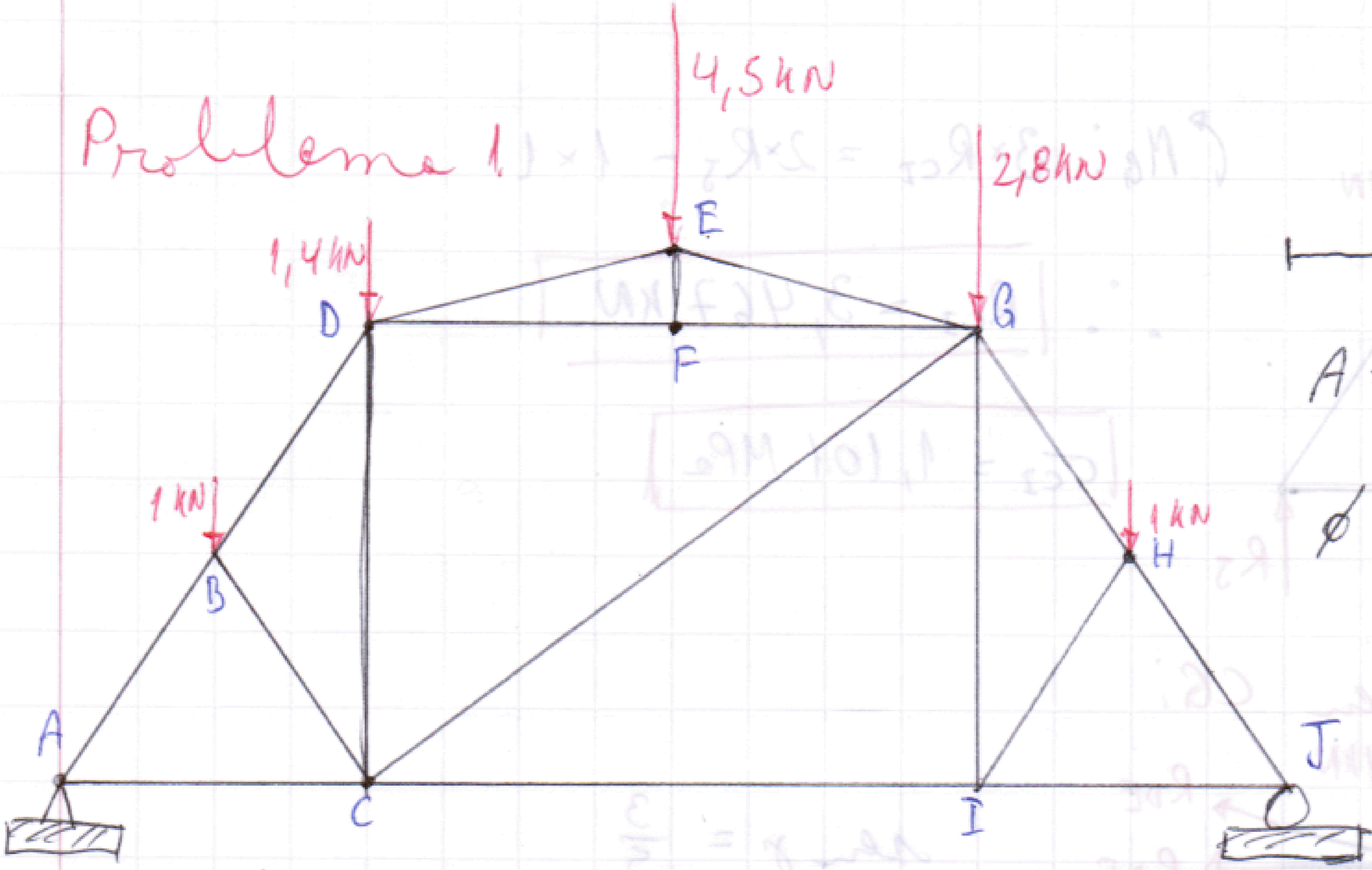
Punto Tarea 1 R1

Problema 1



= 1 m

$A = 31,5 \text{ cm}^2$

$\phi = 2 \text{ cm}$

Equilibrio de la estructura.

