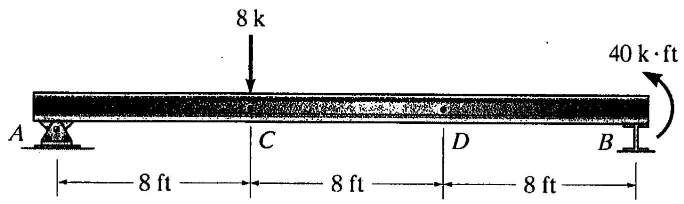
PROBLEMS

4–1. Determine the internal shear, axial load, and bending moment in the beam at points C and D. Assume the support at B is a roller. Point C is located just to the right of the 8-k load.

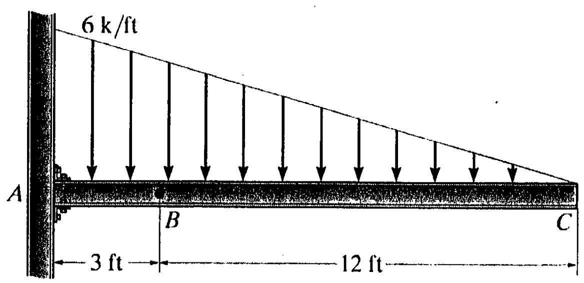
4–2. Draw the shear and moment diagrams for the beam in Prob. 4–1.



Probs. 4–1/4–2

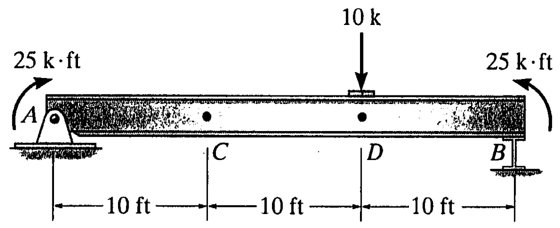
4–3. Determine the internal shear, axial load, and bending moment in the beam at point B.

***4–4.** Draw the shear and moment diagrams for the beam in Prob. 4–3.



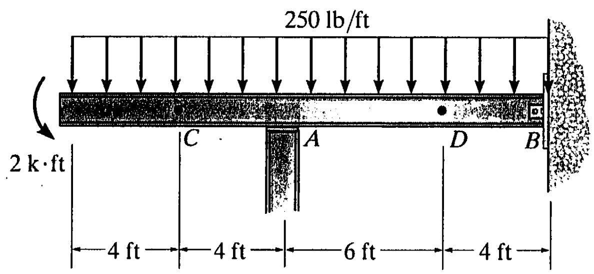
Probs. 4–3/4–4

4–5. Determine the internal shear, axial force, and bending moment in the beam at points C and D. Assume the support at B is a roller. Point D is located just to the right of the 10-k load.



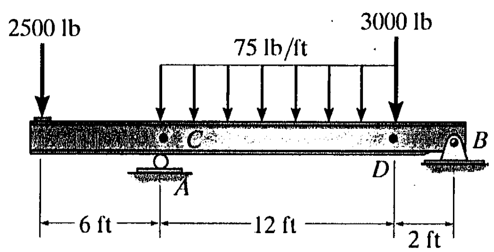
Prob. 4–5

4–6. Determine the internal shear, axial force, and bending moment in the beam at points C and D. Assume the support at A is a roller and B is a pin.



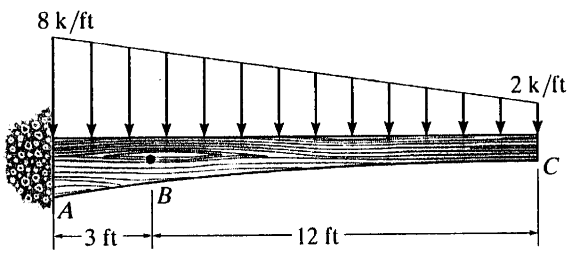
Prob. 4–6

4–7. Determine the internal shear, axial load, and bending moment at point C, which is just to the right of the roller at A, and point D, which is just to the left of the 3000-lb concentrated force.



Prob. 4–7

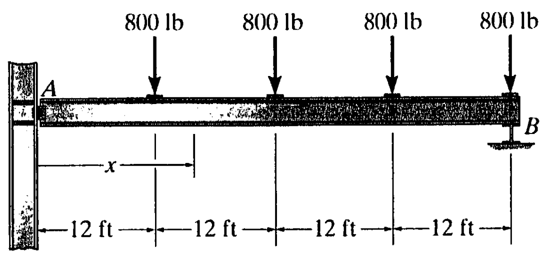
***4–8.** Determine the internal shear, axial force, and bending moment in the beam at point B.



Prob. 4–8

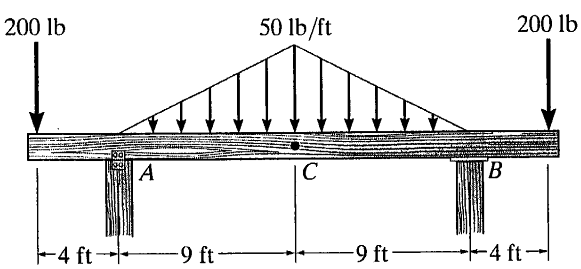
4–10. Determine the shear and moment in the floor girder as a function of x, where 12 ft $< x <$ 24 ft. Assume the support at A is a pin and B is a roller.

4–11. Draw the shear and moment diagram of the floor girder in Prob. 4–10. Assume there is a pin at A and a roller at B.



