5q$	← DIAG
BC = FE	$(12,5/\sqrt{3})q$	$\approx$	$7,217q$	← C. INF
HC = LE	$(15/\sqrt{3})q$	$\approx$	$8,66q$	← DIAG
HI = KL	$(-20/\sqrt{3})q$	$\approx$	$-11,547q$	← C SUP
CI = EK	0	$=$	0	← DIAG
CJ = JE	$(-5/\sqrt{3})q$	$\approx$	$-2,887q$	← DIAG
CD = DE	$(22,5/\sqrt{3})q$	$\approx$	$12,990q$	← C. INF
JI = JK	$(-20/\sqrt{3})q$	$\approx$	$-11,547q$	← C SUP
JD	$5q.$	$=$	$5q.$	← DIAG

b) Hallar q / $\sigma \leq \sigma_{adm}$ en cordón superior.

→ Tomo barra CD (o DE)

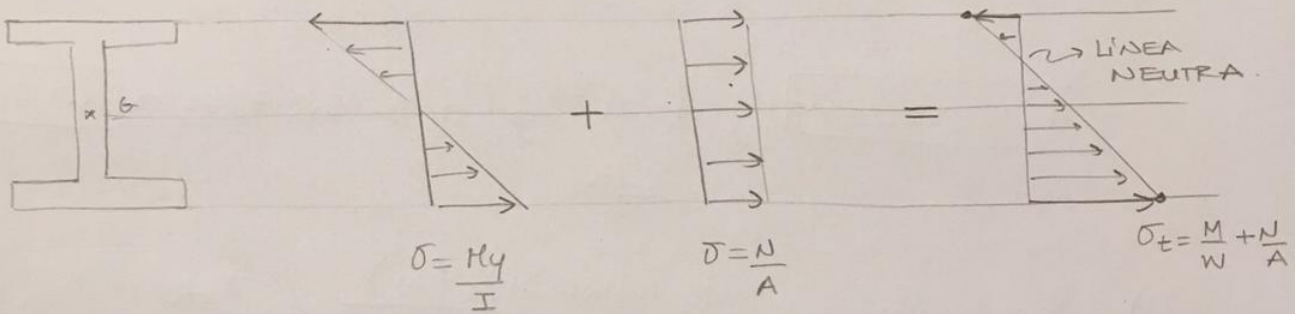


- $\sigma_{máx} = \frac{M}{W} + \frac{N}{A}$ en sección media de la barra CD (S)



- $M_{máx} = \frac{q l^2}{8} = \frac{q \cdot 5^2}{8} = 3{,}125\, q$.
- $N_{máx} = 12{,}990\, q$ (de parte a).

$$\sigma_c = \frac{M}{W} - \frac{N}{A}$$



- $\sigma_{máx}$ es de tracción →

$$\sigma_{máx} = \frac{M}{W} + \frac{N}{A} = \frac{3{,}125\, q\,(Nm)}{(542 \times 10^{-6}\, m^3)} + \frac{12{,}990\, q\,(N)}{(61{,}1 \times 10^{-4}\, m^2)} \leq 140 \times 10^6\ Pa$$

$$= 7891{,}706\, q\ \frac{N}{m^2} \leq 140 \times 10^6\ Pa \rightarrow \boxed{q = 17740\ N/m}$$

$$\rightarrow \boxed{q = 17{,}74\ kN/m}$$

c) i) $F^{DIAG}_{máx} = -14,434\,q \Longrightarrow N^{DIAG}_{máx} = -(14,434m)\left(10\frac{kN}{m}\right)$

$$\boxed{N^{DIAG}_{máx} = -144,34\ kN}$$

$$\sigma_c = \frac{N}{A} \leq 140\times10^6\,Pa \rightarrow A \geq \frac{144,34\times10^3\,N}{140\times10^6\,Pa} = 10,31\times10^{-4}\,m^2$$

$$\boxed{A \geq 10,31\,cm^2}\ ;\ A = \pi r^2 \Rightarrow r \geq 1,81\,cm \Rightarrow \boxed{D \geq 3,7\,cm}$$

⊙r

ii) $F^{CSUP}_{máx} = -11,547\,q \Rightarrow \boxed{N^{CSUP}_{máx} = -115,47\ kN}$

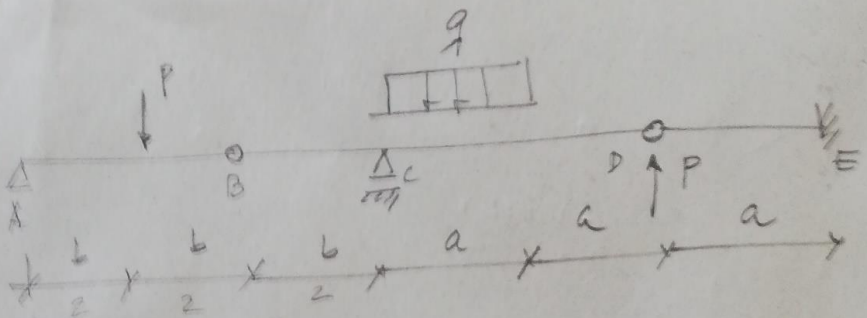
$$\sigma_c = \frac{N}{A} \leq 140\times10^6\,Pa \rightarrow A \geq \frac{115,47\times10^3\,N}{140\times10^6\,Pa} = 8,25\times10^{-4}\,m^2$$