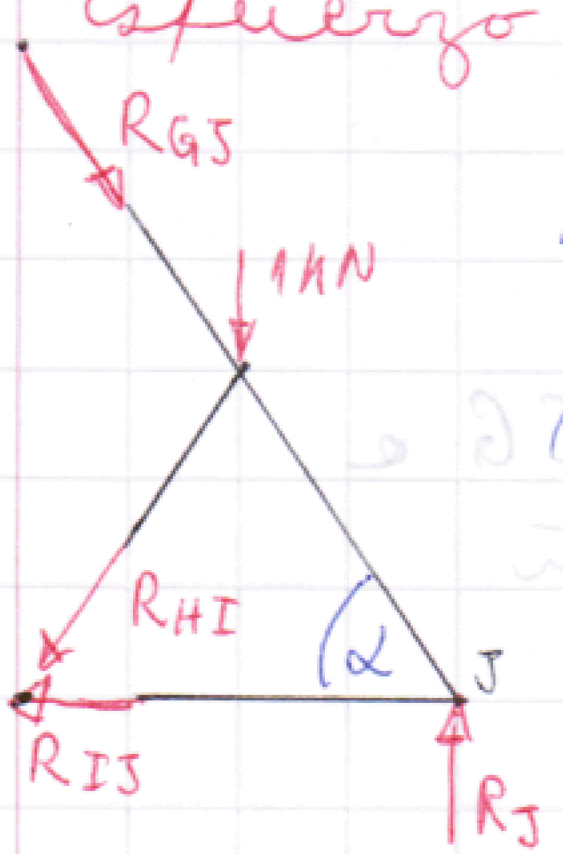
$\rightarrow \Sigma X: \quad H_A = 0 \text{ kN}$

$\uparrow \Sigma Y: \quad V_A + R_J = 10,7 \text{ kN}.$

$\curvearrowright M_A: \quad 8 R_J = 1\times 1 + 2\times 1,4 + 4\times 4,5 + 6\times 2,8 + 7\times 1$

$R_J = 5,7 \text{ kN}$
$V_A = 5 \text{ kN}.$

Esfuerzo en HI:



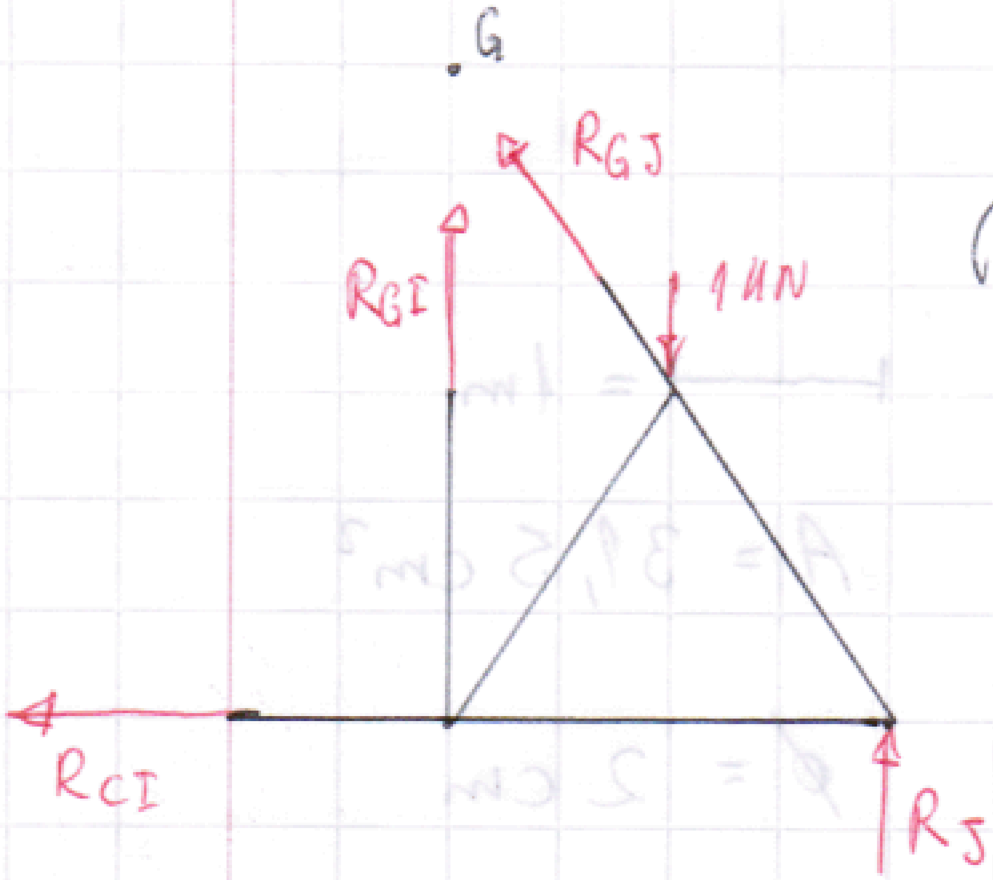
$\operatorname{sen} \alpha = \frac{3}{\sqrt{13}} \ ; \ \cos \alpha = \frac{2}{\sqrt{13}}$

