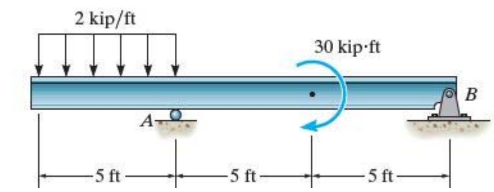
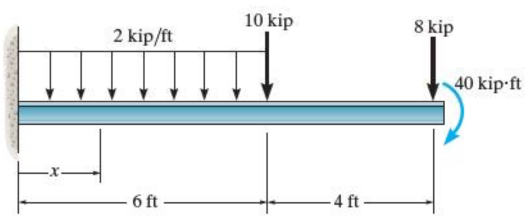
6–19. Draw the shear and moment diagrams for the beam.



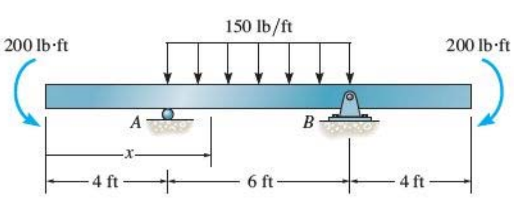
Prob. 6–19

***6–20.** Draw the shear and moment diagrams for the beam, and determine the shear and moment throughout the beam as functions of *x*.



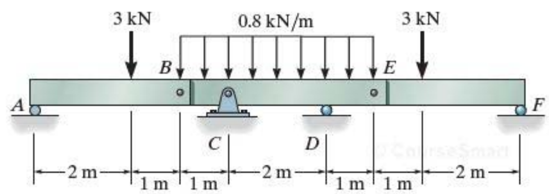
Prob. 6–20

6–21. Draw the shear and moment diagrams for the beam and determine the shear and moment in the beam as functions of x, where 4 ft $< x <$ 10 ft.



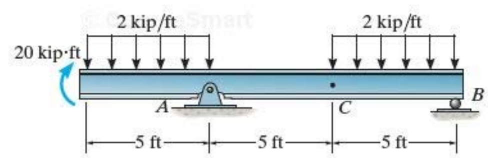
Prob. 6–21

6–22. Draw the shear and moment diagrams for the compound beam. The three segments are connected by pins at *B* and *E*.



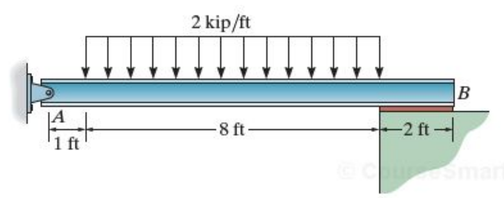
Prob. 6–22

6–23. Draw the shear and moment diagrams for the beam.



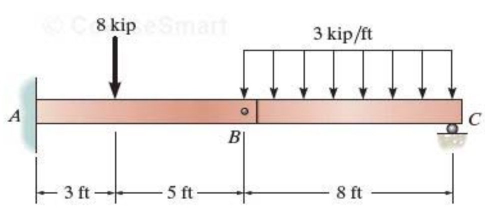
Prob. 6–23

***6–24.** The beam is bolted or pinned at *A* and rests on a bearing pad at *B* that exerts a uniform distributed loading on the beam over its 2-ft length. Draw the shear and moment diagrams for the beam if it supports a uniform loading of 2 kip/ft.



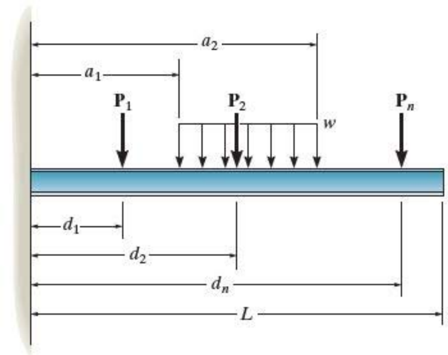
Prob. 6–24

6–25. Draw the shear and moment diagrams for the beam. The two segments are joined together at *B*.



