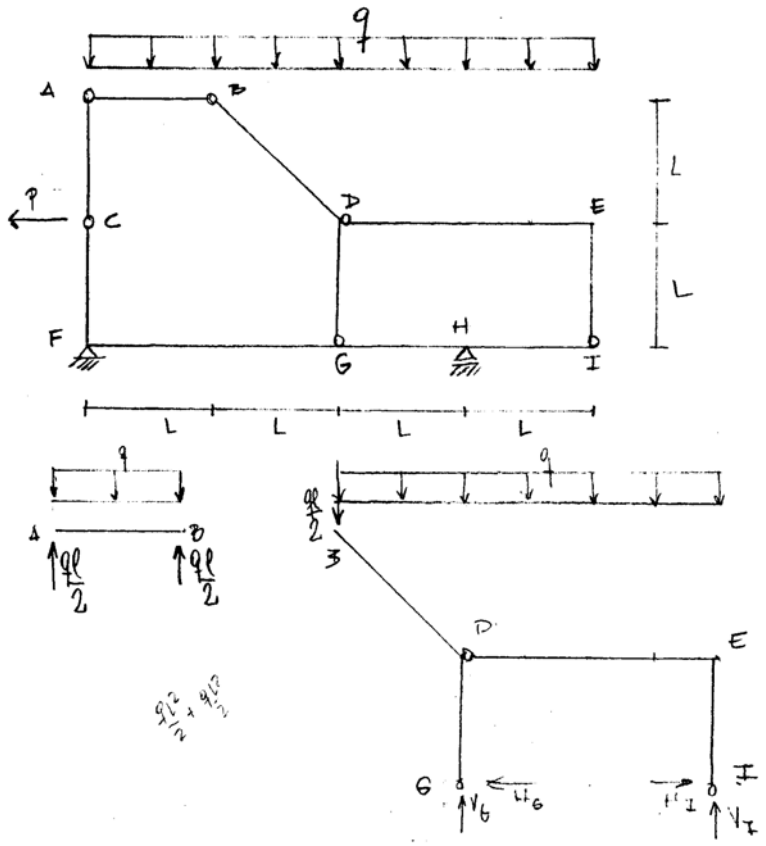
Solución - Examen diciembre 2005 – Resistencia de materiales 1 y 1N

Ejercicio 1

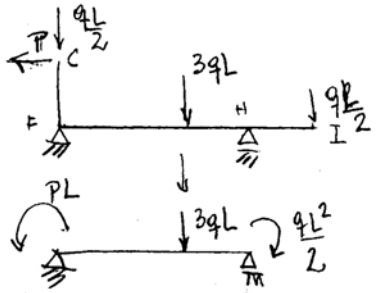
a)



$$qL^2 + \frac{qL}{2}\frac{L}{2} - 7\frac{L}{2}\frac{L}{4}$$

$$\frac{qL^2}{2} + \frac{qL^2}{2}$$

$$\Sigma M_G = 2LV_I + \frac{qL}{2}L - q\,3L\frac{L}{2} = 0 \Rightarrow \boxed{\begin{array}{l} V_I = \frac{qL}{2} \\ V_G = 3qL \end{array}}$$



$$\Sigma M_D^{der} = 2qL^2 + LH_I - 2L\frac{qL}{2} = 0$$

$$\rightarrow H_I = H_G = qL$$

$$\theta_H = -\frac{PL\,3L}{6EI} + \frac{3qL\,2L\,L(3L-12L)}{6\,3L\,EI} - \frac{qL^2}{2}\cdot\frac{2L}{3EI}$$

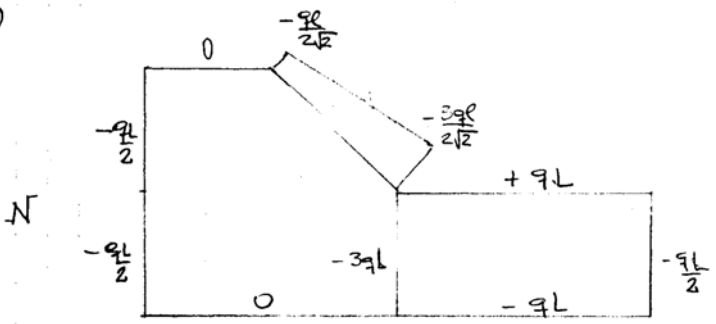
$$\theta_H = -\frac{PL^2}{2EI} + \frac{7}{6}\frac{qL^3}{EI} = 0$$