Probs. 4–10/4–11

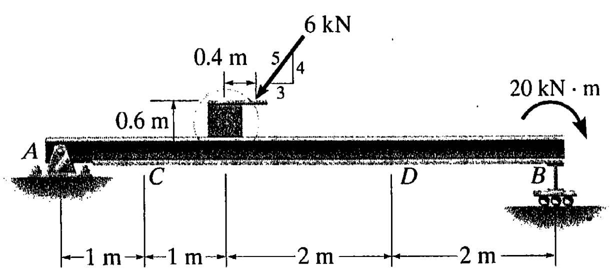
4–9. Determine the internal shear, axial force, and bending moment at point C. Assume the support at A is a pin and B is a roller.



Prob. 4–9

***4–12.** Determine the internal shear, axial load and bending moment in the beam at points C and D. Assume A is a pin and B is a roller.

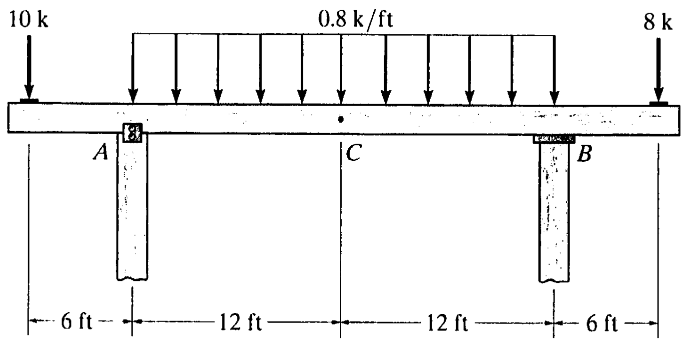
4–13. Draw the shear and moment diagrams for the beam in Prob. 4–12.



Probs. 4–12/4–13

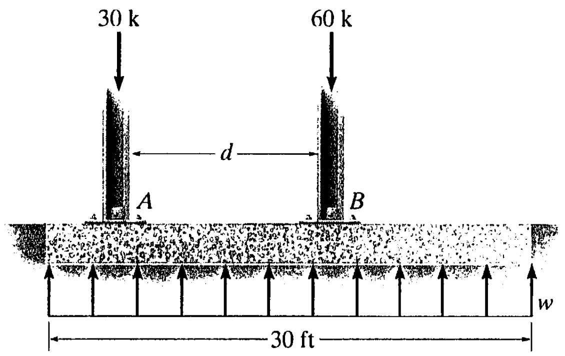
4–14. Determine the internal shear, axial load, and bending moment at point C. Assume the support at A is a pin and B is a roller.

4–15. Draw the shear and moment diagrams of the beam in Prob. 4–14.



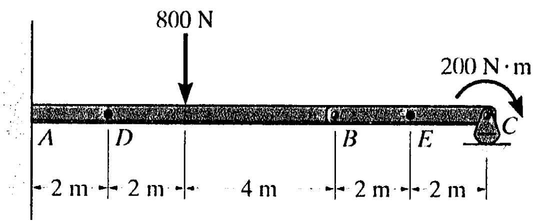
Probs. 4–14/4–15

4–17. The concrete girder supports the two column loads. If the soil pressure under the girder is assumed to be uniform, determine its intensity w and the placement d of the column at B. Draw the shear and moment diagrams for the girder.



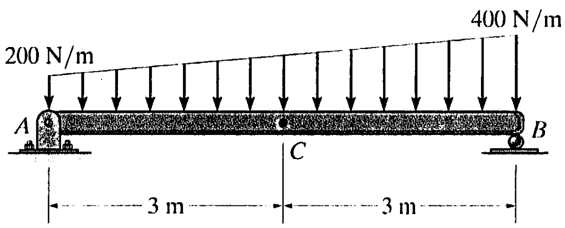
Prob. 4–17

***4–16.** Determine the internal normal force, shear force, and moment at points E and D of the compound beam.



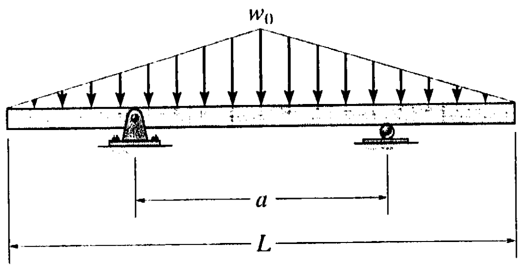
Prob. 4–16

4–18. Determine the internal normal force, shear force, and moment at point C of the beam.



Prob. 4–18

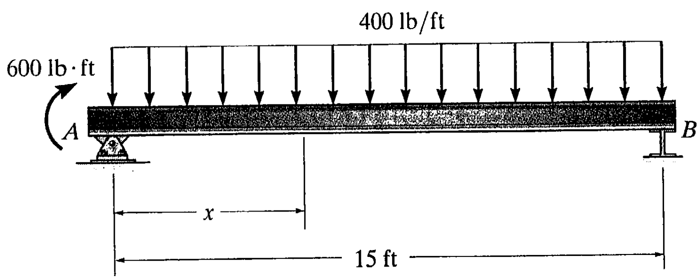
4–19. Determine the distance a between the supports in terms of the beam's length L so that the bending moment in the *symmetric* shaft is zero at the center. The intensity of the distributed load at the center is w_0.



Prob. 4–19

***4–20.** Determine the shear and moment in the beam as a function of x. Assume the support at B is a roller.

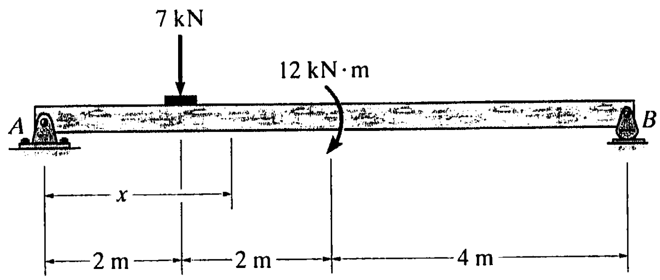
4–21. Draw the shear and moment diagrams for the beam in Prob. 4–20.



