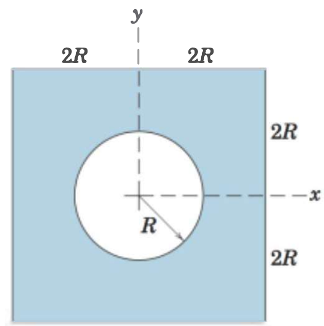
PROBLEMS

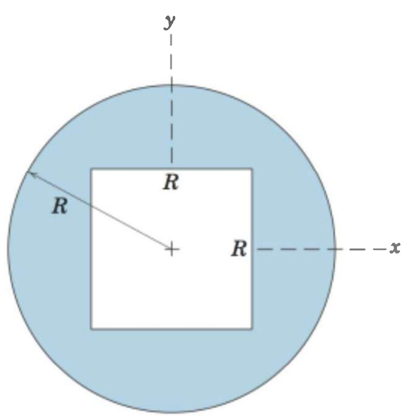
Introductory Problems

A/35 Determine the moment of inertia about the x-axis of the square area without and with the central circular hole.



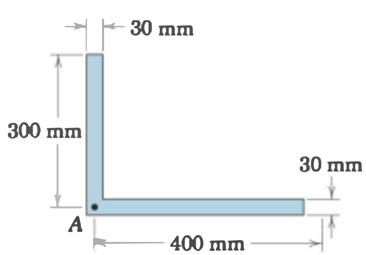
Problem A/35

A/36 Determine the polar moment of inertia of the circular area without and with the central square hole.



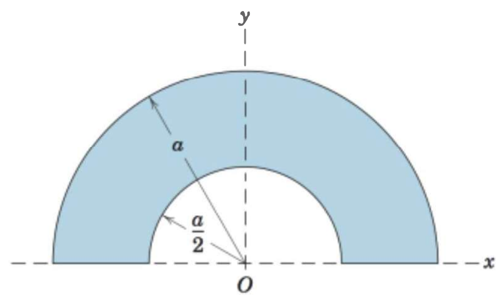
Problem A/36

A/37 Calculate the polar radius of gyration of the area of the angle section about point A. Note that the width of the legs is small compared with the length of each leg.



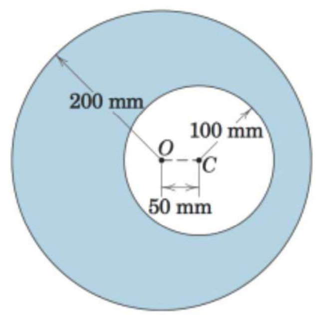
Problem A/37

A/38 By the method of this article, determine the rectangular and polar radii of gyration of the shaded area, repeated here from Prob. A/33, about the axes shown.



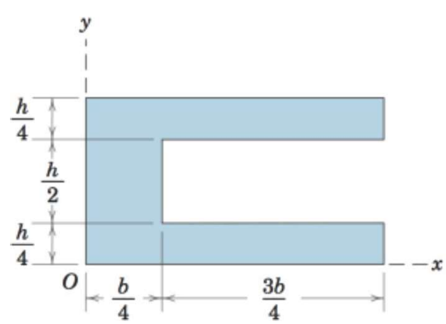
Problem A/38

A/39 Calculate the polar radius of gyration of the shaded area about the center O of the larger circle.



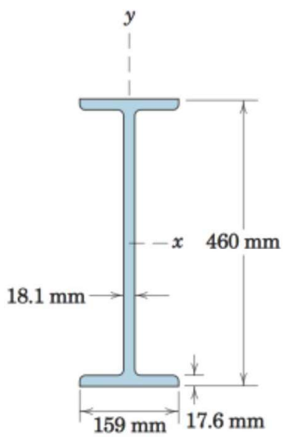
Problem A/39

A/40 Determine the percent reductions in both area and area moment of inertia about the y-axis caused by removal of the rectangular cutout from the rectangular plate of base b and height h.