$\curvearrowright M_J: \quad 2 \times R_{HI} \operatorname{sen} \alpha + 1 \times 1 = 0 \Rightarrow R_{HI} = \frac{-\sqrt{13}}{6}$

Elemento HI a compresión.

$\sigma_{HI} = 0,191 \text{ MPa}$

Esfuerzo en CI:

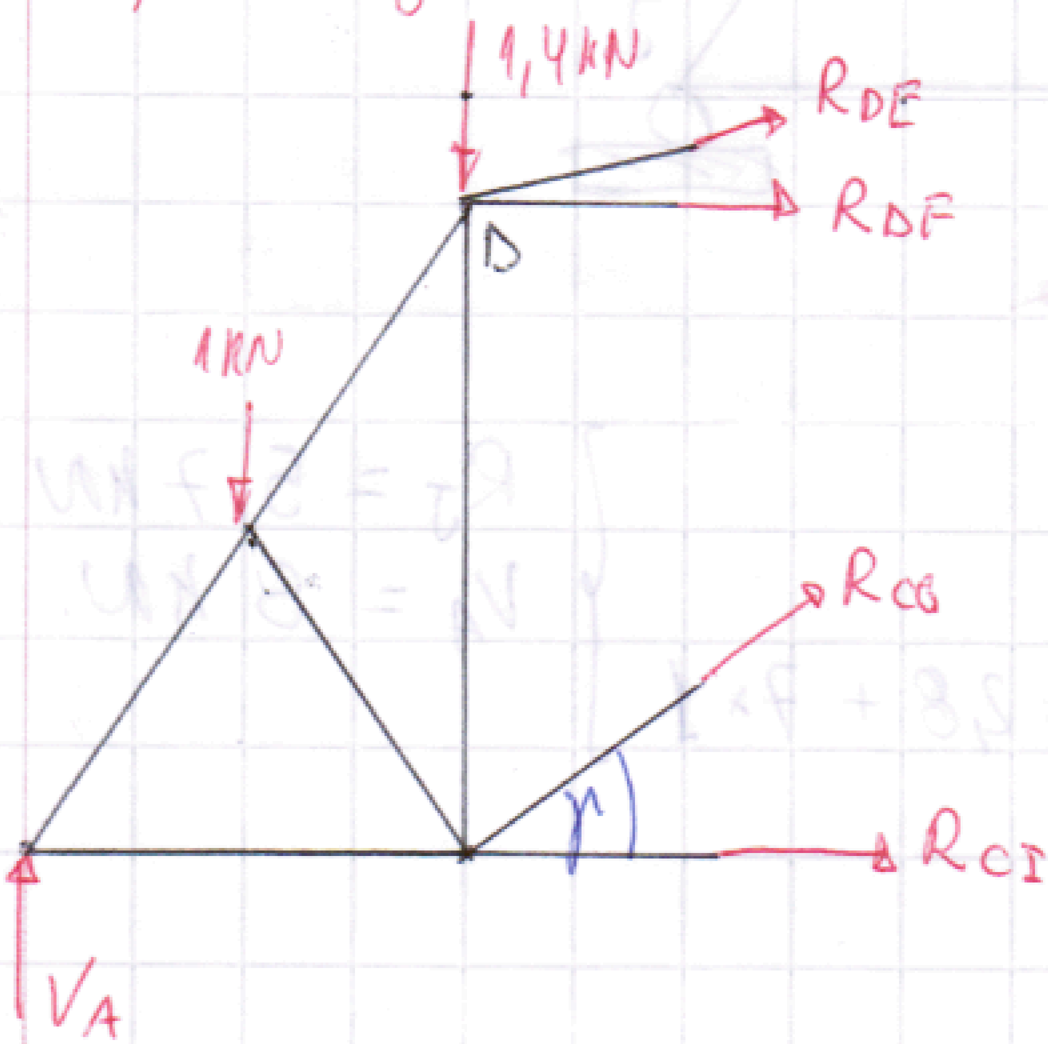


$\curvearrowright M_G$: $3 \times R_{CI} = 2 \times R_J - 1 \times 1$

$\therefore$ $R_{CI} = 3,467$ kN

$\sigma_{CI} = 1,101$ MPa

Esfuerzo en CG:



$\operatorname{sen} \gamma = \frac{3}{5}$

$\cos \gamma = \frac{4}{5}$