Probs. 4–20/4–21

4–22. Determine the shear and moment in the function of x, where $2 \text{ m} < x < 4 \text{ m}$.

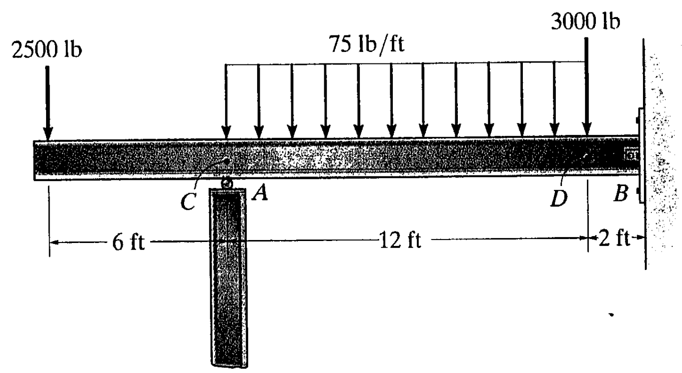
4–23. Draw the shear and moment diagrams for Prob. 4–22.



Probs. 4–22/4–23

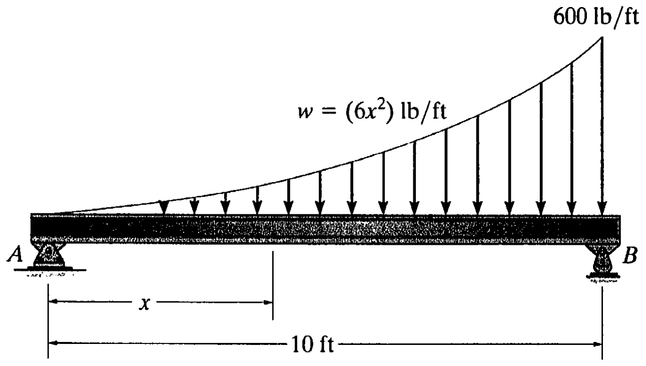
***4–24.** Determine the internal shear, axial load, and bending moment at (a) point C, which is just to the left of the roller at A, and (b) point D, which is just to the right of 3000-lb concentrated force. Assume the support at B is a pin.

4–25. Draw the shear and moment diagrams for beam in Prob. 4–24.



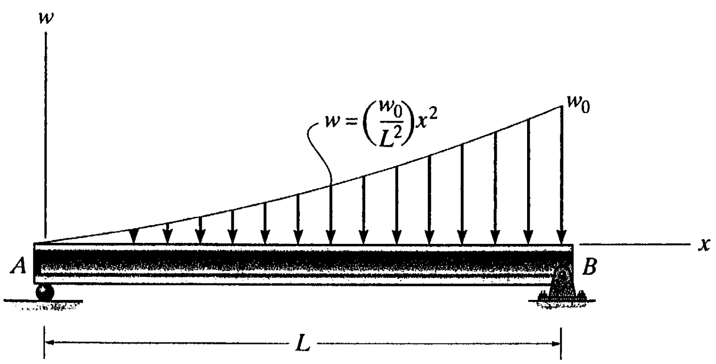
Probs. 4–24/4–25

4–26. Determine the shear and moment in the beam as a function of x.



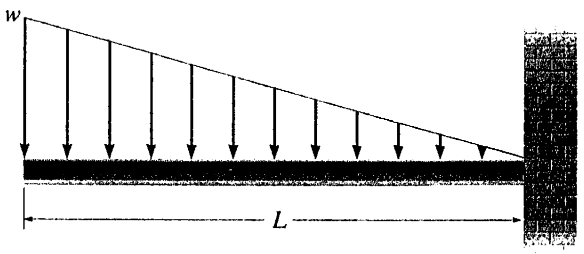
Prob. 4–26

4–27. Draw the shear and moment diagrams for the beam.



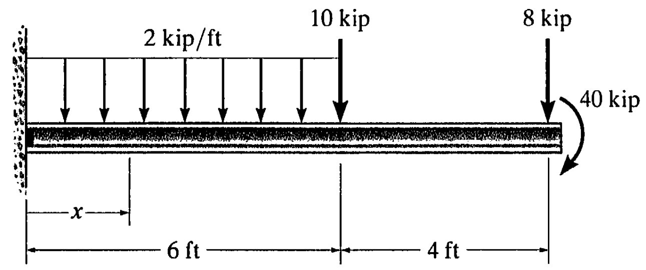
Prob. 4–27

***4–28.** Draw the shear and moment diagrams for the cantilever beam.



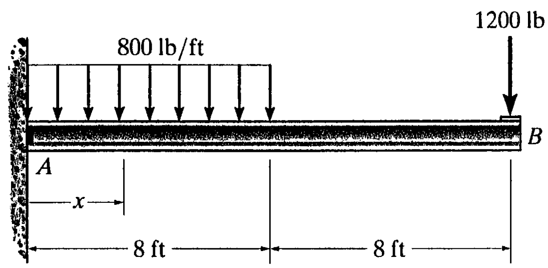
Prob. 4–28

4–29. Draw the shear and moment diagrams for the beam, and determine the shear and moment throughout the beam as functions of x.



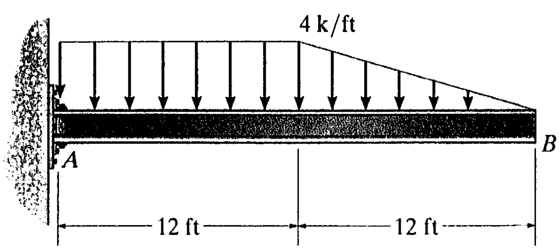
Prob. 4–29

4–30. Draw the shear and moment diagrams for the beam, and determine the shear and moment throughout the beam as functions of x.