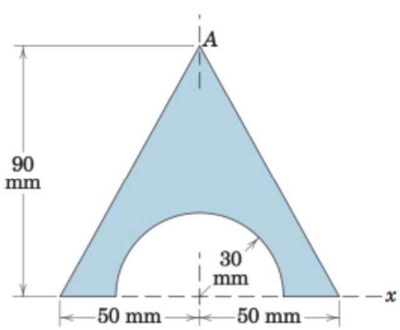
Problem A/40

A/41 The cross-sectional area of an I-beam has the dimensions shown. Obtain a close approximation to the handbook value of $I_x = 385(10^6)$ mm^4 by treating the section as being composed of three rectangles.



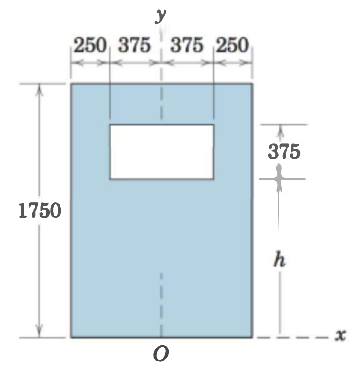
Problem A/41

A/42 Calculate the moment of inertia of the shaded area about the x-axis.



Problem A/42

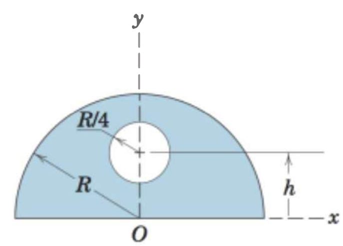
A/43 The variable h designates the arbitrary vertical location of the bottom of the rectangular cutout within the rectangular area. Determine the area moment of inertia about the x-axis for (a) $h = 1000$ mm and (b) $h = 1500$ mm.



Dimensions in millimeters

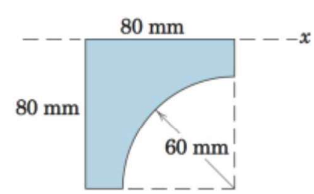
Problem A/43

A/44 The variable h designates the arbitrary vertical location of the center of the circular cutout within the semicircular area. Determine the area moment of inertia about the x-axis for (a) $h = 0$ and (b) $h = R/2$.



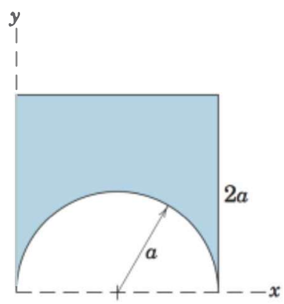
Problem A/44

A/45 Calculate the moment of inertia of the shaded area about the x-axis.



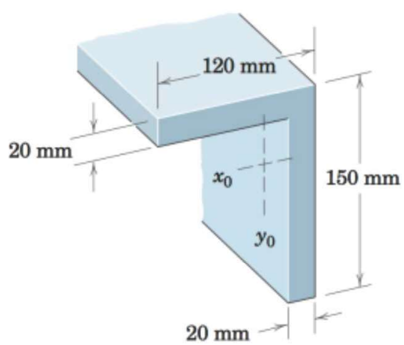
Problem A/45

A/46 Determine the moments of inertia of the shaded area about the x- and y-axes.



Problem A/46

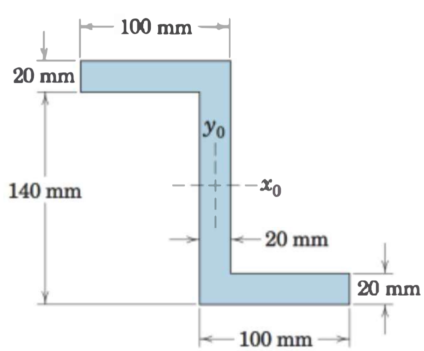
A/47 Calculate the moment of inertia of the cross section of the beam about its centroidal x_0-axis.



Problem A/47

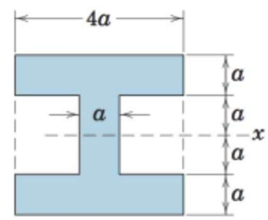
Representative Problems

A/48 Determine the moments of inertia of the Z-section about its centroidal x_0- and y_0-axes.



