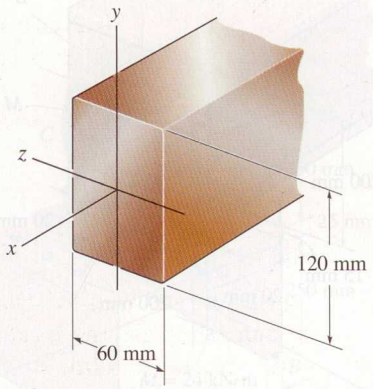
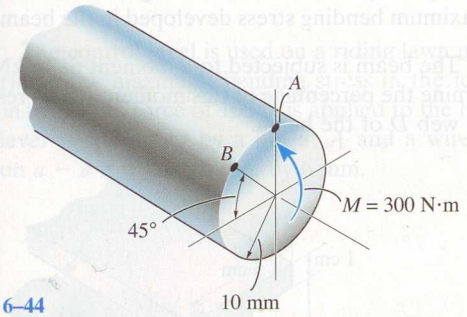
PROBLEMS

6-43. A member having the dimensions shown is to be used to resist an internal bending moment of $M = 2$ kN · m. Determine the maximum stress in the member if the moment is applied (a) about the z axis, (b) about the y axis. Sketch the stress distribution for each case.



Prob. 6–43

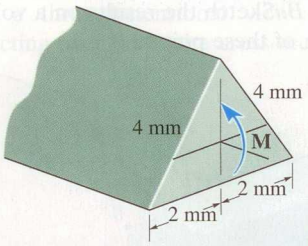
***6-44.** The steel rod having a diameter of 20 mm is subjected to an internal moment of $M = 300$ N · m. Determine the stress created at points A and B. Also, sketch a three-dimensional view of the stress distribution acting over the cross section.



Prob. 6–44

6-45. A member has the triangular cross section shown. Determine the largest internal moment M that can be applied to the cross section without exceeding allowable tensile and compressive stresses of $(\sigma_{allow})_t = 154$ MPa and $(\sigma_{allow})_c = 105$ MPa, respectively.

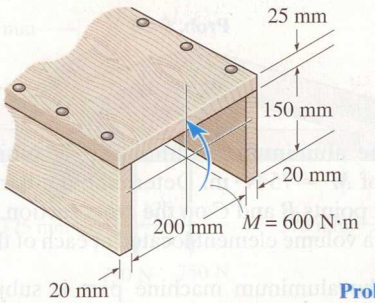
6-46. A member has the triangular cross section shown. If a moment of $M = 80$ N · mm is applied to the cross section, determine the maximum tensile and compressive bending stresses in the member. Also, sketch a three-dimensional view of the stress distribution acting over the cross section.



Probs. 6–45/46

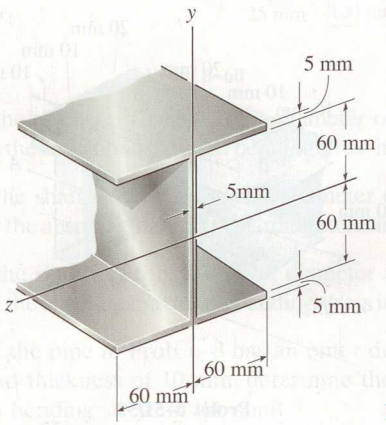
6-47. The beam is made from three boards nailed together as shown. If the moment acting on the cross section is $M = 600$ N · m, determine the maximum bending stress in the beam. Sketch a three-dimensional view of the stress distribution acting over the cross section.

***6-48.** The beam is made from three boards nailed together as shown. If the moment acting on the cross section is $M = 600$ N · m, determine the resultant force the bending stress produces on the top board.