Prob. 4–30

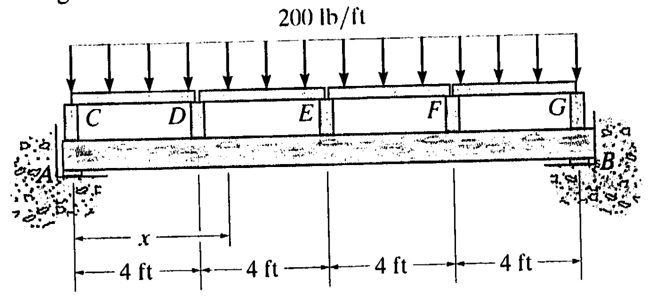
4–31. Draw the shear and moment diagrams for the tapered cantilever beam.



Prob. 4–31

*4–32. Determine the shear and moment in the floor girder as a function of x, where 4 ft < x < 8 ft. Assume the support at A is a roller and B is a pin. The floor boards are simply supported on the joists at C, D, E, F, and G.

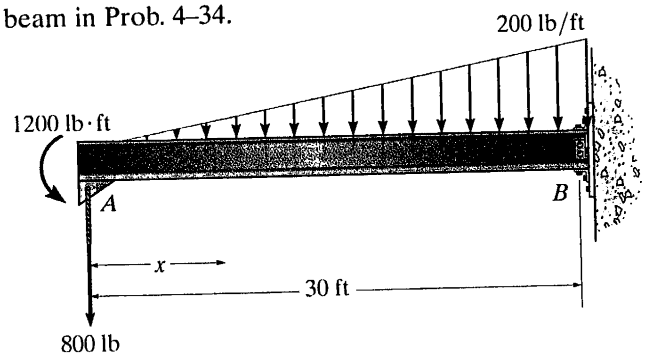
4–33. Draw the shear and moment diagrams for the floor girder in Prob. 4–32.



Probs. 4–32/4–33

4–34. Determine the shear and moment in the beam as a function of x.

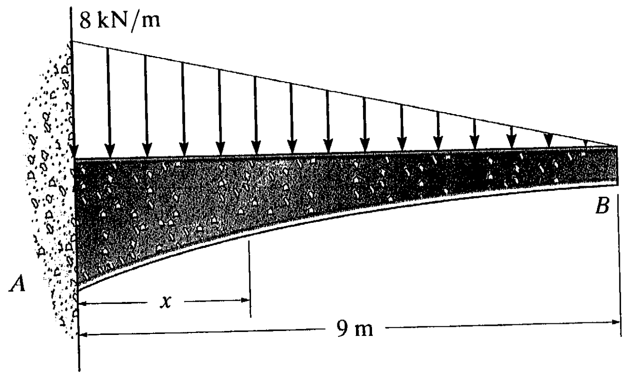
4–35. Draw the shear and moment diagrams for the beam in Prob. 4–34.



Probs. 4–34/4–35

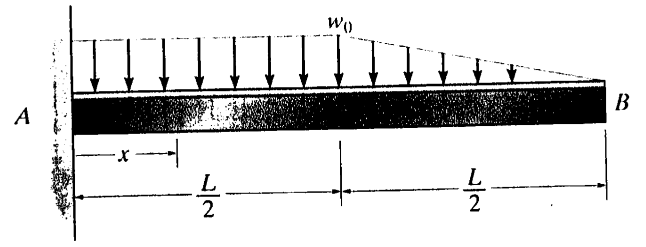
*4–36. Determine the shear and moment in the tapered beam as a function of x.

4–37. Draw the shear and moment diagrams for the beam in Prob. 4–36.



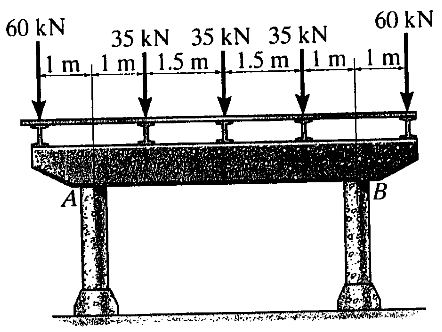
Probs. 4–36/4–37

4–38. Draw the shear and moment diagrams for the beam, and determine the shear and moment in the beam as functions of x.



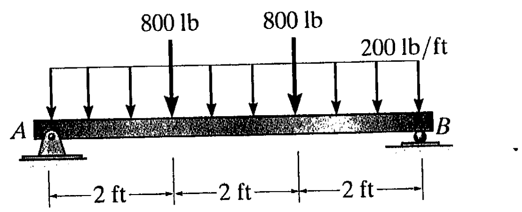
Prob. 4–38

4–39. A reinforced concrete pier is used to support the stringers for a bridge deck. Draw the shear and moment diagrams for the pier when it is subjected to the stringer loads shown. Assume the columns at A and B exert only vertical reactions on the pier.



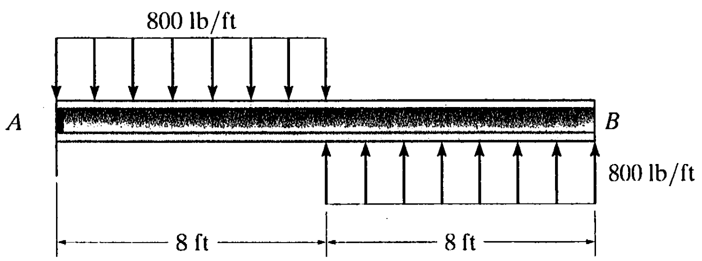
Prob. 4–39

*4–40. Draw the shear and moment diagrams for the beam. The bearings at A and B only exert vertical reactions on the beam.