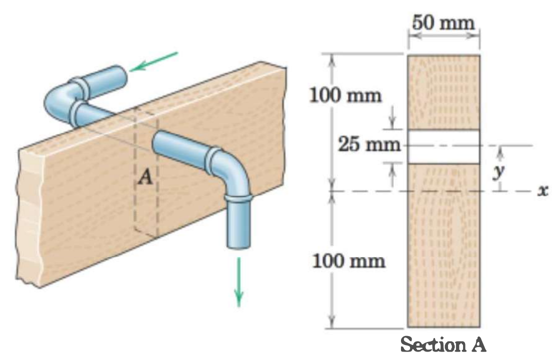
Problem A/48

A/49 Determine the moment of inertia of the shaded area about the x-axis in two different ways.



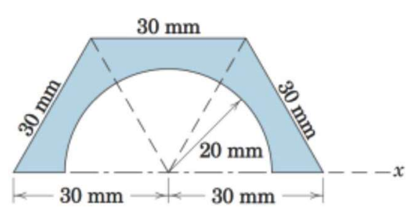
Problem A/49

A/50 A floor joist which measures a full 50 mm by 200 mm has a 25-mm hole drilled through it for a water-pipe installation. Determine the percent reduction n in the moment of inertia of the cross-sectional area about the x-axis (compared with that of the undrilled joist) for hole locations in the range $0 \le y \le 87.5$ mm. Evaluate your expression for $y = 50$ mm.



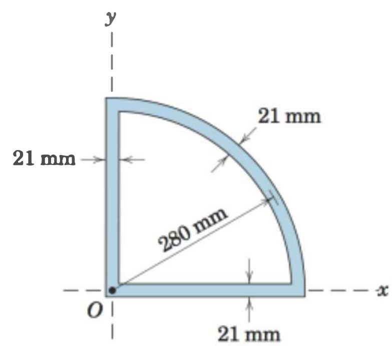
Problem A/50

A/51 Calculate the moment of inertia of the shaded area about the x-axis.



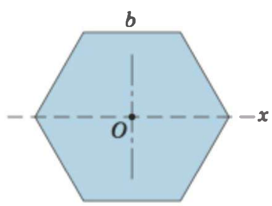
Problem A/51

A/52 Calculate the polar radius of gyration about point O of the area shown. Note that the widths of the elements are small compared with their lengths.



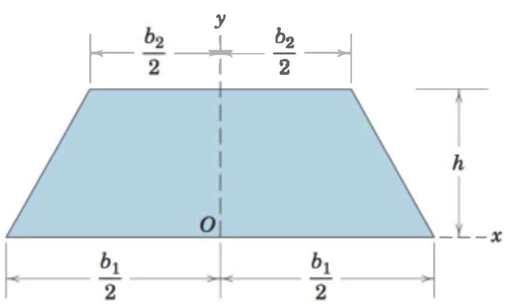
Problem A/52

A/53 Develop a formula for the moment of inertia of the regular hexagonal area of side b about its central x-axis.



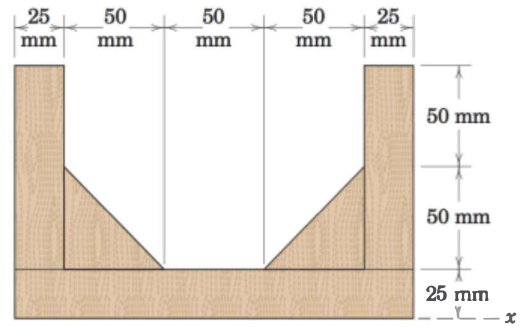
Problem A/53

A/54 By the method of this article, determine the moments of inertia about the x- and y-axes of the trapezoidal area.



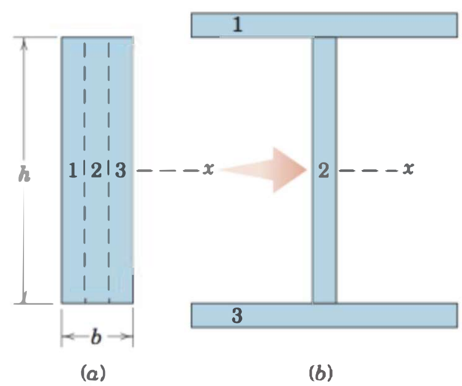
Problem A/54

A/55 Determine the moment of inertia of the cross-sectional area of the reinforced channel about the x-axis.