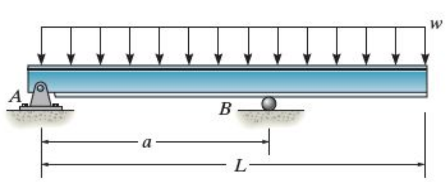
Prob. 6–25

■**6–26.** Consider the general problem of a cantilevered beam subjected to n concentrated loads and a constant distributed loading w. Write a computer program that can be used to determine the internal shear and moment at any specified location x along the beam, and plot the shear and moment diagrams for the beam. Show an application of the program using the values $P_1 = 4$ kN, $d_1 = 2$ m, $w = 800$ N/m, $a_1 = 2$ m, $a_2 = 4$ m, $L = 4$ m.



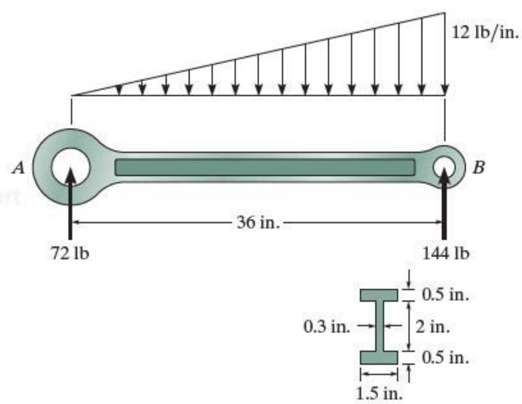
Prob. 6–26

6–27. Determine the placement distance a of the roller support so that the largest absolute value of the moment is a minimum. Draw the shear and moment diagrams for this condition.



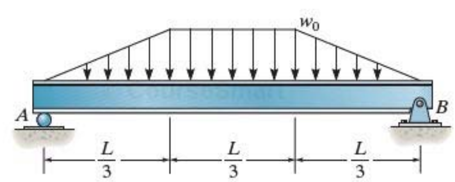
Prob. 6–27

***6–28.** Draw the shear and moment diagrams for the rod. Only vertical reactions occur at its ends A and B.



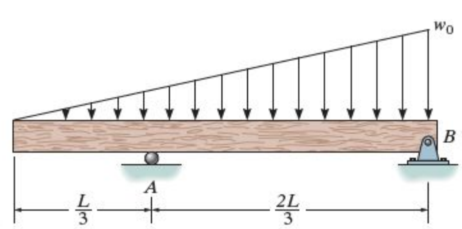
Prob. 6–28

6–29. Draw the shear and moment diagrams for the beam.



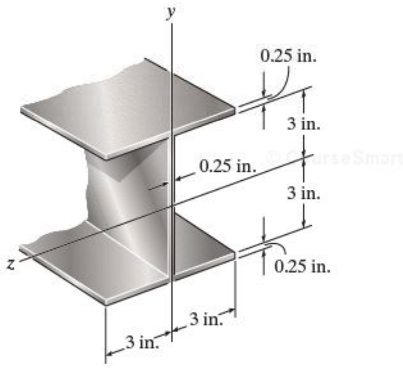
Prob. 6–29

6–30. Draw the shear and moment diagrams for the beam.



Prob. 6–30

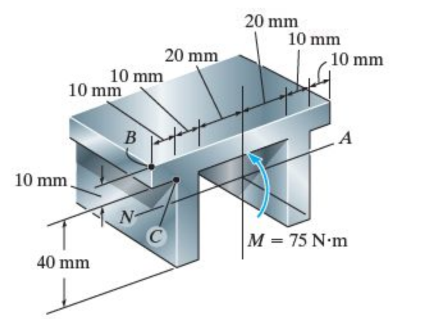
6–49. A beam has the cross section shown. If it is made of steel that has an allowable stress of $\sigma_{allow} = 24$ ksi, determine the largest internal moment the beam can resist if the moment is applied (a) about the z axis, (b) about the y axis.



Prob. 6–49

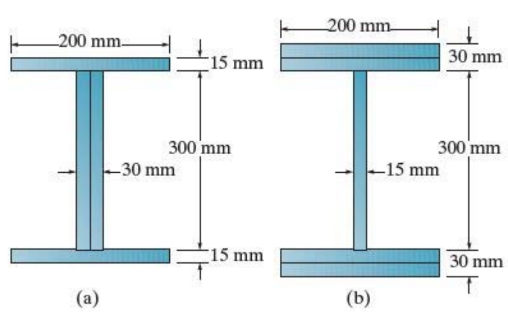
6–51. The aluminum machine part is subjected to a moment of $M = 75$ N·m. Determine the bending stress created at points B and C on the cross section. Sketch the results on a volume element located at each of these points.