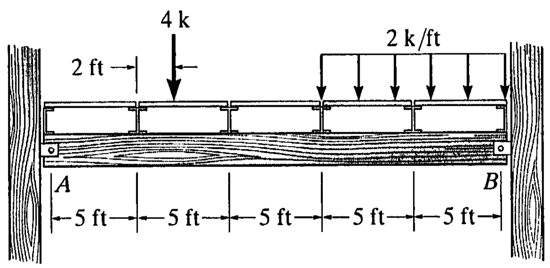
Prob. 4–40

4–41. Draw the shear and moment diagrams for the beam.



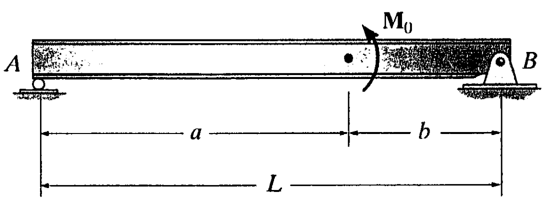
Prob. 4–41

***4–44.** The flooring system for a building consists of a girder that supports laterally running floor beams, which in turn support the longitudinal simply supported floor slabs. Draw the shear and moment diagrams for the girder. Assume the girder is simply supported.



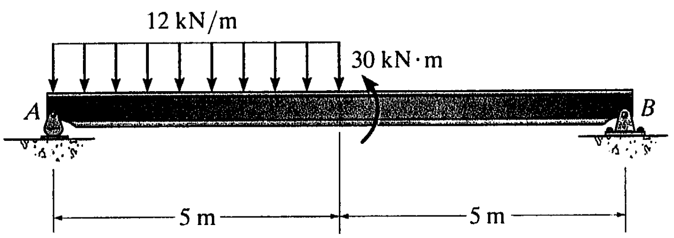
Prob. 4–44

4–42. Determine the shear and moment in the beam as a function of x and then draw the shear and moment diagrams for the beam.



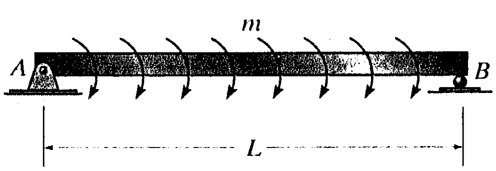
Prob. 4–42

4–45. Draw the shear and moment diagrams for the beam.



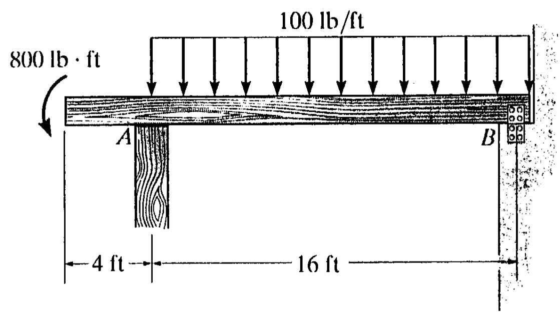
Prob. 4–45

4–43. The beam is subjected to the uniformly distributed moment m (moment/length). Draw the shear and moment diagrams for the beam.



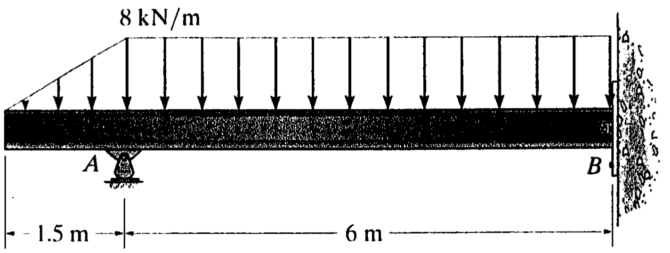
Prob. 4–43

4–46. Draw the shear and moment diagrams of the beam. Assume the support at B is a pin and A is a roller.



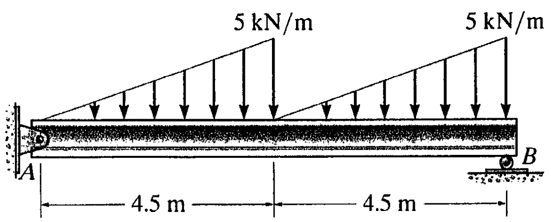
Prob. 4–46

4–47. Draw the shear and moment diagrams for the beam. Assume the support at B is a pin.



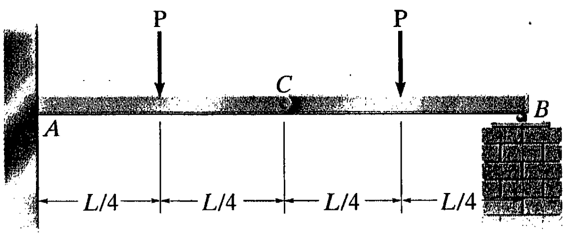
Prob. 4–47

***4–48.** Draw the shear and moment diagrams for the beam.



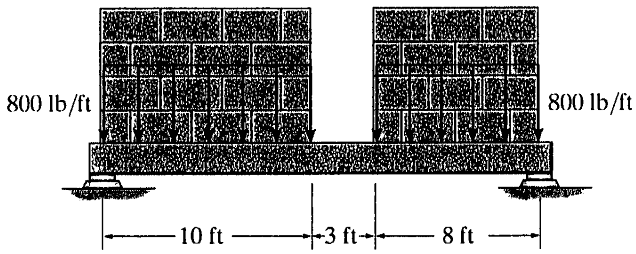
Prob. 4–48

4–49. Draw the shear and moment diagrams for the beam. There is a pin at C.