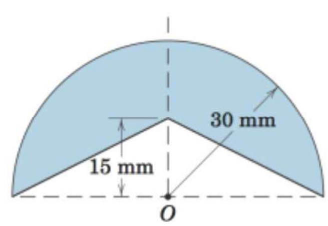
Problem A/55

A/56 The rectangular area shown in part *a* of the figure is split into three equal areas which are then arranged as shown in part *b* of the figure. Determine an expression for the moment of inertia of the area in part *b* about the centroidal x-axis. What percent increase n over the moment of inertia for area *a* does this represent if $h = 200$ mm and $b = 60$ mm?



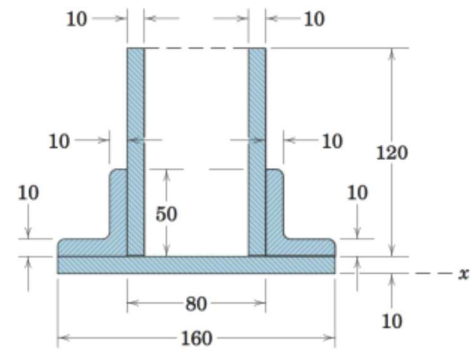
Problem A/56

A/57 Calculate the polar moment of inertia of the shaded area about point O.



Problem A/57

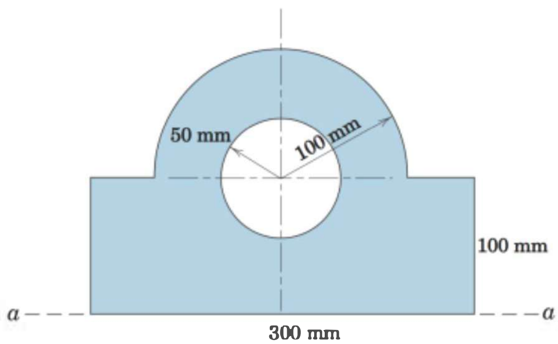
A/58 Calculate the area moment of inertia about the x-axis for the built-up structural section shown.



Dimensions in millimeters

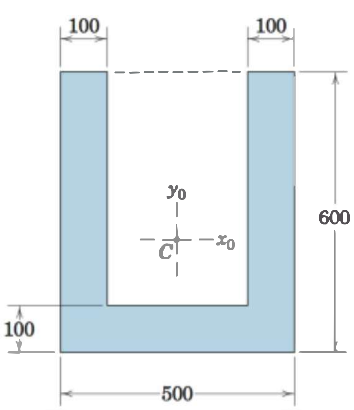
Problem A/58

A/59 The cross section of a bearing block is shown in the figure by the shaded area. Calculate the moment of inertia of the section about its base a-a.



Problem A/59

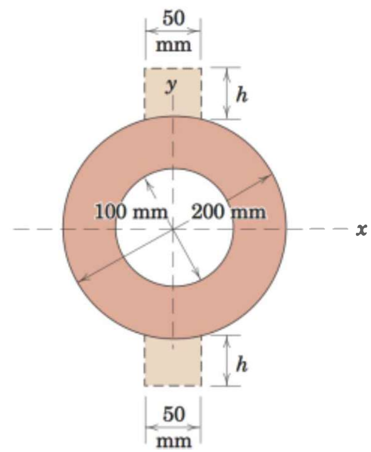
A/60 Calculate the polar radius of gyration of the shaded area about its centroid C.



Dimensions in millimeters

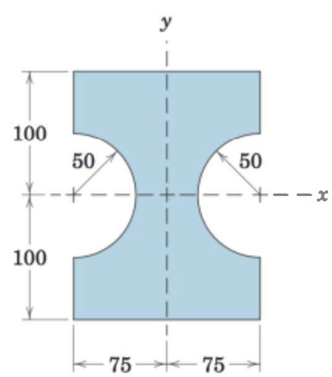
Problem A/60

A/61 A hollow mast of circular section as shown is to be stiffened by bonding two strips of the same material and of rectangular section to the mast throughout its length. Determine the proper dimension h of each near-rectangle which will exactly double the stiffness of the mast to bending in the y-z plane. (Stiffness in the y-z plane is proportional to the area moment of inertia about the x-axis.) Take the inner boundary of each strip to be a straight line.



Problem A/61

A/62 Calculate the moments of inertia of the shaded area about the x- and y-axes.



Dimensions in millimeters

Problem A/62