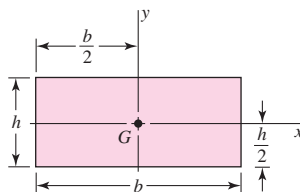
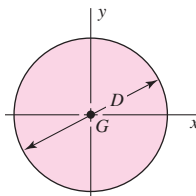


**Table A-18**

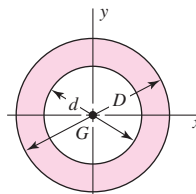
Geometric Properties

**Part 1 Properties of Sections** $A$  = area $G$  = location of centroid $I_x = \int y^2 dA$  = second moment of area about  $x$  axis $I_y = \int x^2 dA$  = second moment of area about  $y$  axis $I_{xy} = \int xy dA$  = mixed moment of area about  $x$  and  $y$  axes $J_G = \int r^2 dA = \int (x^2 + y^2) dA = I_x + I_y$ = second polar moment of area about axis through  $G$  $k_x^2 = I_x/A$  = squared radius of gyration about  $x$  axis**Rectangle**

$$A = bh \quad I_x = \frac{bh^3}{12} \quad I_y = \frac{b^3h}{12} \quad I_{xy} = 0$$

**Circle**

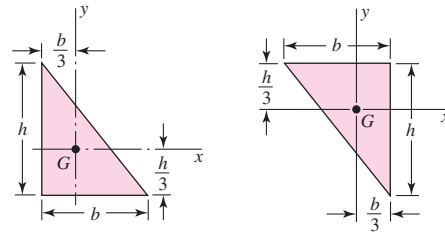
$$A = \frac{\pi D^2}{4} \quad I_x = I_y = \frac{\pi D^4}{64} \quad I_{xy} = 0 \quad J_G = \frac{\pi D^4}{32}$$

**Hollow circle**

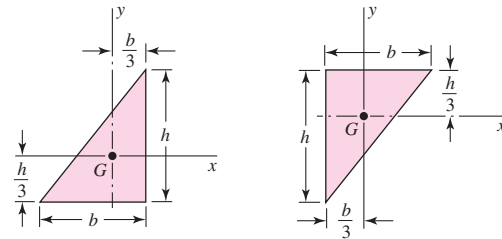
$$A = \frac{\pi}{4}(D^2 - d^2) \quad I_x = I_y = \frac{\pi}{64}(D^4 - d^4) \quad I_{xy} = 0 \quad J_G = \frac{\pi}{32}(D^4 - d^4)$$

**Table A-18**

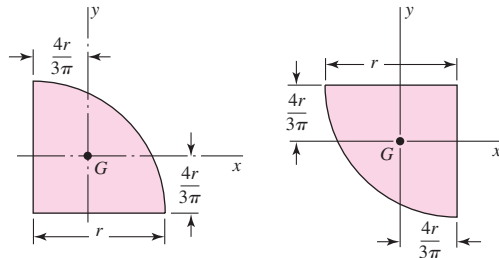
Geometric Properties  
(Continued)

**Right triangles**

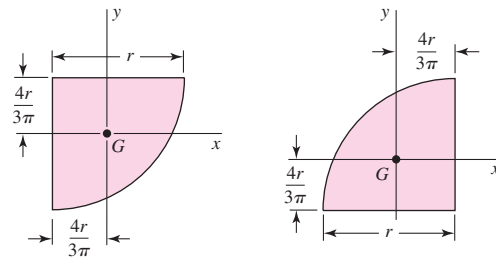
$$A = \frac{bh}{2} \quad I_x = \frac{bh^3}{36} \quad I_y = \frac{b^3h}{36} \quad I_{xy} = \frac{-b^2h^2}{72}$$

**Right triangles**

$$A = \frac{bh}{2} \quad I_x = \frac{bh^3}{36} \quad I_y = \frac{b^3h}{36} \quad I_{xy} = \frac{b^2h^2}{72}$$

**Quarter-circles**

$$A = \frac{\pi r^2}{4} \quad I_x = I_y = r^4 \left( \frac{\pi}{16} - \frac{4}{9\pi} \right) \quad I_{xy} = r^4 \left( \frac{1}{8} - \frac{4}{9\pi} \right)$$

**Quarter-circles**

$$A = \frac{\pi r^2}{4} \quad I_x = I_y = r^4 \left( \frac{\pi}{16} - \frac{4}{9\pi} \right) \quad I_{xy} = r^4 \left( \frac{4}{9\pi} - \frac{1}{8} \right)$$

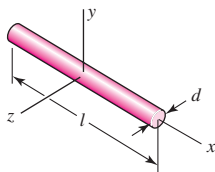
(continued)

**Table A-18**

Geometric Properties  
(Continued)

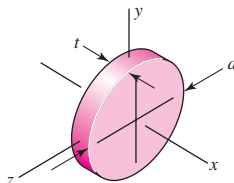
**Part 2 Properties of Solids ( $\rho =$  Density, Weight per Unit Volume)**

Rods



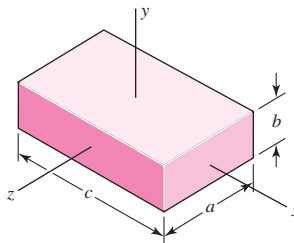
$$m = \frac{\pi d^2 l \rho}{4g} \quad I_y = I_z = \frac{ml^2}{12}$$

Round disks



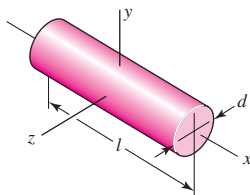
$$m = \frac{\pi d^2 t \rho}{4g} \quad I_x = \frac{md^2}{8} \quad I_y = I_z = \frac{md^2}{16}$$

Rectangular prisms



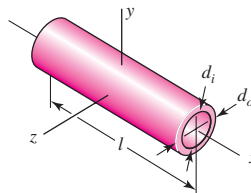
$$m = \frac{abc\rho}{g} \quad I_x = \frac{m}{12}(a^2 + b^2) \quad I_y = \frac{m}{12}(a^2 + c^2) \quad I_z = \frac{m}{12}(b^2 + c^2)$$

Cylinders



$$m = \frac{\pi d^2 l \rho}{4g} \quad I_x = \frac{md^2}{8} \quad I_y = I_z = \frac{m}{48}(3d^2 + 4l^2)$$

Hollow cylinders



$$m = \frac{\pi (d_o^2 - d_i^2) l \rho}{4g} \quad I_x = \frac{m}{8} (d_o^2 + d_i^2) \quad I_y = I_z = \frac{m}{48} (3d_o^2 + 3d_i^2 + 4l^2)$$