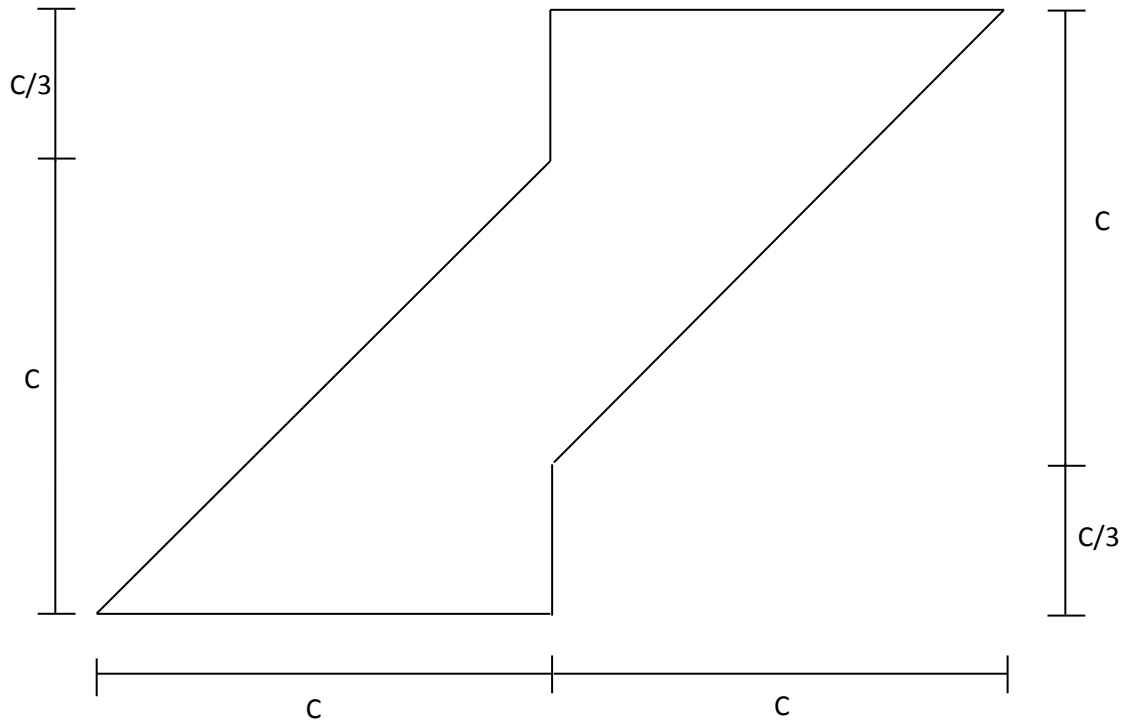**PEF 2201 – RESISTÊNCIA DOS MATERIAIS E ESTÁTICA DAS CONSTRUÇÕES I**
2ª PROVA – 10/10/2012
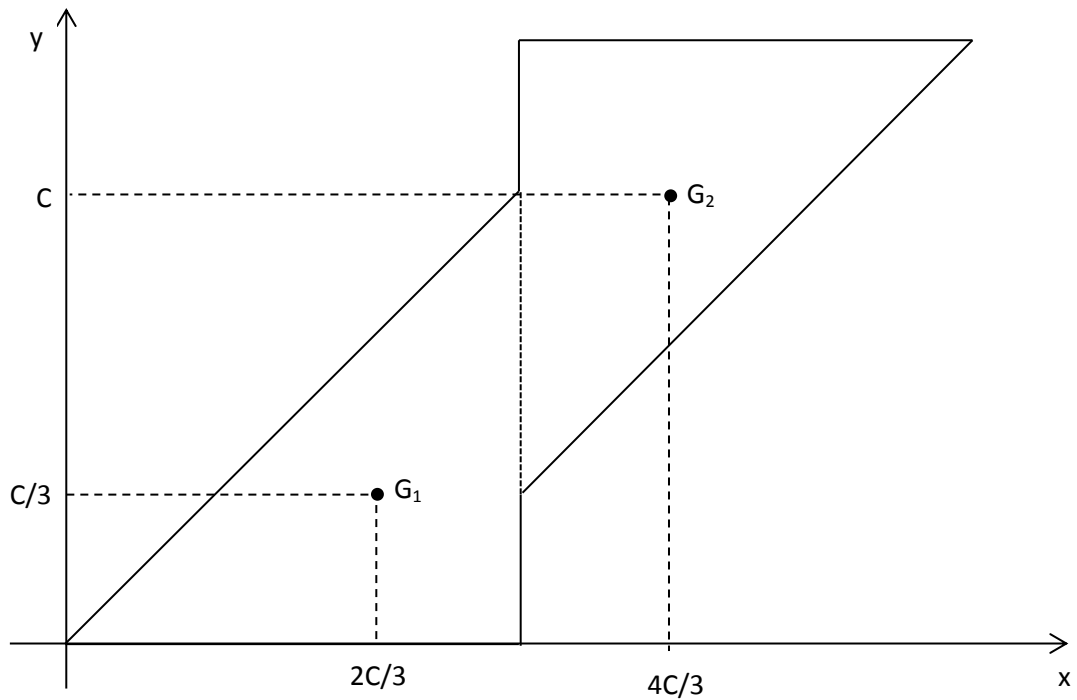Nome: _____ no USP: _____

