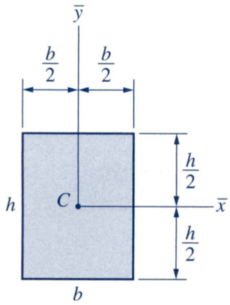
TABLE 8–1 Properties of Areas of Common Shapes

Rectangle



$A = bh$

$\bar{I}_x = \frac{1}{12}bh^3$

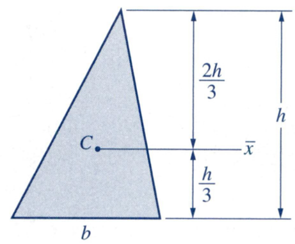
$\bar{I}_y = \frac{1}{12}hb^3$

$\bar{J} = \frac{1}{12}bh(h^2 + b^2)$

$\bar{r}_x = \frac{h}{\sqrt{12}}$

$\bar{r}_y = \frac{b}{\sqrt{12}}$

Triangle

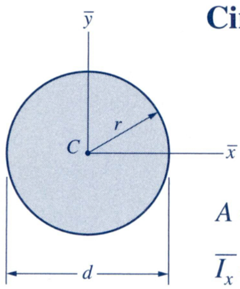


$A = \frac{1}{2}bh$

$\bar{I}_x = \frac{1}{36}bh^3$

$\bar{r}_x = \frac{h}{\sqrt{18}}$

Circle



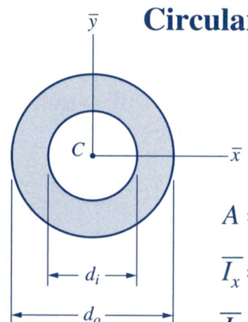
$A = \frac{1}{4}\pi d^2 = \pi r^2$

$\bar{I}_x = \bar{I}_y = \frac{1}{64}\pi d^4 = \frac{1}{4}\pi r^4$

$\bar{J} = \frac{1}{32}\pi d^4 = \frac{1}{2}\pi r^4$

$\bar{r}_x = \bar{r}_y = \frac{1}{4}d$

Circular Ring



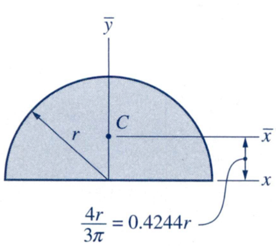
$A = \frac{1}{4}\pi(d_o^2 - d_i^2)$

$\bar{I}_x = \bar{I}_y = \frac{1}{64}\pi(d_o^4 - d_i^4)$

$\bar{J} = \frac{1}{32}\pi(d_o^4 - d_i^4)$

$\bar{r}_x = \bar{r}_y = \frac{1}{4}\sqrt{d_o^2 + d_i^2}$

Semicircle



$A = \frac{1}{2}\pi r^2$

$\bar{I}_x = 0.1098r^4$

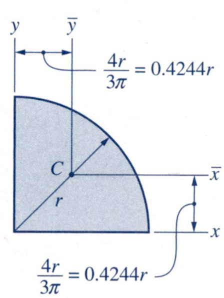
$I_y = I_x = \frac{1}{8}\pi r^4$

$\bar{J} = 0.5025r^4$

$\bar{r}_x = 0.2644r$

$\bar{r}_y = r_x = \frac{1}{2}r$

Quarter-Circle



$A = \frac{1}{4}\pi r^2$

$\bar{I}_x = \bar{I}_y = 0.0549r^4$

$I_x = I_y = \frac{1}{16}\pi r^4$

$\bar{J} = 0.1098r^4$

$\bar{r}_x = \bar{r}_y = 0.2644r$

$r_x = r_y = \frac{1}{2}r$

In the above equation, the first term represents moment of inertia $\bar{I}_x$ of the area about the centroidal $\bar{x}$ axis. The second term is zero since $\Sigma y\Delta A = A\bar{y}$, and $\bar{y}$ is zero with respect to the centroidal $\bar{x}$ axis. The third term is simply Ad^2. Thus, the expression for I_x becomes

$$I_x = \bar{I}_x + Ad^2 \tag{8–7}$$