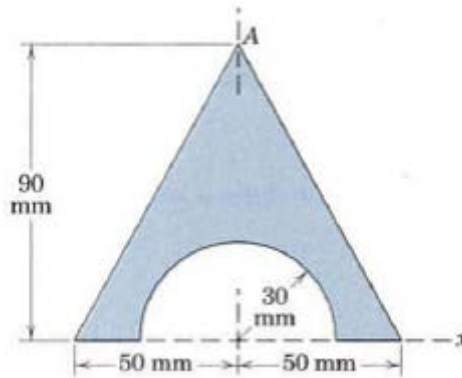
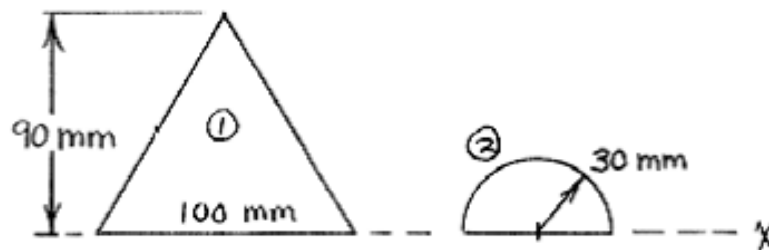


Problem 6

Calculate the moment of inertia of the shaded area about the .x-axis



Solution



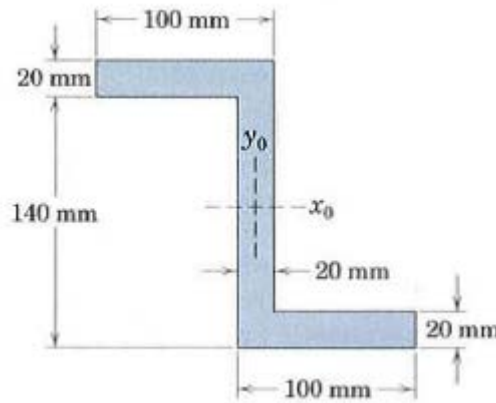
$$I_{x_1} = \frac{1}{12} (100) (90^3) = 6.08 (10^6) \text{ mm}^4$$

$$I_{x_2} = - \frac{\pi (30^4)}{8} = -0.318 (10^6) \text{ mm}^4$$

$$\text{So } I_x = (6.08 - 0.318) 10^6 = \underline{\underline{5.76 (10^6) \text{ mm}^4}}$$

Problem 7

Determine the moments of inertia of the Z-section about its centroidal x_0 - and y_0 -axes.



Solution

① $I_{x_0} = \frac{1}{12}(80)(20)^3 + (80)(20)(70)^2 = 7.89(10^6) \text{ mm}^4$
 $I_{y_0} = \frac{1}{12}(20)(80)^3 + (20)(80)(80)^2 = 4.85(10^6) \text{ mm}^4$

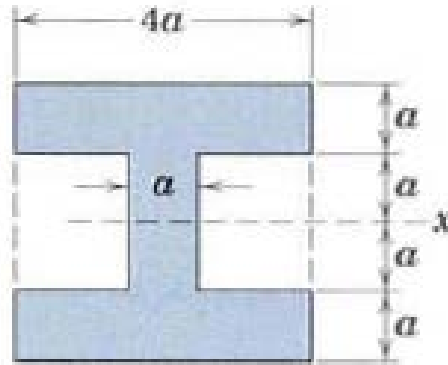
② $I_{x_0} = \frac{1}{12}(20)(160)^3 = 6.83(10^6) \text{ mm}^4$
 $I_{y_0} = \frac{1}{12}(160)(20)^3 = 0.1067(10^6) \text{ mm}^4$

Total $\bar{I}_x = [2(7.89) + 6.83](10^6)$
 $= \underline{22.6(10^6) \text{ mm}^4}$

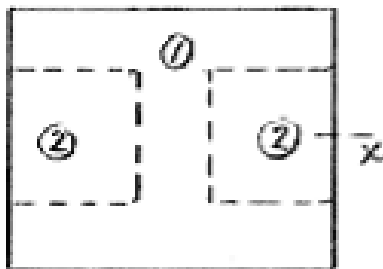
$\bar{I}_y = [2(4.85) + 0.1067](10^6)$
 $= \underline{9.81(10^6) \text{ mm}^4}$

Problem 8

Determine the moment of inertia of the shaded area about the .x-axis



Solution



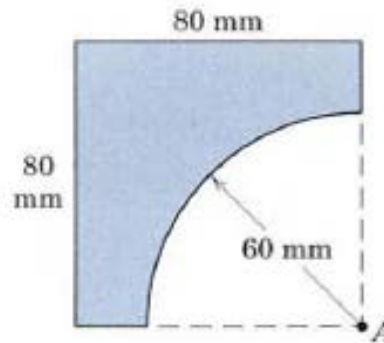
$$I_{\textcircled{1}} = \frac{1}{12} (4a)(4a)^3 = \frac{64}{3} a^4$$

$$I_{\textcircled{2}} = -\frac{1}{12} (3a)(2a)^3 = -2a^4$$

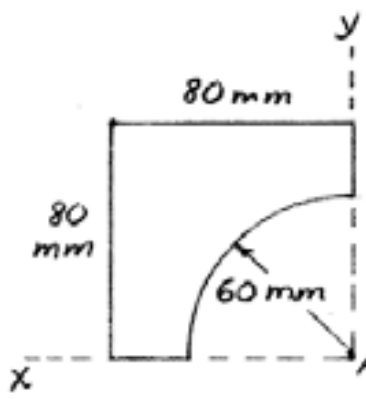
$$\text{Total} = \left(\frac{64}{3} - \frac{6}{3} \right) a^4 = \underline{\underline{\frac{58}{3} a^4}}$$

Problem 9

Determine the polar radius of gyration about point A for the shaded area shown



Solution



$$\text{Square:}$$

$$I_x = I_y = \frac{1}{3}(80)(80)^3 = 13.65(10^6) \text{ mm}^4$$

$$\text{Quarter-circular area:}$$

$$I_x = I_y = -\frac{1}{4} \left(\frac{1}{4} \pi [60]^4 \right) = -2.54(10^6) \text{ mm}^4$$

$$\text{Area } A = (80)^2 - \frac{1}{4} \pi (60)^2 = 3573 \text{ mm}^2$$

$$I_z = I_x + I_y = 2(13.65 - 2.54)10^6$$

$$= 22.22(10^6) \text{ mm}^4$$

$$k_A^2 = I_z / A = 22.22(10^6) / 3573 = 6219 \text{ mm}^2, \quad k_A = \sqrt{6219} = \underline{78.9 \text{ mm}}$$