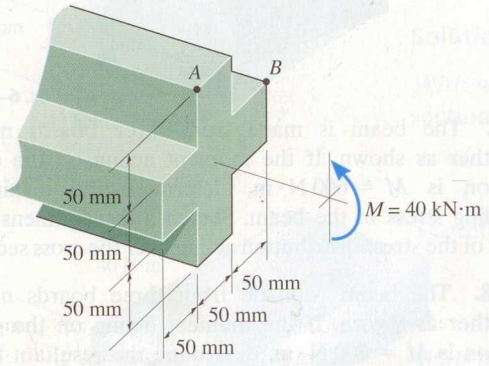
Probs. 6–47/48

6-49. A beam has the cross section shown. If it is made of steel that has an allowable stress of $\sigma_{allow} = 170$ MPa, 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

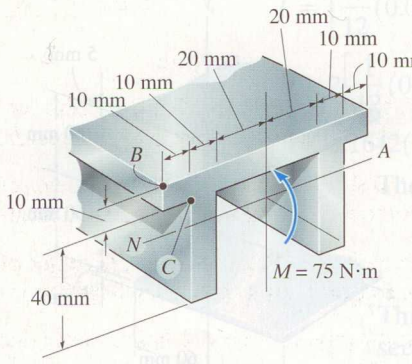
6-50. The beam is subjected to a moment of $M = 40\ \text{kN}\cdot\text{m}$. Determine the bending stress acting at points A and B. Sketch the results on a volume element acting at each of these points.



Prob. 6–50

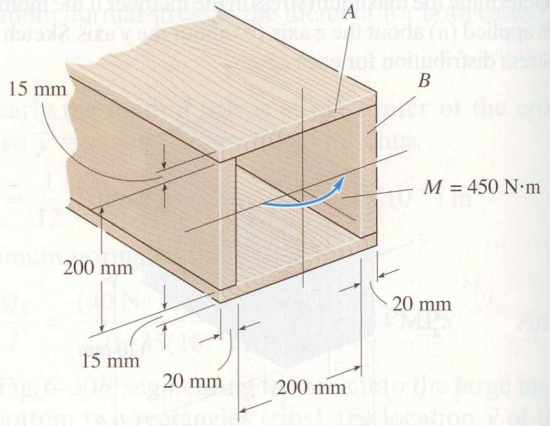
6-51. The aluminum machine part is subjected to a moment of $M = 75\ \text{N}\cdot\text{m}$. Determine the bending stress created at points B and C on the cross section. Sketch the results on a volume element located at each of these points.

***6-52.** The aluminum machine part is subjected to a moment of $M = 75\ \text{N}\cdot\text{m}$. Determine the maximum tensile and compressive bending stresses in the part.



Probs. 6–51/52

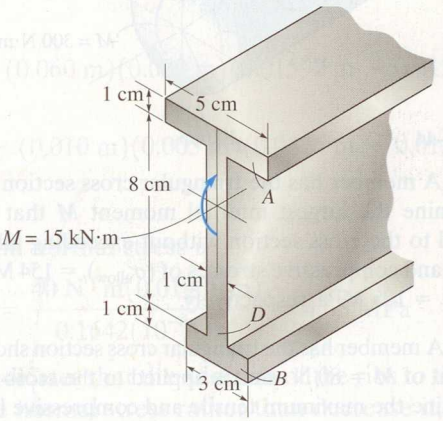
6-53. A beam is constructed from four pieces of wood, glued together as shown. If the moment acting on the cross section is $M = 450\ \text{N}\cdot\text{m}$, determine the resultant force the bending stress produces on the top board A and on the side board B.



Prob. 6–53

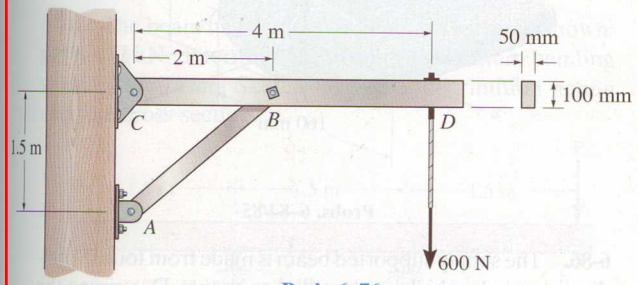
6-54. The beam is subjected to a moment of $15\ \text{kN}\cdot\text{m}$. Determine the resultant force the bending stress produces on the top flange A and bottom flange B. Also compute the maximum bending stress developed in the beam.

6-55. The beam is subjected to a moment of $15\ \text{kN}\cdot\text{m}$. Determine the percentage of this moment that is resisted by the web D of the beam.