***6–52.** The aluminum machine part is subjected to a moment of $M = 75$ N·m. Determine the maximum tensile and compressive bending stresses in the part.



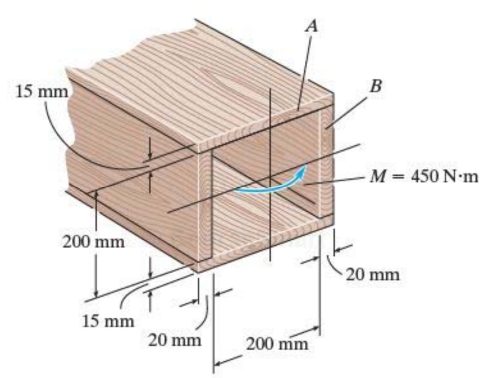
Probs. 6–51/52

6–50. Two considerations have been proposed for the design of a beam. Determine which one will support a moment of $M = 150$ kN·m with the least amount of bending stress. What is that stress? By what percentage is it more effective?



Prob. 6–50

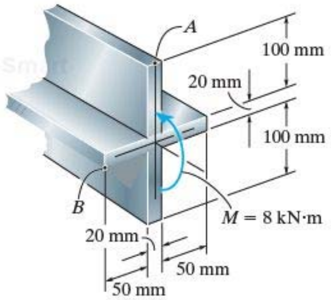
6–53. A beam is constructed from four pieces of wood, glued together as shown. If the moment acting on the cross section is $M = 450$ N·m, determine the resultant force the bending stress produces on the top board A and on the side board B.



Prob. 6–53

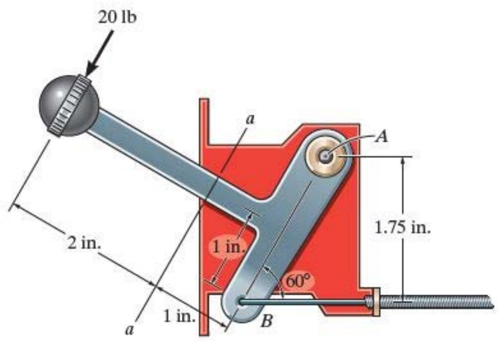
6–54. The aluminum strut has a cross-sectional area in the form of a cross. If it is subjected to the moment $M = 8\ \text{kN}\cdot\text{m}$, determine the bending stress acting at points A and B, and show the results acting on volume elements located at these points.

6–55. The aluminum strut has a cross-sectional area in the form of a cross. If it is subjected to the moment $M = 8\ \text{kN}\cdot\text{m}$, determine the maximum bending stress in the beam, and sketch a three-dimensional view of the stress distribution acting over the entire cross-sectional area.



Probs. 6–54/55

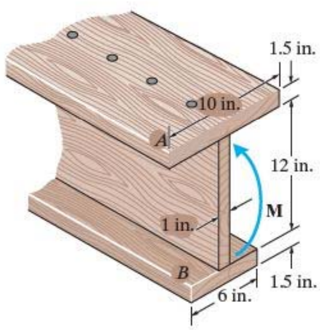
6–58. The control level is used on a riding lawn mower. Determine the maximum bending stress in the lever at section a–a if a force of 20 lb is applied to the handle. The lever is supported by a pin at A and a wire at B. Section a–a is square, 0.25 in. by 0.25 in.



Prob. 6–58

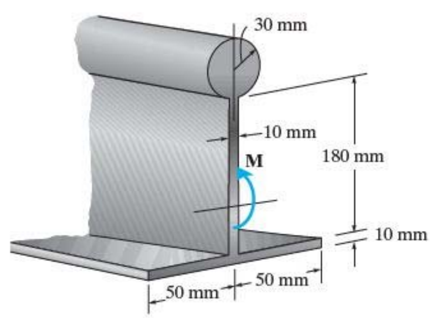
***6–56.** The beam is made from three boards nailed together as shown. If the moment acting on the cross section is $M = 1\ \text{kip}\cdot\text{ft}$, determine the maximum bending stress in the beam. Sketch a three-dimensional view of the stress distribution acting over the cross section.