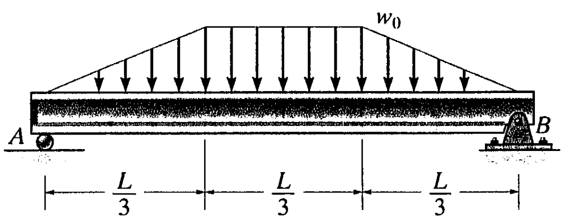
Prob. 4–49

4–50. The concrete beam supports the wall, which subjects the beam to the uniform loading shown. The beam itself has cross-sectional dimensions of 12 in. by 26 in. and is made from concrete having a specific weight of $\gamma = 150\ \text{lb/ft}^3$. Draw the shear and moment diagrams for the beam and specify the maximum and minimum moments in the beam. Neglect the weight of the steel reinforcement in the beam.



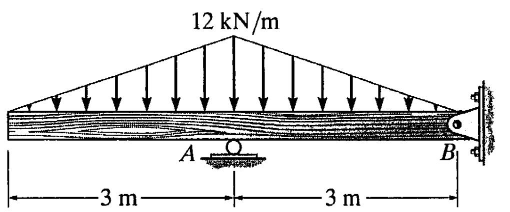
Prob. 4–50

4–51. Draw the shear and moment diagrams for the beam.



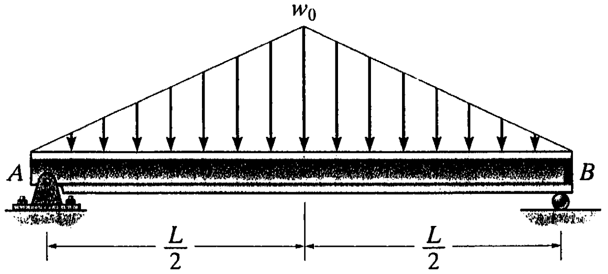
Prob. 4–51

***4–52.** Draw the shear and moment diagrams for the beam.



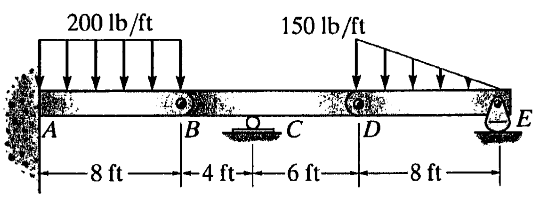
Prob. 4–52

4–53. Draw the shear and moment diagrams for the beam.



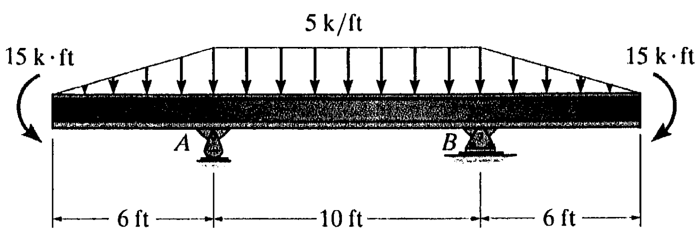
Prob. 4–53

4–54. Draw the shear and moment diagrams for the compound beam. The segments are connected by pins at B and D.



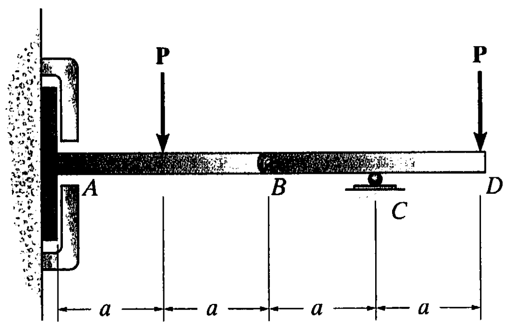
Prob. 4–54

4–55. Draw the shear and moment diagrams for the beam.



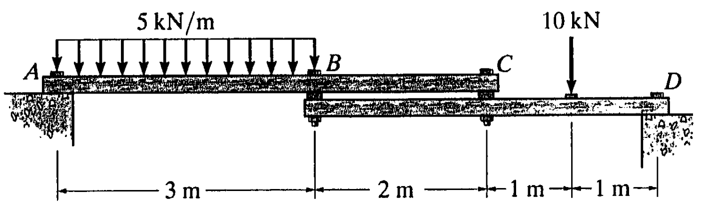
Prob. 4–55

***4–56.** Draw the shear and moment diagrams for the compound beam. It is supported by a smooth plate at A, which slides within the groove and so it cannot support a vertical force, although it can support a moment and axial load.



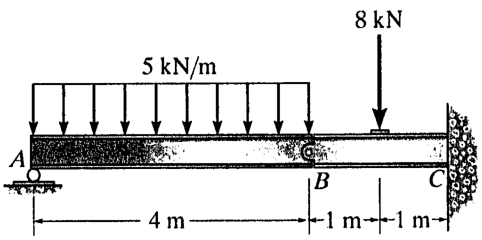
Prob. 4–56

4–57. The boards ABC and BCD are loosely bolted together as shown. If the bolts exert only vertical reactions on the boards, determine the reactions at the supports and draw the shear and moment diagrams for each board.



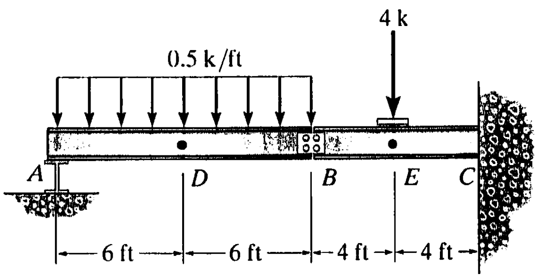
Prob. 4–57

4–58. Draw the shear and moment diagrams for the compound beam. The segments are connected by a pin at B.



