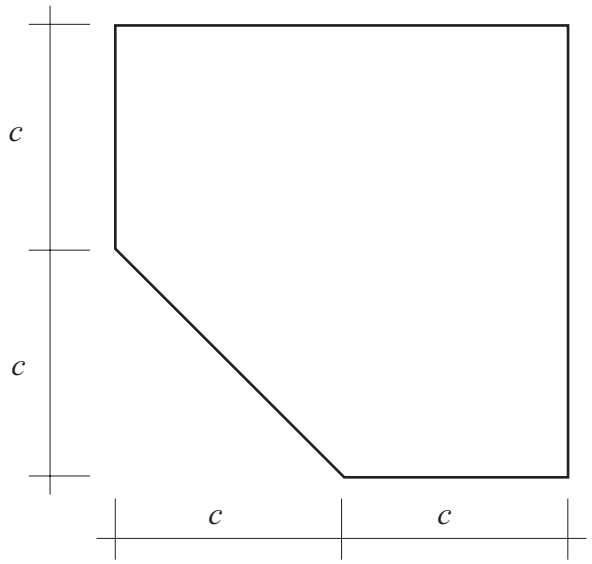
PEF-2201 Resistência dos Materiais e Estática das Construções – 2ª Prova – 18.10.2002

N°USP:_____Nome:_____

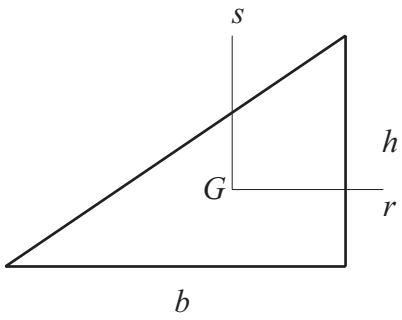
3ª Questão (3,5)

Determinar os momentos centrais de inércia da figura e indicar os eixos correspondentes.

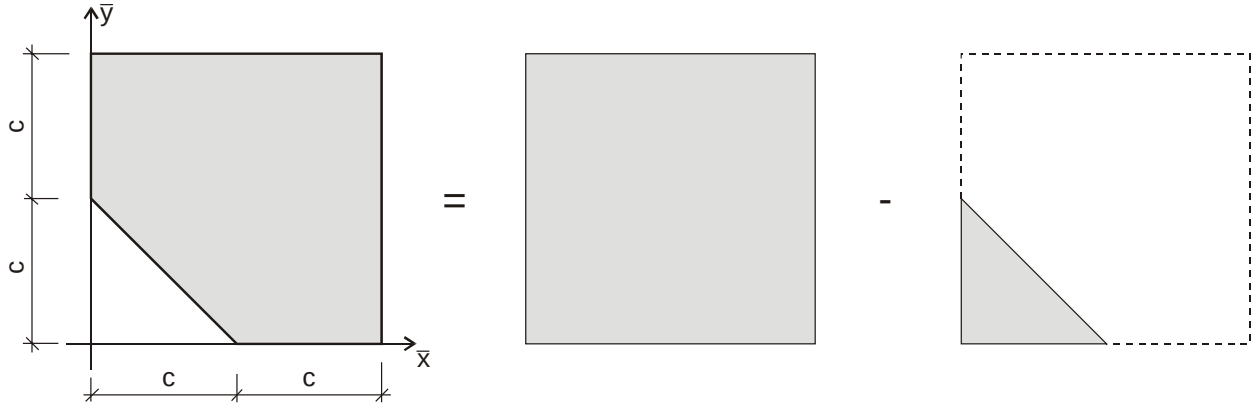


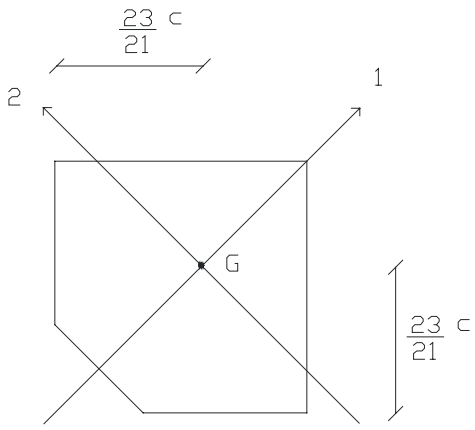
$$I_r = \frac{bh^3}{36}$$

$$I_{rs} = \frac{b^2h^2}{72}$$



Resposta:





$$\bar{x}_C = \frac{M_{S\bar{y}}}{S} = \frac{4c^2.c - \frac{1}{2}c^2.\frac{1}{3}c}{4c^2 - \frac{1}{2}c^2} = \frac{23c}{21} = \bar{y}_C$$

$$I_{\bar{x}} = \frac{(2c).(2c)^3}{3} - \frac{c.c^3}{12} = \frac{21c^4}{4} = I_{\bar{y}}$$

$$I_{\bar{x}\bar{y}} = \left(0 + c.c.4c^2\right) - \left[-\frac{c^2.c^2}{72} + \left(\frac{c}{3}\right).\left(\frac{c}{3}\right).\left(\frac{c^2}{2}\right)\right] = \frac{95c^4}{24}$$

$$I_x = \frac{21c^4}{4} - \left(\frac{23c}{21}\right)^2 \cdot \frac{7c^2}{2} = \frac{265c^4}{252} = I_y$$

$$I_{xy} = \frac{95c^4}{24} - \left(\frac{23c}{21}\right) \cdot \left(\frac{23c}{21}\right) \cdot \frac{7c^2}{2} = -\frac{121c^4}{504}$$

$$I_1 = \frac{I_x + I_y}{2} + \sqrt{\left(\frac{I_x - I_y}{2}\right)^2 + I_{xy}{}^2}$$

$$I_1 = I_x + \left\|I_{xy}\right\| = \frac{651c^4}{504} = \frac{217c^4}{168}$$

$$I_2 = I_x - \left\|I_{xy}\right\| = \frac{409c^4}{504}$$

$$\alpha_1 = arctg\frac{I_x - I_1}{I_{xy}} = arctg\frac{I_x - (I_x + \left\|I_{xy}\right\|)}{I_{xy}} = arctg\,1$$

$$\alpha_1 = +45^o \rightarrow \alpha_2 = +135^o$$