$\curvearrowright M_D$: $2 \times V_A = 1 \times 1 + 3 \times R_{CI} + 3 \times R_{CG} \frac{4}{5}$

$R_{CG} = -0,58375$ kN

Elemento CG a compresión

$\sigma_{CG} = 0,185$ MPa

Problema 21

$h = 2,5\,m$; $D = 2,8\,m$; $L = 8\,m$; $\rho_{H_2O} = 1000\ kg/m^3$

Acero A36 $\Rightarrow \sigma_y = 250\ MPa$; $FS = 3$.

- El esfuerzo permisible será de:

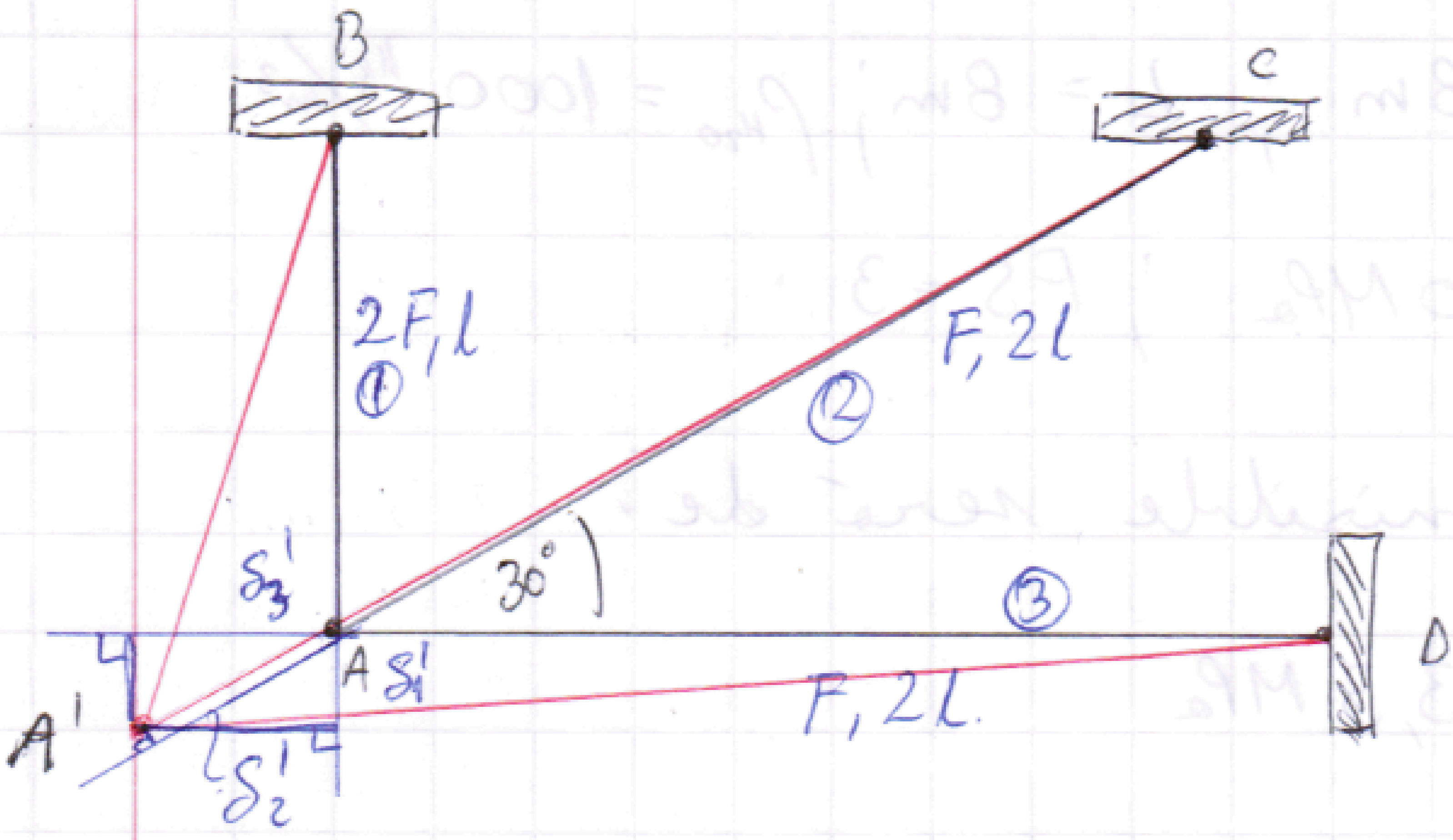
$$\sigma = \frac{\sigma_y}{FS} \Rightarrow \sigma = 83,3\ MPa$$