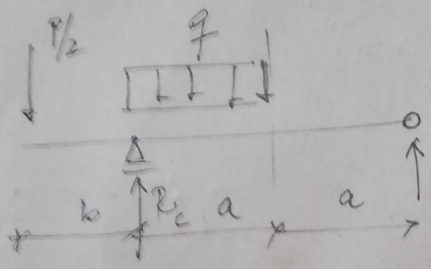
$$\boxed{A \geq 8,25\,cm^2}\ ;\ A = a^2 \Rightarrow a \geq 2,87\,cm \Rightarrow \boxed{a \geq 2,9\,cm}$$

□a

iii) $\Delta L_{KJ} = \frac{NL}{EA} = \frac{(115,47\times10^3\,N)(5\,m)}{(210\times10^9\,Pa)(0,029\,m)^2} \Rightarrow$

$$\Rightarrow \Delta L_{KJ} = 3,27\times10^{-3}\,m \rightarrow \boxed{\Delta L_{KJ} = 3,27\,mm}$$





$$R_{Dc} = \frac{\frac{P}{2}(2a+b) + \frac{qa}{4}\left(\frac{3a}{2}\right)}{2a}$$

$$R_c = \frac{P}{2}\left(1 + \frac{b}{2a}\right) + \frac{3qa}{4}$$

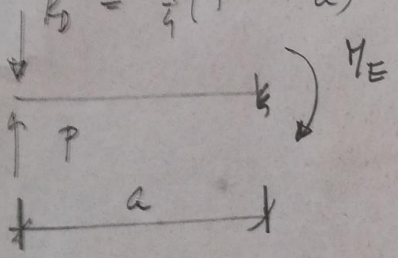
$R_c = 8{,}30$ kN

$R_D = 2{,}00$

$$-\frac{Pb}{2} + \frac{qa^2}{2} - R_D \cdot 2a = 0$$

$$R_D = \frac{\frac{qa^2}{2} - \frac{Pb}{2}}{2a} = \frac{1}{4}\left(qa - \frac{Pb}{a}\right)$$

