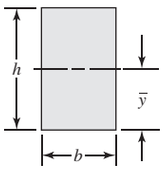
Appendix B-1a Properties of Sections

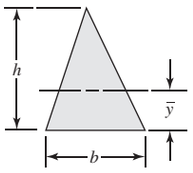
A = area, in.^{2}
I = moment of inertia, in.^{4}
J = polar moment of inertia, in.^{4}
Z = section modulus, in.^{3}
ρ = radius of gyration, in.
$\bar{y}$ = centroidal distance, in.



Rectangle

$$A = bh \qquad I = \frac{bh^3}{12} \qquad Z = \frac{bh^2}{6}$$

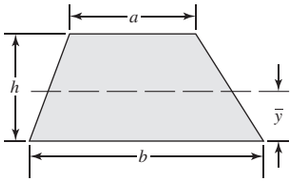
$$\rho = 0.289h \qquad \bar{y} = \frac{h}{2}$$



General triangle

$$A = \frac{bh}{2} \qquad I = \frac{bh^3}{36} \qquad Z = \frac{bh^2}{24}$$

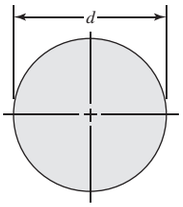
$$\rho = 0.236h \qquad \bar{y} = \frac{h}{3}$$



General trapezoid

$$A = \frac{h}{2}(a + b) \qquad I = \frac{h^3(a^2 + 4ab + b^2)}{36(a + b)} \qquad Z = \frac{h^2}{12}\frac{(a^2 + 4ab + b^2)}{(a + 2b)}$$

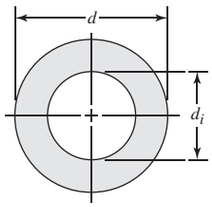
$$\rho = \frac{h}{6}\sqrt{2 + \frac{4\,ab}{(a + b)^2}} \qquad \bar{y} = \frac{h}{3}\frac{(2a + b)}{(a + b)}$$



Circle

$$A = \frac{\pi d^2}{4} \qquad I = \frac{\pi d^4}{64} \qquad Z = \frac{\pi d^3}{32}$$

$$J = \frac{\pi d^4}{32} \qquad \rho = \frac{d}{4}$$



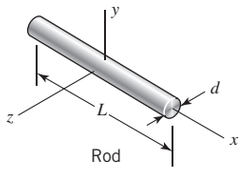
Hollow circle

$$A = \frac{\pi}{4}(d^2 - d_i^2) \qquad I = \frac{\pi}{64}(d^4 - d_i^4) \qquad Z = \frac{\pi}{32d}(d^4 - d_i^4)$$

$$J = \frac{\pi}{32}(d^4 - d_i^4) \qquad \rho = \sqrt{\frac{d^2 + d_i^2}{16}}$$

Appendix B-2 *Mass and Mass Moments of Inertia of Homogeneous Solids*

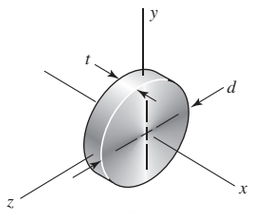
ρ = mass density



Rod

$$m = \frac{\pi d^2 L \rho}{4}$$

$$I_y = I_z = \frac{mL^2}{12}$$

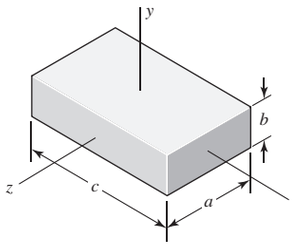


Disk

$$m = \frac{\pi d^2 t \rho}{4}$$

$$I_x = \frac{md^2}{8}$$

$$I_y = I_z = \frac{md^2}{16}$$



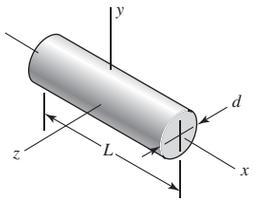
Rectangular prism

$$m = abc\rho$$

$$I_x = \frac{m}{12}(a^2 + b^2)$$

$$I_y = \frac{m}{12}(a^2 + c^2)$$

$$I_z = \frac{m}{12}(b^2 + c^2)$$

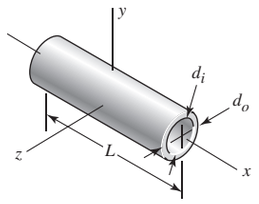


Cylinder

$$m = \frac{\pi d^2 L \rho}{4}$$

$$I_x = \frac{md^2}{8}$$

$$I_y = I_z = \frac{m}{48}(3d^2 + 4L^2)$$



$$m = \frac{\pi L \rho}{4}(d_o^2 - d_i^2)$$

$$I_x = \frac{m}{8}(d_o^2 + d_i^2)$$

$$I_y = I_z = \frac{m}{48}(3d_o^2 + 3d_i^2 + 4L^2)$$