- Presión más alta en el fondo.

$$P = \rho_{H_2O}\, g\, h \Rightarrow P = 24,5\ kPa$$

Luego: $e = \dfrac{PD}{2\sigma} \Rightarrow \boxed{e = 0,412\ mm}$

Problema 31



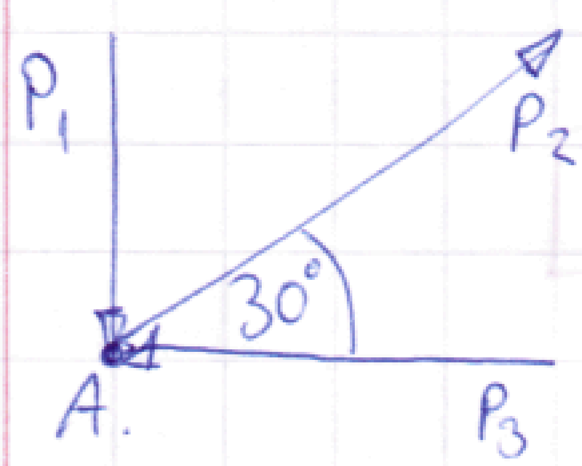
$T_0 = 290\,K$

$T_f = 340\,K$

$E = 210\,GPa$

$\alpha = 1{,}25 \times 10^{-5}\ 1/K$

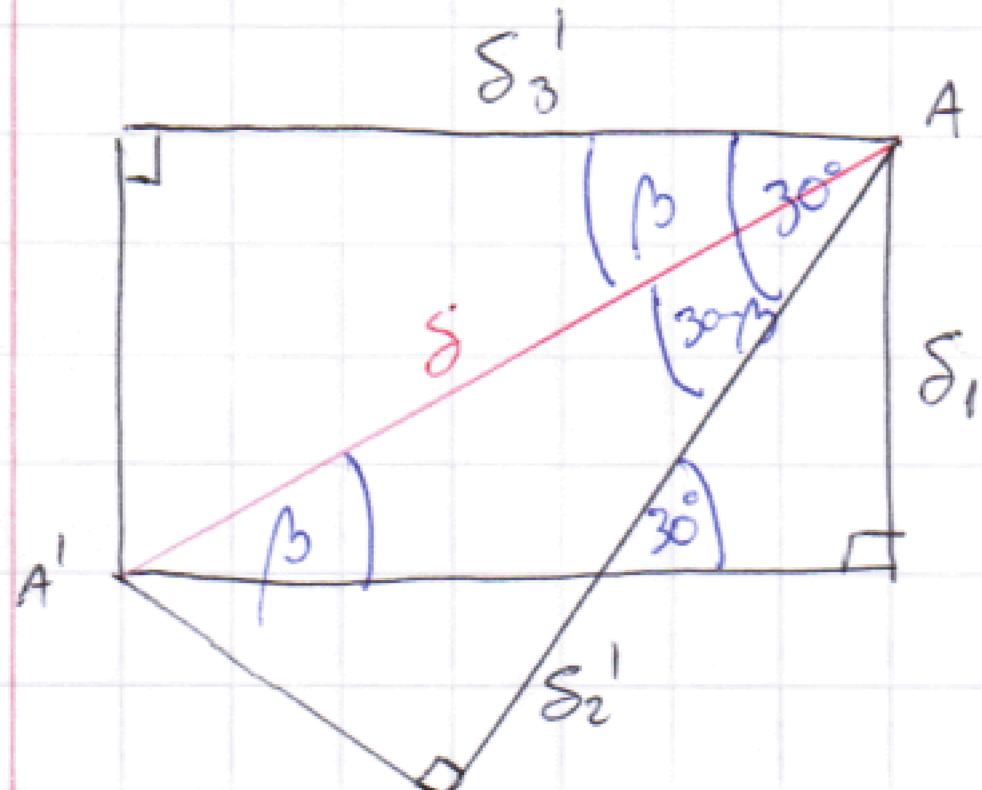
Equilibrio de Fuerzas en Nodo A:



X: $P_2 \cos(30) - P_3 = 0 \Rightarrow P_3 = \frac{\sqrt{3}}{2} P_2$

Y: $P_2 \operatorname{sen}(30) - P_1 = 0 \Rightarrow P_1 = \frac{1}{2} P_2$

Estado de deformación:



$\operatorname{sen}\beta = \frac{\delta_1'}{\delta}$

$\cos\beta = \frac{\delta_3'}{\delta}$

$\cos(30-\beta) = \frac{\delta_2'}{\delta}$

Luego:

$$\frac{\delta_2'}{\delta} = \cos(30)\cos\beta + \operatorname{sen}(30)\operatorname{sen}\beta$$

$$\frac{\delta_2'}{\delta} = \frac{\sqrt{3}}{2}\frac{\delta_3'}{\delta} + \frac{1}{2}\frac{\delta_1'}{\delta} \Rightarrow \boxed{2\delta_2' = \sqrt{3}\,\delta_3' + \delta_1'}$$

Cada delta es una superposición de los efectos térmicos y esfuerzos generados.

① a compresión ⇒ $\delta_1' = \delta_{T1} - \delta_1$

② a tracción ⇒ $\delta_2' = \delta_{T2} + \delta_2$

③ a compresión ⇒ $\delta_3' = \delta_{T3} - \delta_3$.

$$2(\delta_{T2}+\delta_2) = \sqrt{3}(\delta_{T3}-\delta_3) + (\delta_{T1}-\delta_1)$$

$$2\left(\alpha \Delta T\, 2l + \frac{P_2\, 2l}{EF}\right) = \sqrt{3}\left(\alpha\Delta T\, 2l - \frac{P_3\, 2l}{EF}\right) + \left(\alpha\Delta T\, l - \frac{P_1\, l}{2EF}\right)$$

Juntando términos y reemplazando P_1 y P_3.

$$\frac{4l}{EF}P_2 + \frac{3l}{EF}P_2 + \frac{l}{4EF}P_2 = 2\sqrt{3}\,\alpha\Delta T l - 3\alpha\Delta T l$$

$$P_2 \frac{29}{4EF} = \alpha\Delta T(2\sqrt{3}-3) \Rightarrow \boxed{P_2 = \frac{4}{29}EF\alpha\Delta T(2\sqrt{3}-3)}$$

$$\boxed{P_1 = \frac{2}{29}EF\alpha\Delta T(2\sqrt{3}-3)} \qquad \boxed{P_3 = \frac{2\sqrt{3}}{29}EF\alpha\Delta T(2\sqrt{3}-3)}$$

$$\boxed{\sigma_1 = \frac{1}{29}E\alpha\Delta T(2\sqrt{3}-3) = 2{,}1\ MPa}$$

$$\boxed{\sigma_2 = \frac{4}{29}E\alpha\Delta T(2\sqrt{3}-3) = 8{,}402\ MPa}$$

$$\boxed{\sigma_3 = \frac{2\sqrt{3}}{29}E\alpha\Delta T(2\sqrt{3}-3) = 7{,}276\ MPa}$$