$$R_D = \frac{1}{4}\left(qa - \frac{Pb}{a}\right)$$



$$P = \frac{1}{4}\left(qa - \frac{Pb}{a}\right)$$

$P = 8{,}0$ kN

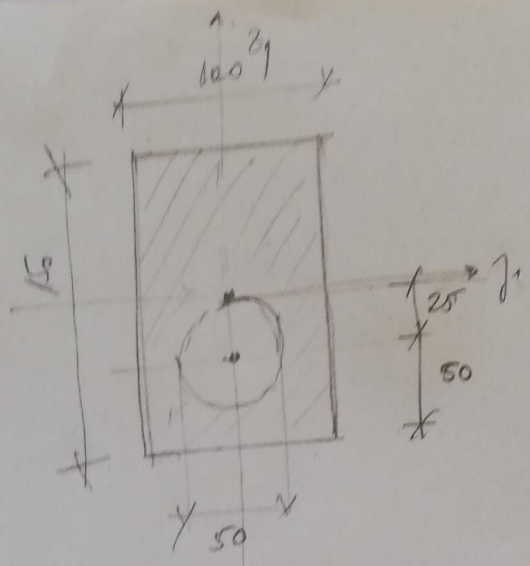
$q = 30$ kN/m

$a = 3{,}10$ m

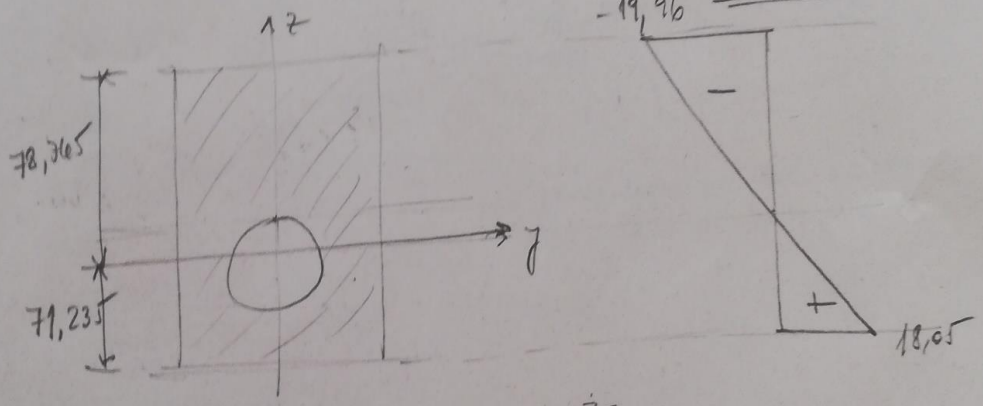
$$qa^2 - 4aP - Pb = 0$$

$$a = \frac{4P \pm \sqrt{16P^2 - 4(q)(-Pb)}}{2q}$$

$$a = \frac{4P \pm \sqrt{16P^2 + 4qPb}}{2q}$$



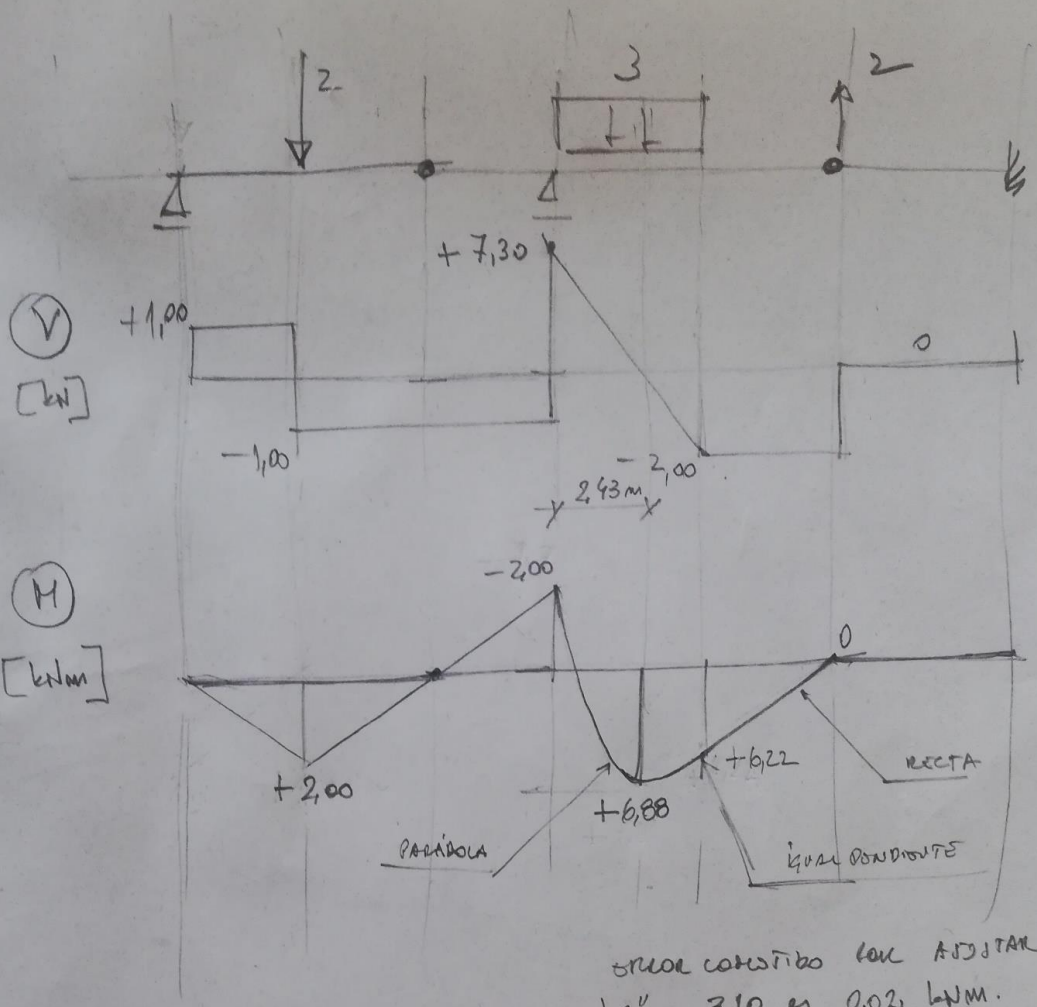
$$\hat{z} = \frac{-\pi 50^2/4 \cdot 25}{(100 \cdot 150 - \pi 50^2/4)} = -3{,}765 \text{ mm}$$



$$J_x = \frac{100 \times 150^3}{12} + 100 \times 150 \cdot 3{,}765^2 - \frac{\pi 50^4}{64} - \frac{\pi \cdot 50^2}{4} \cdot 21{,}235^2 = 27{,}145 \times 10^6 \text{ mm}^4$$

$$\sigma_s = \frac{-6{,}88 \times 10^6 \cdot 78{,}765}{27{,}145 \times 10^6} = -19{,}96 \text{ MPa}$$

$$\sigma_i = \frac{-6{,}88 \times 10^6 \cdot (-71{,}235)}{27{,}145 \times 10^6} = +18{,}05 \text{ MPa}$$



ERROR CORRETIBO CON AJUSTAR
'a' a 3,10 es 0,02 kNm.