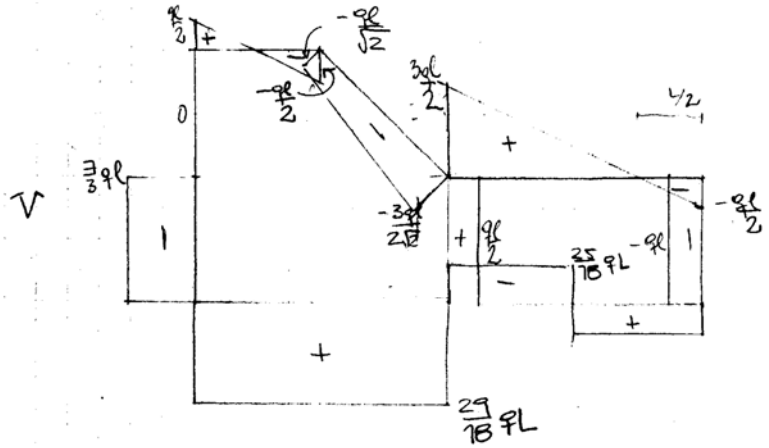
$$\Rightarrow \boxed{P = \frac{7}{3}qL}$$

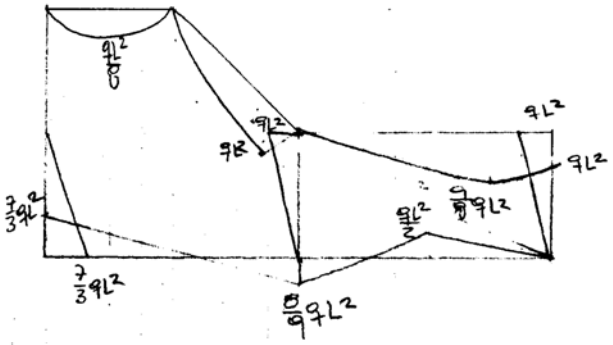
b) $\Sigma M_F = 3V_H L + L\frac{7}{3}qL - 4qL\,2L = 0 \rightarrow V_H = \frac{17}{9}qL$

$$V_F = \frac{19}{9} \qquad H_F = \frac{7}{3}qL$$

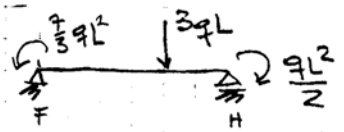
b)







c)



$$\curvearrowleft \theta_F = +\frac{7}{3}ql^2\frac{3L}{3EI} + \frac{ql^2}{2}\frac{3L}{6EI} - \frac{3ql\cdot 2L\cdot L(3L+L)}{6\cdot 3LEI}$$

$$\curvearrowleft \theta_F = \frac{5}{4}\frac{qL^3}{EI}$$

$$\leftarrow \delta_C = \frac{5}{4}\frac{qL^4}{EI} + \frac{7}{3}ql\cdot\frac{L^3}{3EI} = \frac{73}{36}\frac{qL^4}{EI}$$

$$\boxed{\leftarrow \delta_C = \frac{73}{36}\frac{qL^4}{EI}}$$

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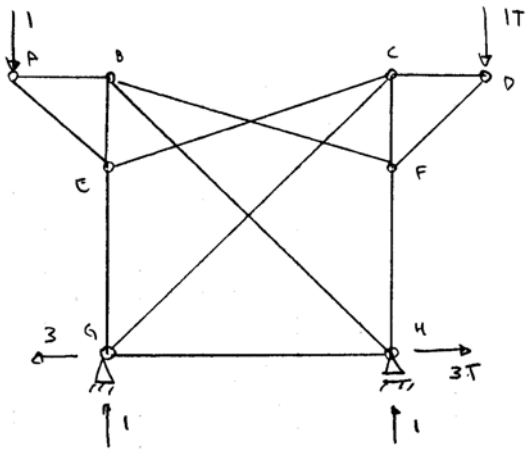
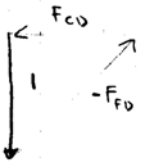
Ejercicio 2



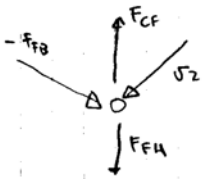
Eq Nudos: Nudo D (A)



$F_{CD} = 1$

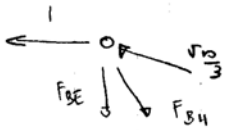
$F_{DF} = -\sqrt{2}$

Nudo F



$F_{FB} = -\frac{\sqrt{10}}{3}$

Nudo B:



$\frac{F_{BH}}{\sqrt{2}} = 2 \Rightarrow F_{BH} = 2\sqrt{2}$

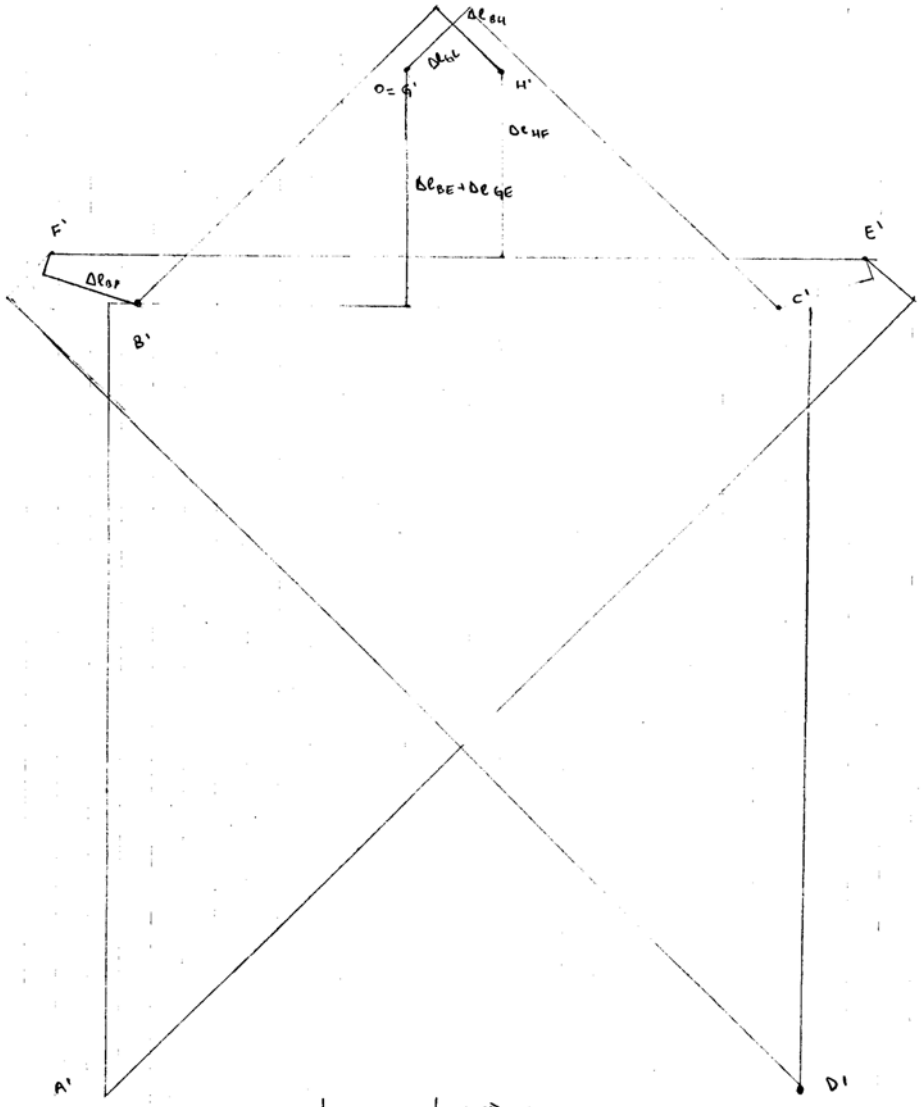
$F_{BE} = -2 + \frac{1}{3} = -\frac{5}{3}$

$F_{BE} = F_{CF} = -\frac{5}{3}$

$F_{FH} = -\frac{5}{3} - 1 - \frac{1}{3} = -3$

Nudo G $\longrightarrow F_{GH} = 1$

Barra	F	L	ΔLEA
AB = CD	1	1	1
AE = FD	$-\sqrt{2}$	$\sqrt{2}$	-2
BE = CF	$-5/3$	1	$-5/3$
EG = FH	-3	2	-6
BF = CE	$-\sqrt{10}/3$	$\sqrt{10}$	$-10/3$
BH = CG	$2\sqrt{2}$	$3\sqrt{2}$	$12/4 = 3$
GH	1	3	3



	↓ δ_{vEA}	→ δ_{HEA}
A	33,6	- 9,9
B	7,6	- 8,9
C	7,6	11,9
D	33,6	12,9
E	6	11,9
F	6	-11,9
G	0	0
H	0	3

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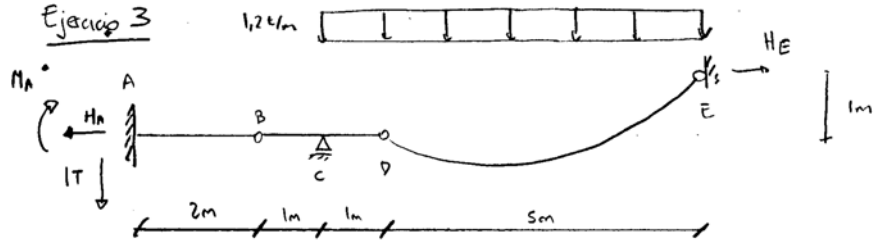
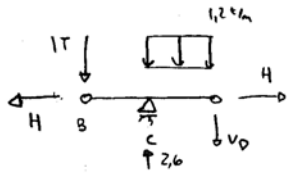
Ejercicio 3

