

Composite Bodies

Take a complex shape, and divide into simpler shapes with known geometric properties

$$\bar{X} = \frac{\sum \tilde{x} A}{\sum A}$$

$$\bar{Y} = \frac{\sum \tilde{y} A}{\sum A}$$

Inside back Cover: Geometric Properties of Common Shapes

Holes: Negative Area

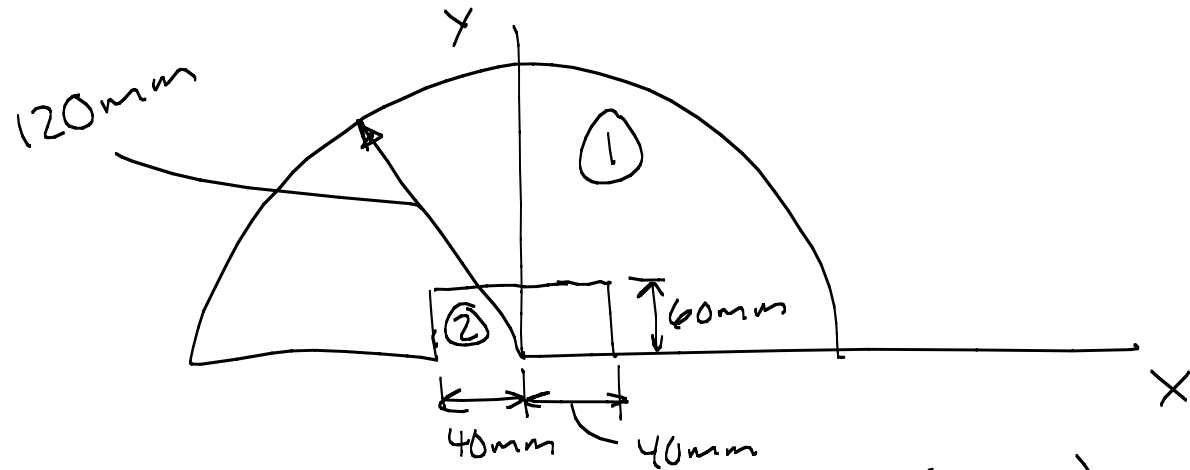
Below the x-axis: $-\tilde{y}$

Left of the y-axis: $-\tilde{x}$

\tilde{x} & \tilde{y} must be measured from a common base point

Example

Find \bar{y}



Shape

Area (mm²)

\bar{y} (mm)

$\bar{y}A$ (mm³)

①

$$\begin{aligned} & \frac{1}{2}(\pi)r^2 \\ &= \frac{1}{2}\pi(120)^2 \\ &= \underline{22619.5} \end{aligned}$$

$$\begin{aligned} & \frac{4r}{3\pi} \\ &= \frac{4(120)}{3\pi} \\ &= 50.9 \end{aligned}$$

$$1,152,002$$

②

$$\begin{aligned} & -(80)(60) \\ &= -4800 \end{aligned}$$

$$\begin{aligned} & \frac{1}{2}(60) \\ &= 30 \end{aligned}$$

$$-144,000$$

$$\underline{\underline{\bar{y}A = 17,819.5}}$$

$$\bar{y}A = 1,008,002$$

$$\bar{y} = \frac{1,008,002 \text{ mm}^3}{17,819.5 \text{ mm}^2} = \boxed{56.57 \text{ mm}}$$