

<5.1~5.5 >

$$5.6 \quad A = (8 \text{ cm} + 9 \text{ cm})(9 \text{ cm}) = 153 \text{ cm}^2$$

$$\bar{x} = \frac{1}{2} (17 \text{ cm}) = 8.5 \text{ cm}$$

$$\bar{y} = \frac{1}{2} (9 \text{ cm}) = 4.5 \text{ cm}$$

$$A = -\frac{\pi}{4} (4.5 \text{ cm})^2 = -15.904 \text{ cm}^2$$

$$\bar{x} = (8 \text{ cm}) - \frac{4}{3\pi} (4.5 \text{ cm}) = 6.0901 \text{ cm}$$

$$\bar{y} = (9 \text{ cm}) - \frac{4}{3\pi} (4.5 \text{ cm}) = 7.0901 \text{ cm}$$

$$A = -\frac{\pi}{4} (6 \text{ cm})^2 = -28.27 \text{ cm}^2$$

$$\bar{x} = (8 \text{ cm}) + \frac{4}{3\pi} (6 \text{ cm}) = 10.5465 \text{ cm}$$

$$\bar{y} = (9 \text{ cm}) - \frac{4}{3\pi} (6 \text{ cm}) = 6.4535 \text{ cm}$$

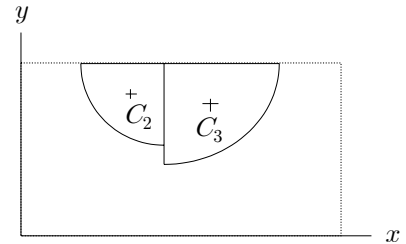
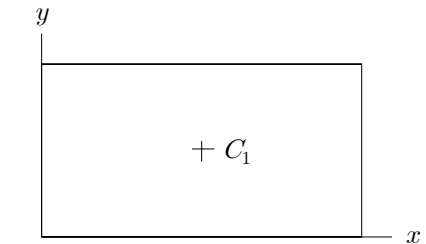
$$A = 153 - 15.904 - 28.27 \text{ (cm}^2\text{)} = 108.83 \text{ cm}^2$$

$$(\bar{x}A) = (8.5 \text{ cm})(153 \text{ cm}^2) + (6.090 \text{ cm})(-15.904 \text{ cm}^2) + (10.546 \text{ cm})(-28.27 \text{ cm}^2) \\ = 905.5 \text{ cm}^3$$

$$(\bar{y}A) = (4.5 \text{ cm})(153 \text{ cm}^2) + (7.090 \text{ cm})(-15.904 \text{ cm}^2) + (6.457 \text{ cm})(-28.27 \text{ cm}^2) \\ = 393.2 \text{ cm}^3$$

$$\bar{X} = \frac{\Sigma(\bar{x}A)}{\Sigma A} = \frac{905.5 \text{ cm}^3}{108.83 \text{ cm}^2} = 8.32 \text{ cm}$$

$$\bar{Y} = \frac{\Sigma(\bar{y}A)}{\Sigma A} = \frac{393.2 \text{ cm}^3}{108.83 \text{ cm}^2} = 3.61 \text{ cm}$$



centroid = (8.32 cm, 3.61 cm)

5.18

$$A = (40 + 40 \text{ mm})(20 \text{ mm}) = 1,600 \text{ mm}^2$$

$$\bar{y} = (80 \text{ mm}) + \frac{1}{2}(20 \text{ mm}) = 90 \text{ mm}$$

$$A = (20 \text{ mm})(100 - 20 \text{ mm}) = 1,600 \text{ mm}^2$$

$$\bar{y} = \frac{1}{2}(80 \text{ mm}) = 40 \text{ mm}$$

$$A = 1,600 + 1,600 \text{ (mm}^2\text{)} = 3,200 \text{ mm}^2$$

$$(\bar{y}A) = (90 \text{ mm})(1,600 \text{ mm}^2) + (40 \text{ mm})(1,600 \text{ mm}^2) \\ = 208,000 \text{ mm}^3$$

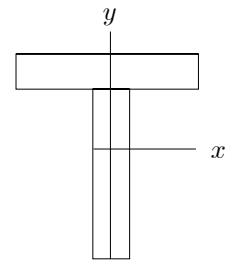
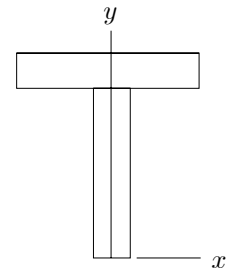
$$\bar{Y} = \frac{\Sigma(\bar{y}A)}{\Sigma A} = \frac{208,000 \text{ mm}^3}{3200 \text{ mm}^2} = 65.0 \text{ mm}$$

$$Q_{xI} = (\bar{y}A) = (80 - 65 + 10 \text{ mm})(1,600 \text{ mm}^2) \\ + \frac{1}{2}(80 - 65 \text{ mm})(20 \times 15 \text{ mm}^2) = 42,250 \text{ mm}^3$$

$$Q_{xII} = (\bar{y}A) = \frac{1}{2}(-65 \text{ mm})(20 \times 65 \text{ mm}) = -42,250 \text{ mm}^3$$

$$Q_x = Q_{xI} + Q_{xII} = 0$$

$$x \qquad \qquad \bar{y} = 0 \qquad \qquad Q_x = \bar{y} A = 0 \qquad \qquad .$$



5.28

$$L = 2\theta r$$

$$\bar{x} = -\frac{r \sin\theta}{\theta}$$

$$L = r$$

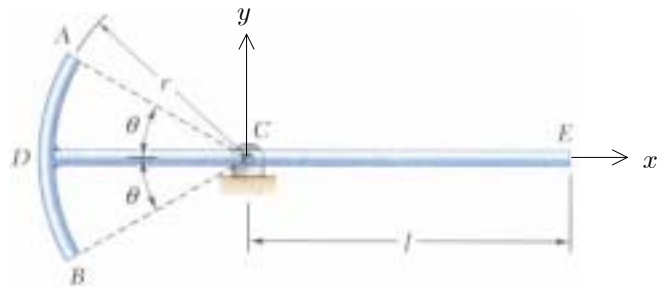
$$\bar{x} = -\frac{1}{2}r$$

$$L = l$$

$$\bar{x} = \frac{1}{2}l$$

$$(\bar{x}L) = -\frac{r \sin\theta}{\theta} (2\theta r) + (-\frac{1}{2}r) r + (\frac{1}{2}l) l = -2r^2 \sin\theta - \frac{1}{2}r^2 + \frac{1}{2}l^2 = 0$$

$$l = r \sqrt{1 + 4 \sin\theta}$$



(a) $\theta = 15^\circ$

$$l = r \sqrt{1 + 4 \sin 15^\circ} = 1.427 r$$

(b) $\theta = 60^\circ$

$$l = r \sqrt{1 + 4 \sin 60^\circ} = 2.11 r$$