PROB. 5.111

FIND $\bar{z}$.

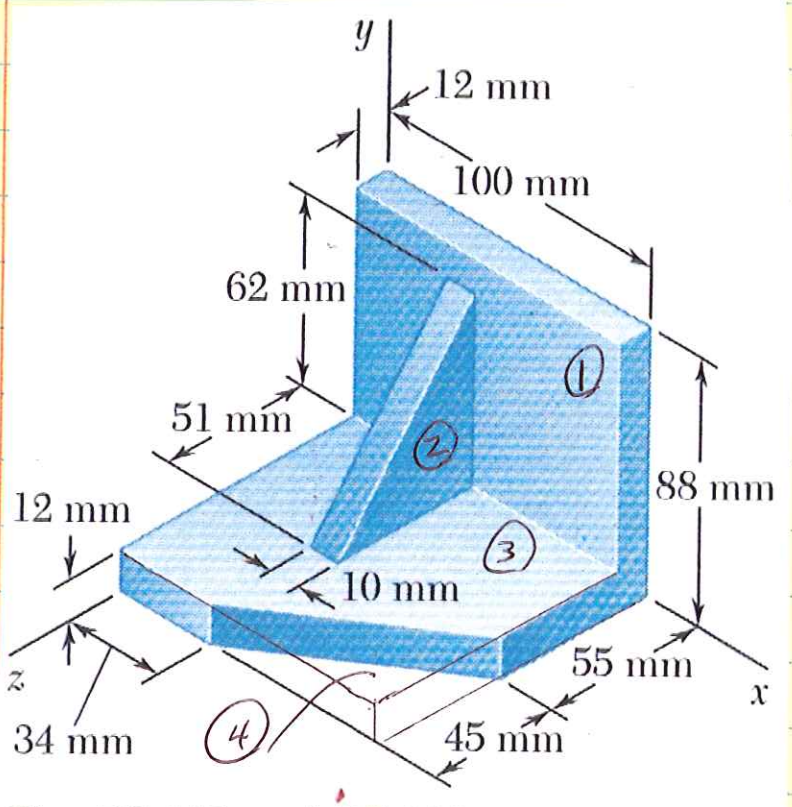

Fig. P5.110 and P5.111

$$\bar{z} = \frac{\sum \bar{z}_i V_i}{\sum V_i}$$

VOLUME 1: $V_1 = (12)(88)(100) = 1.056 \times 10^5 \text{ mm}^3$

$\bar{z}_1 = \frac{1}{2}(12) = 6^{\text{mm}}$, $\bar{z}_1 V_1 = 6.336 \times 10^5 \text{ mm}^4$

VOLUME 2: $V_2 = \frac{1}{2}(51)(62)(10) = 1.581 \times 10^4 \text{ mm}^3$

PROB. 5.111 CONT.

$\bar{z}_2 = 12 + \frac{1}{3}(51) = 29^{mm}$

$\bar{z}_2 V_2 = 4.585 \times 10^5 \ mm^4$

VOLUME 3: $V_3 = (45 + 55 - 12)(100)(12)$

$V_3 = 1.056 \times 10^5 \ mm^3$

$\bar{z}_3 = 12 + \frac{1}{2}(45 + 55 - 12) = 56^{mm}$

$\bar{z}_3 V_3 = 5.914 \times 10^6 \ mm^4$

VOLUME 4: $V_4 = -\frac{1}{2}(45)(100 - 34)(12) = -1.782 \times 10^4 \ mm^3$

$\bar{z}_4 = 100 - \frac{1}{3}(45) = 85^{mm}$, $\bar{z}_4 V_4 = -1.515 \times 10^6 \ mm^4$

$$\bar{z} = \frac{6.336 \times 10^5 + 4.585 \times 10^5 + 5.914 \times 10^6 - 1.515 \times 10^6}{1.056 \times 10^5 + 1.581 \times 10^4 + 1.056 \times 10^5 - 1.782 \times 10^4}$$

$$\bar{z} = \frac{5.491 \times 10^6}{2.092 \times 10^5} = 26.25^{mm}$$