6–57. Determine the resultant force the bending stresses produce on the top board A of the beam if $M = 1\ \text{kip}\cdot\text{ft}$.



Probs. 6–56/57

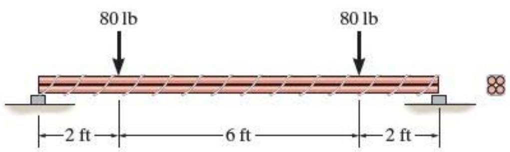
6–59. Determine the largest bending stress developed in the member if it is subjected to an internal bending moment of $M = 40\ \text{kN}\cdot\text{m}$.



Prob. 6–59

6–86. The simply supported beam is made from four $\frac{3}{4}$-in.-diameter rods, which are bundled as shown. Determine the maximum bending stress in the beam due to the loading shown.

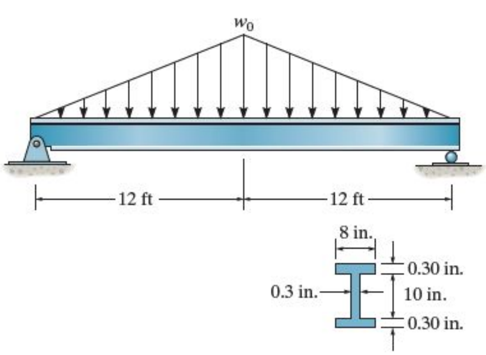
6–87. Solve Prob. 6–86 if the bundle is rotated 45° and set on the supports.



Probs. 6–86/87

***6–88.** The steel beam has the cross-sectional area shown. Determine the largest intensity of distributed load w_0 that it can support so that the maximum bending stress in the beam does not exceed $\sigma_{max} = 22$ ksi.

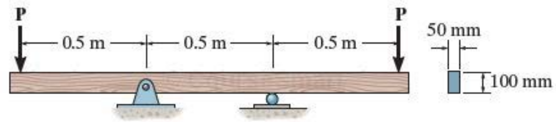
6–89. The steel beam has the cross-sectional area shown. If $w_0 = 0.5$ kip/ft, determine the maximum bending stress in the beam.



Probs. 6–88/89

6–90. The beam has a rectangular cross section as shown. Determine the largest load P that can be supported on its overhanging ends so that the bending stress in the beam does not exceed $\sigma_{max} = 10$ MPa.

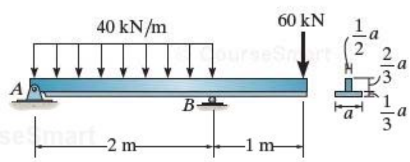
6–91. The beam has the rectangular cross section shown. If $P = 1.5$ kN, determine the maximum bending stress in the beam. Sketch the stress distribution acting over the cross section.



Probs. 6–90/91

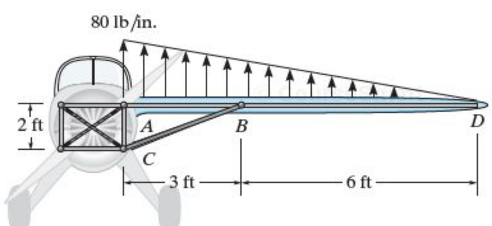
***6–92.** The beam is subjected to the loading shown. If its cross-sectional dimension $a = 180$ mm, determine the absolute maximum bending stress in the beam.

6–93. The beam is subjected to the loading shown. Determine its required cross-sectional dimension a, if the allowable bending stress for the material is $\sigma_{allow} = 150$ MPa.



Probs. 6–92/93

6–94. The wing spar ABD of a light plane is made from 2014–T6 aluminum and has a cross-sectional area of 1.27 in^2, a depth of 3 in., and a moment of inertia about its neutral axis of 2.68 in^4. Determine the absolute maximum bending stress in the spar if the anticipated loading is to be as shown. Assume A, B, and C are pins. Connection is made along the central longitudinal axis of the spar.



Prob. 6–94