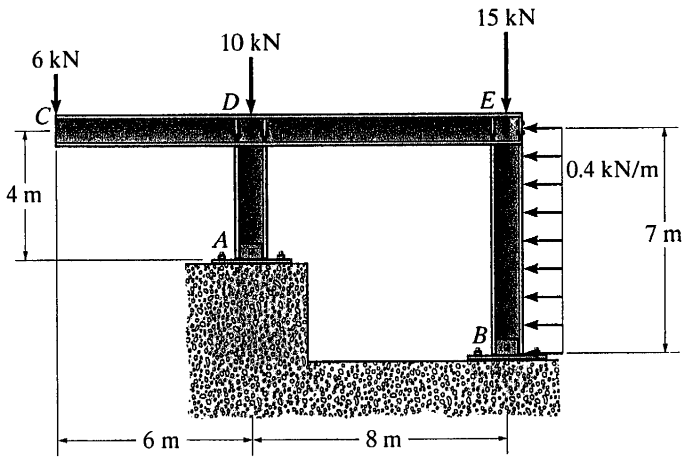
Prob. 4–58

4–59. Determine the internal shear, axial load, and bending moment in the beam at points D and E. Point E is just to the right of the 4-k load. Assume A is a roller, the splice at B is a pin, C is a fixed support.



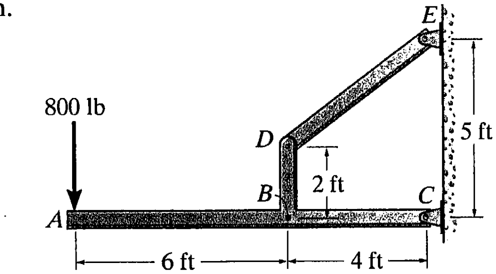
Prob. 4–59

***4–60.** Draw the shear and moment diagrams of the beam CDE. Assume the support at A is a roller and B is a pin. There are fixed-connected joints at D and E.



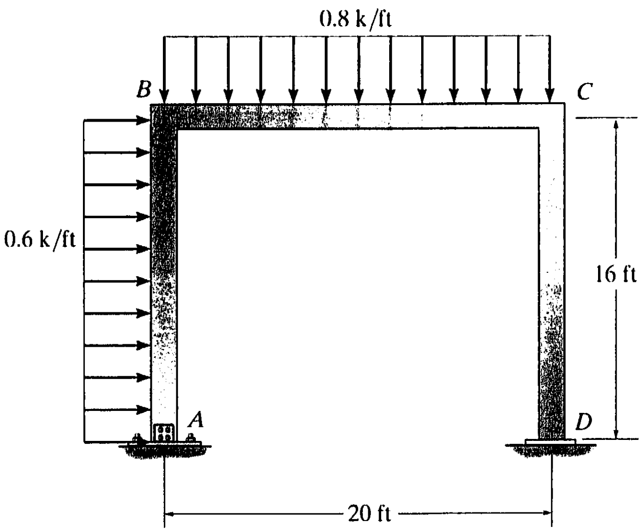
Prob. 4–60

4–61. The overhanging beam has been fabricated with projected arm BD on it. Draw the shear and moment diagrams for the beam ABC if it supports a load of 800 lb. *Hint:* The loading in the supporting strut DE must be replaced by equivalent loads at point B on the axis of the beam.



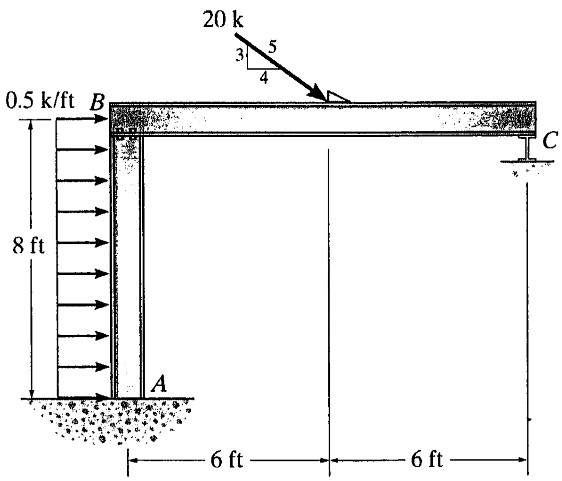
Prob. 4–61

4–62. Draw the shear and moment diagrams for each member of the frame. Assume the support at A is a pin and D is a roller.



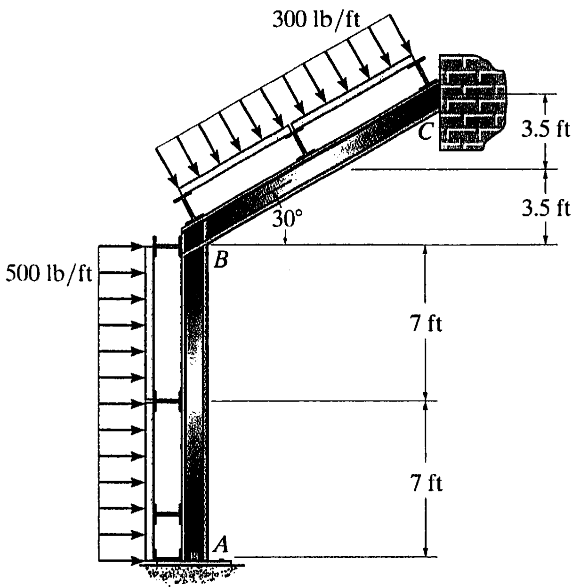
Prob. 4–62

4–63. Draw the shear and moment diagrams for each member of the frame. Assume A is fixed, the joint at B is a pin, and support C is a roller.



