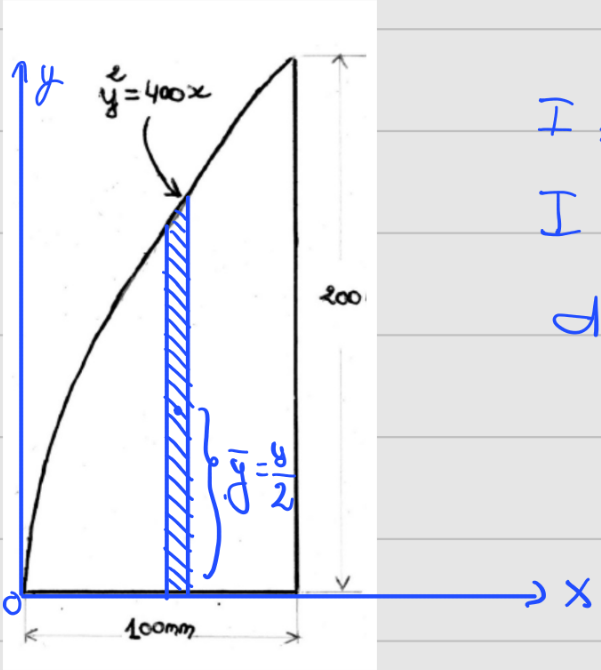
Problem 1 : **(irregular area)**

For the figure given in Problem 2, TD 3, Determine the moment of inertia I with respect to the x axis lying on its base.
Use the vertical rectangular differential element (strip.). compare with the first result.



$$I_x = \int y^2\, dA$$

$$I_x = I_{xc} + A\, d^2$$

$$d = \bar{y} = \frac{y}{2} = \frac{\sqrt{400x}}{2} = 10\sqrt{x}$$

$$dI_{xc} = \frac{b h^3}{12} = \frac{dx\,(400x)^{3/2}}{12}$$

$$dI_x = \frac{(400x)^{3/2}}{12}\,dx + dx \cdot 20\sqrt{x}\;\frac{400x}{4}$$

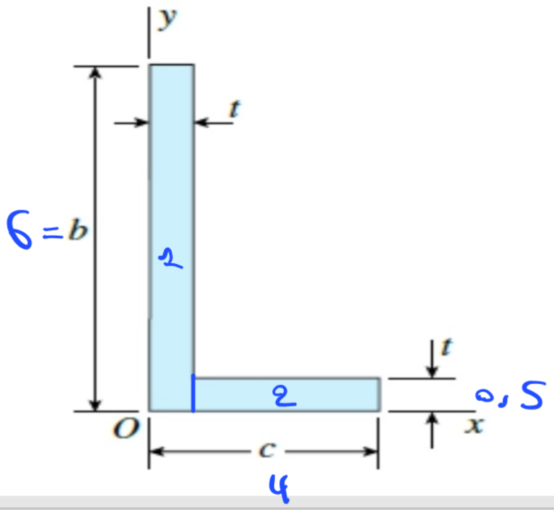
$$dI_x = \left(\frac{2000}{3}x^{3/2} + 2000x^{3/2}\right)dx$$

$$\int_0^{100} dI_x = \frac{8000}{3}\cdot\frac{2}{5}\left[x^{5/2}\right]_0^{100}$$

$$I_x = 106{,}66\ldots$$

Problem 2 : **(Composite Area)**

Calculate the moments of Inertia for this L shape cross section with respect to the centroidal axes x_c, y_c. (b = 6 in, c = 4 in, t = 0.5 in).
Calculate the product of Inertia with respect to the same centroidal axes.



$$\bar{x} = \frac{Q_y}{A} = \frac{\sum A_i x_i}{\sum A_i} = \frac{(6 \times 0,5) \times 0,25 + (3,5 \times 0,5)(1,75 + 0,5)}{(6 \times 0,5) + (3,5 \times 0,5)}$$

$$\bar{x} = 0,986 \text{ inch}$$

$$\bar{y} = \frac{Q_x}{A} = \frac{\sum A_i y_i}{\sum A_i} = \frac{(6 \times 0,5) \times (3) + (3,5 \times 0,5) \times 0,25}{(6 \times 0,5) + (3,5 \times 0,5)}$$

$$\bar{y} = 1,986 \text{ inch}$$

$$I_{xc} = I_x - Ad^2 = I_x - A\bar{y}^2$$

$$I_x = (I_{x_1}) + (I_{x_2}) = \frac{t b^3}{3} + \frac{t (c-t)^3}{3}$$

$$= \frac{0,5 \times 6^3}{3} + \frac{0,5^3 \cdot (4 - 0,5)}{3}$$

$$= 36,1458 \text{ inch}^4$$

$$A = 4,75$$

$$I_{xc} = 36,1458 - 4,75 \cdot (1,986)^2$$
$$= 17,41 \text{ inch}^4$$

No reply Homework 1:

Calculate the moments of inertia with respect to the x and y axes for your L shape (problem 2) using the integral method (you must obtain the same results)

$$I_x = I_{x1} + I_{x2}$$

$$I_{x1} = \int y^2 \, dA = \int_0^b \int_0^t y^2 \, dx \, dy$$

$$= \int_0^b t \, y^2 \, dy = \frac{t}{3} \left[y^3 \right]_0^b$$

$$= \frac{t b^3}{3} = \frac{0{,}5 \times 6^3}{3} = 36$$

$$I_{x2} = \int_0^t \int_t^c y^2 \, dx \, dy = \int_0^t (c-t) \, y^2 \, dy$$

$$= \frac{c-t}{3} \left[y^3 \right]_0^t = \frac{t^3 (c-t)}{3}$$

$$= \frac{(0{,}5)^3 (4-0{,}5)}{3} = 0{,}1458$$

$$I_x = I_{x1} + I_{x2}$$

$$= 36 + 0{,}1458$$

$$I_x = 36{,}1458$$