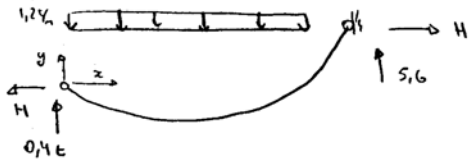


$M_A = 2\,tm$

$H_A = H_E = H$



$M_C = 1 - \frac{1,2 \cdot 1}{2} - V_D \cdot 1 = 0 \rightarrow V_D = 0,4\,t$



$y(x) = ax^2 + bx + c$ $\qquad a = \frac{+q}{2H}$

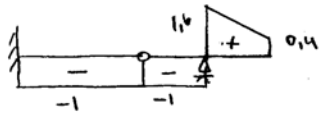
$M_D = 0 = \frac{1,2 \cdot 5^2}{2} - 5,6 \cdot 5 + H = 0 \Rightarrow H = 13$

$y(x) = \frac{+1,2}{2.13} \cdot x^2 + bx + c$ $\qquad y(0) = 0 \rightarrow c = 0$

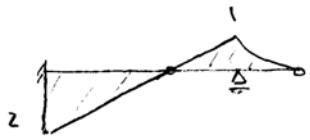
$y(5) = 1 \rightarrow \frac{+1,2}{2.13} 25 + 5b = 0 \Rightarrow b = -\frac{12}{65}$

$$\Rightarrow \boxed{T_{máx} = \sqrt{5,6^2 + 13^2} = 14,15\ T}$$

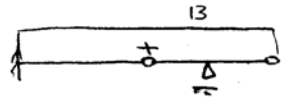
(V)



(M)

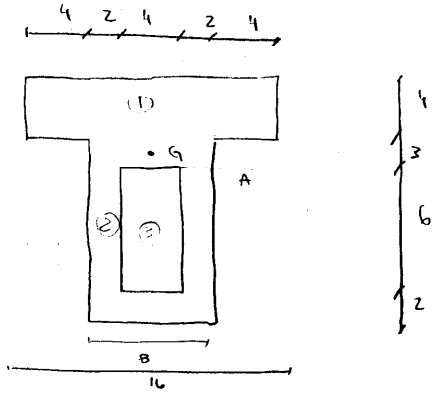


(N)



$M_{máx} = 2\,tm$ en el punto A

$V_{máx} = 1,6\,t$ en B^{der}



$A = 128\ cm^2$

$$y_G = \frac{4\times16\times13 + 11.5{,}5.8 - 6.4.5}{4\times16 + 8.11 - 6.4} = 9{,}34375$$

$$I_x^{(1)} = \frac{16.4^3}{12} + 16.4\left(13-9{,}34375\right)^2 = 940{,}895833$$

$$I_x^{(2)} = \frac{8.11^3}{12} + 8.11.\left(5{,}5-9{,}34375\right)^2 = 2187{,}48177$$

$$I_x^{(3)} = \frac{4.6^3}{12} + 6.4.\left(5-9{,}34375\right)^2 = 524{,}8359$$

$$I_x = 2603{,}54166$$

$$\mu_G = 16.4.\left(13-9{,}34375\right) + \frac{8.}{2}\left(15-4-9{,}34375\right)^2 = 244{,}57876$$

$$\mu_A = 16.4.\left(13-9{,}34375\right) + 8.3.\left(15-4-9{,}34375-1{,}5\right) = 237{,}75$$

$$M_{inf}^{max} = 200000\ kg\,cm \longrightarrow \begin{cases} \text{fisce}\ \ \sigma_{inf}^{M} = \dfrac{200000\ kg\,cm \cdot 9{,}34375\ cm}{2603{,}54166\ cm^4} = 717{,}7\ kg/cm^2 \\ \text{comp}\ \ \sigma_{sup}^{M} = \dfrac{200000.(15-9{,}34375)}{2603{,}54166} = 434{,}5\ kg/cm^2 \end{cases}$$

$$M_{sup}^{max} = 100000\ kg\,cm \begin{cases} \text{comp}\ \ \sigma_{inf}^{M} = \dfrac{100000\ 9{,}34375}{2603{,}54166} = 358{,}9\ kg/cm^2 \\ \text{fisce}\ \ \sigma_{sup}^{M} = \dfrac{100000.(15-9{,}34375)}{2603{,}54166} = 217{,}3\ kg/cm^2 \end{cases}$$

$$\sigma_{max}^{fisce} = \frac{13000}{128} + 717{,}7 = 819{,}3\ kg/cm^2$$

$$\tau_G = \frac{1600\,244{,}57876}{2603{,}54166.8} = 18{,}8\ kg/cm^2$$

$$\tau_A = \frac{1600\,237{,}75}{2603{,}54166.4} = 36{,}52\ kg/cm^2$$

$$\tau_{max}^{A} = 36{,}53\ kg/cm^2$$