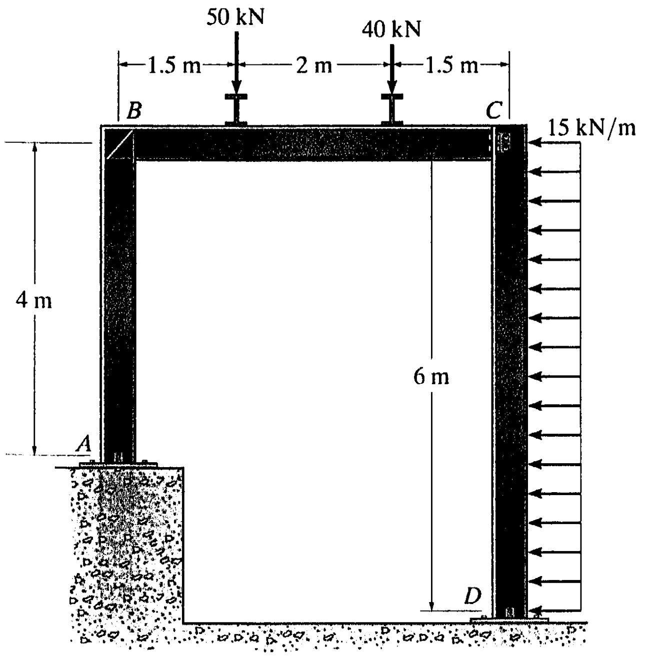
Prob. 4–63

*4–64. Draw the shear and moment diagrams for each member of the frame. Assume the joint at A is a pin and support C is a roller. The joint at B is fixed. The wind load is transferred to the members at the girts and purlins from the simply supported wall and roof segments.



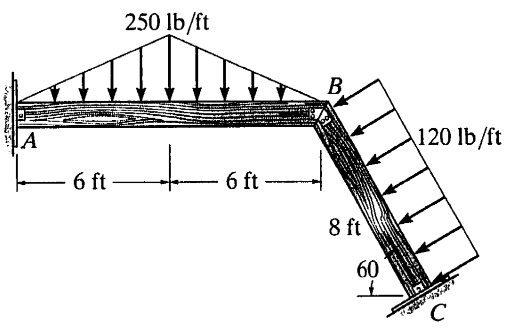
Prob. 4–64

4–65. Draw the shear and moment diagrams for each of the three members of the frame. Assume the frame is pin connected at A, C, and D and there is a fixed joint at B.



Prob. 4–65

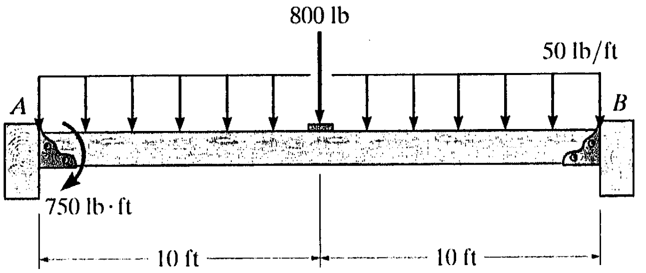
4–66. Draw the shear and moment diagrams for each member of the frame. The joints at A, B, and C are pin connected.



Prob. 4–66

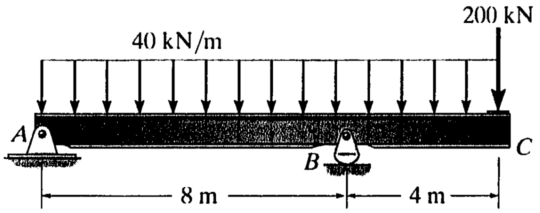
4–67. Draw the moment diagrams for the beam using the method of superposition. Consider the beam to be simply supported. Assume A is a pin and B is a roller.

*4–68. Solve Prob. 4–67 by considering the beam to be cantilevered from the support at A.



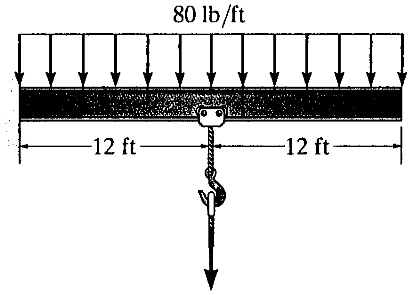
Probs. 4–67/4–68

4–69. Draw the moment diagrams for the beam using the method of superposition. Consider the beam to be cantilevered from the pin at A.



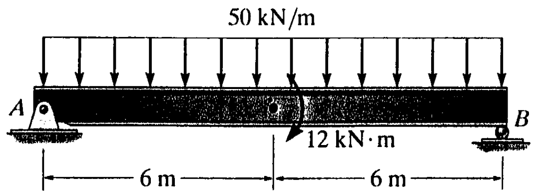
Prob. 4–69

4–70. Draw the moment diagrams for the beam using the method of superposition.



Prob. 4–70

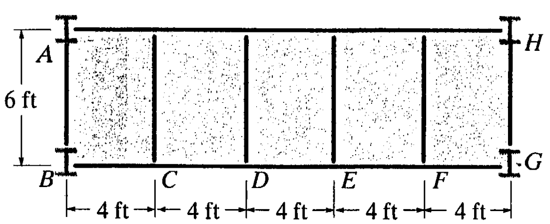
4–71. Draw the moment diagrams for the beam using the method of superposition. Consider the beam to be cantilevered from the pin at A.



Prob. 4–71

PROJECT PROBLEMS

4–1P. The balcony located on the third floor of a motel is shown in the photo. It is constructed using a 4-in.-thick concrete (plain stone) slab which rests on the four simply supported floor beams, two cantilevered side girders AB and HG, and the front and rear girders. The idealized framing plan with average dimensions is shown in the adjacent figure. According to local code, the balcony live load is 45 psf. Draw the shear and moment diagrams for the front girder BG and a side girder AB. Assume the front girder is a channel that has a weight of 25 lb/ft and the side girders are wide flange sections that have a weight of 45 lb/ft. Neglect the weight of the floor beams and front railing. For this solution treat each of the five slabs as two-way slabs.



Prob. 4–1P