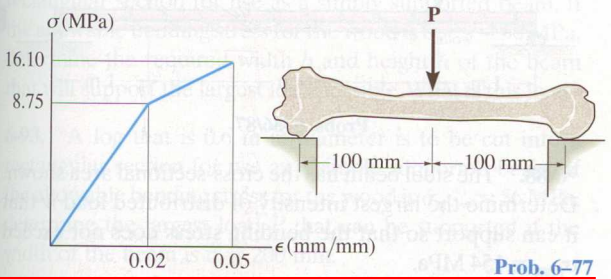
Probs. 6–54/55

*6-76. The strut CD on the utility pole supports the cable having a weight of 600 N. Determine the absolute maximum bending stress in the strut if A, B, and C are assumed to be pinned.



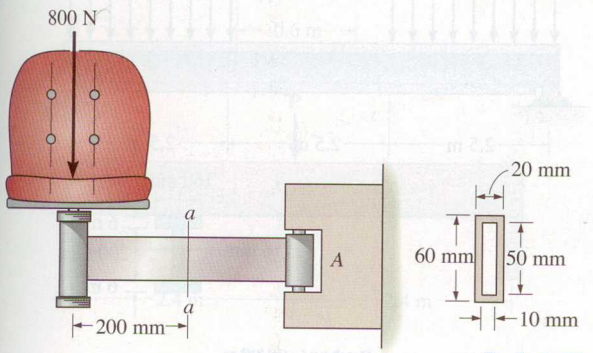
Prob. 6–76

6-77. A portion of the femur can be modeled as a tube having an inner diameter of 10 mm and an outer diameter of 32 mm. Determine the maximum elastic static force P that can be applied to its center without causing failure. Assume the bone to be roller supported at its ends. The $\sigma - \epsilon$ diagram for the bone mass is shown and is the same in tension as in compression.



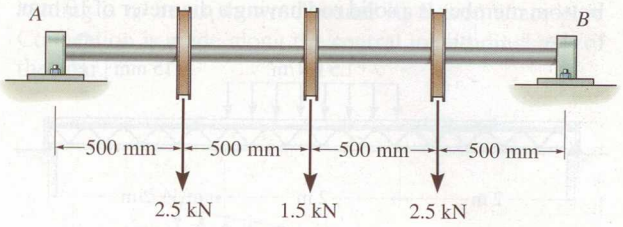
Prob. 6–77

6-78. The chair is supported by an arm that is hinged so it rotates about the vertical axis at A. If the load on the chair is 800 N and the arm is a hollow tube section having the dimensions shown, determine the maximum bending stress at section a–a.



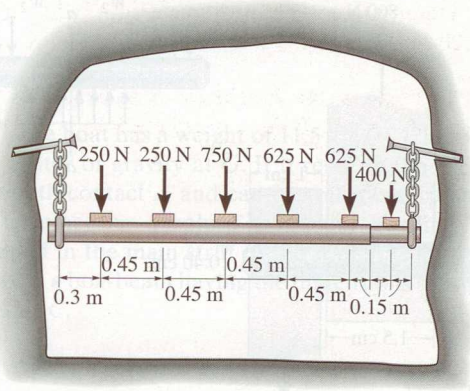
Prob. 6–78

6-79. The steel shaft has a circular cross section with a diameter of 50 mm. It is supported on smooth journal bearings A and B, which exert only vertical reactions on the shaft. Determine the absolute maximum bending stress in the shaft if it is subjected to the pulley loadings shown.



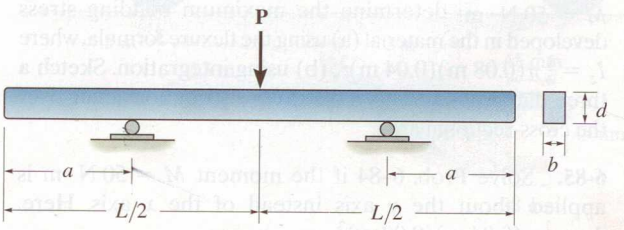
Prob. 6–79

*6-80. The end supports of a drillers' scaffold used in coal mining consist of a suspended 80-mm-outside-diameter pipe and telescoping 60-mm-outside-diameter pipe having a length of 0.45 m. Each pipe has a thickness of 5 mm. If the end reactions of the supported planks are given, determine the absolute maximum bending stress in each pipe. Neglect the size of the planks in the calculation.