1ª Questão (3,0):
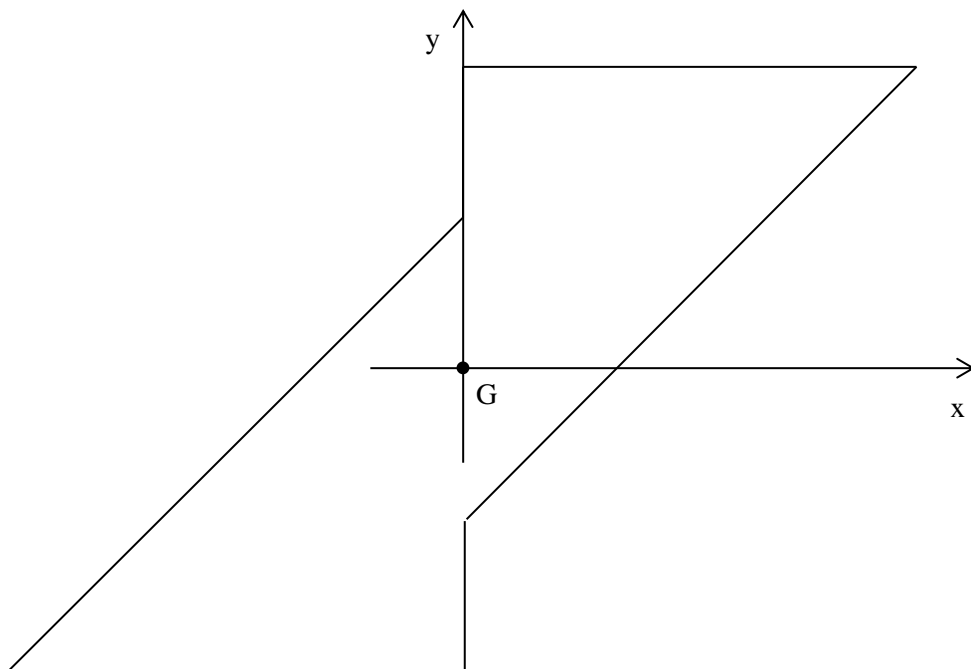Determinar os momentos centrais de inércia e os eixos centrais de inércia da seção da figura.

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

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

$$I_{1,2} = \frac{I_x + I_y}{2} \pm \sqrt{\left(\frac{I_x - I_y}{2}\right)^2 + I_{xy}^2}$$

$$\tan \theta_{1,2} = \frac{I_x - I_{1,2}}{I_{xy}}$$

Resolução:

$$X_G = \frac{\frac{C.C}{2} \cdot \frac{2C}{3} + \frac{C.C}{2} \cdot \frac{4C}{3}}{2\frac{C.C}{2}} = C$$

$$Y_G = \frac{\frac{C.C}{2} \cdot \frac{C}{3} + \frac{C.C}{2} \cdot C}{2\frac{C.C}{2}} = \frac{2C}{3}$$

$$I_x = 2\left(\frac{C.C^3}{36} + \frac{C.C}{2}\left(\frac{C}{3}\right)^2\right) = \frac{6C^4}{36} = \frac{C^4}{6}$$

$$I_y = 2\left(\frac{C.C^3}{36} + \frac{C.C}{2}\left(\frac{C}{3}\right)^2\right) = \frac{6C^4}{36} = \frac{C^4}{6}$$

$$I_{xy} = 2\left(-\frac{C^2.C^2}{72} + \frac{C.C}{2}.\frac{C}{3}\frac{C}{3}\right) = \frac{6C^4}{72} = \frac{C^4}{12}$$

$$I_{1,2} = \frac{\frac{C^4}{6} + \frac{C^4}{6}}{2} \pm \sqrt{\left(\frac{\frac{C^4}{6} - \frac{C^4}{6}}{2}\right)^2 + \left(\frac{C^4}{12}\right)^2} = \frac{C^4}{6} \pm \frac{C^4}{12}$$

$$I_1 = \frac{C^4}{4} \qquad\qquad I_2 = \frac{C^4}{12}$$

$$\alpha_1 = \text{arctg}\left(\frac{\frac{C^4}{6} - \frac{C^4}{4}}{\frac{C^4}{12}}\right) = arctg(-1) = -45°$$

$$\alpha_2 = \text{arctg}\left(\frac{\frac{C^4}{6} - \frac{C^4}{12}}{\frac{C^4}{12}}\right) = arctg(1) = 45°$$