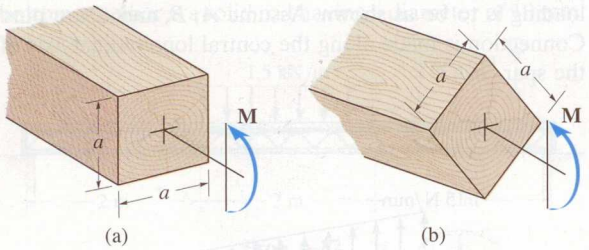
Prob. 6–80

6-81. The beam is subjected to the load **P** at its center. Determine the placement a of the supports so that the absolute maximum bending stress in the beam is as large as possible. What is this stress?



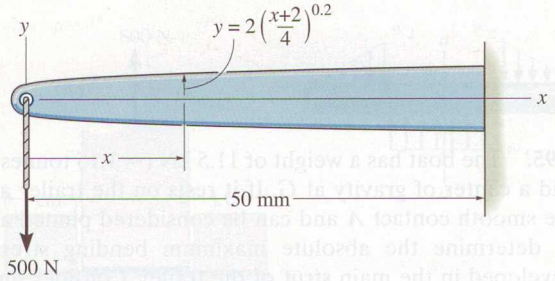
Prob. 6–81

*6-96. A wooden beam has a square cross section as shown. Determine which orientation of the beam provides the greatest strength at resisting the moment **M**. What is the difference in the resulting maximum stress in both cases?



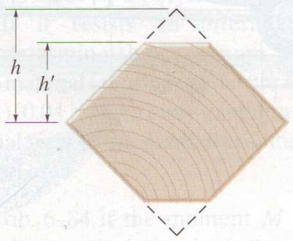
Prob. 6–96

6-97. The cantilevered beam has a thickness of 4 mm and a variable depth that can be described by the function $y = 2[(x + 2)/4]^{0.2}$, where x is in mm. Determine the maximum bending stress in the beam at its center.



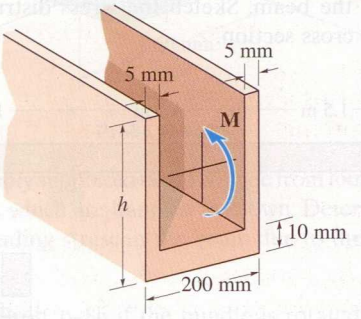
Prob. 6–97

6-98. A timber beam has a cross section which is originally square. If it is oriented as shown, determine the height h' so that it can resist the maximum moment possible. By what factor is this moment greater than that of the beam without its top or bottom flattened?



Prob. 6–98

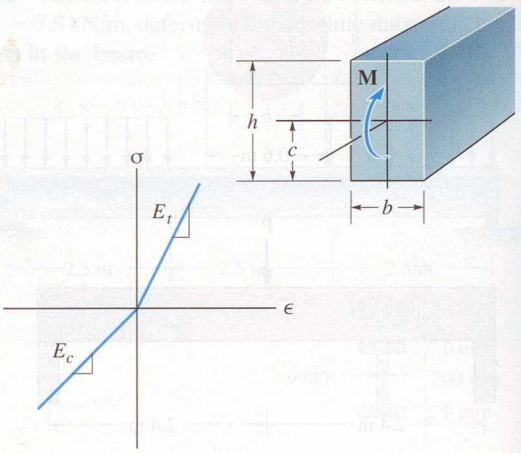
6-99. A beam is to be molded from polyethylene plastic and have the cross section shown. Determine its largest required height so that it supports the greatest moment M. What is this moment? The allowable tensile and compressive stress for the material is $(\sigma_{allow})_t = 70$ MPa and $(\sigma_{allow})_c = 210$ MPa, respectively.



Prob. 6–99

*6-100. A beam is made of a material that has a modulus of elasticity in compression different from that given for tension. Determine the location c of the neutral axis, and derive an expression for the maximum tensile stress in the beam having the dimensions shown if it is subjected to the bending moment M.

6-101. The beam has a rectangular cross section and is subjected to a bending moment M. If the material from which it is made has a different modulus of elasticity for tension and compression as shown, determine the location c of the neutral axis and the maximum compressive stress in the beam.



Probs. 6–100/101