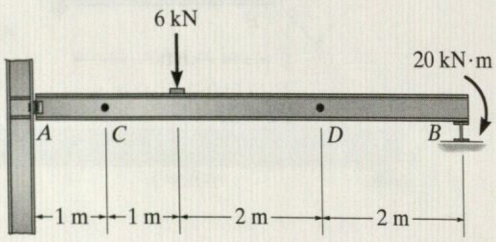
PROBLEMS

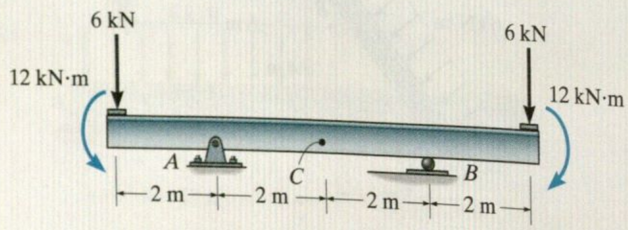
Sec. 4.1

4–1. Determine the internal normal force, shear force, and bending moment in the beam at points C and D. Assume the support at A is a pin and B is a roller.



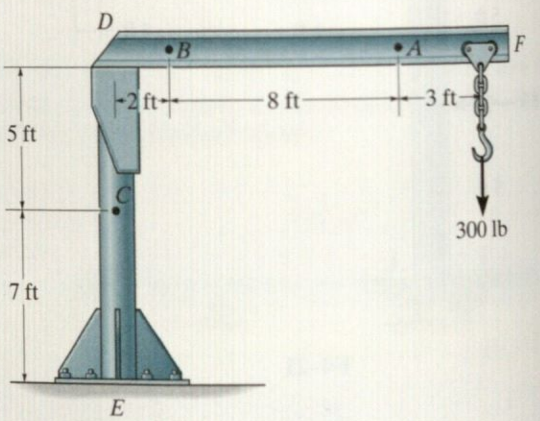
Prob. 4–1

4–2. Determine the internal normal force, shear force, and bending moment at point C.



Prob. 4–2

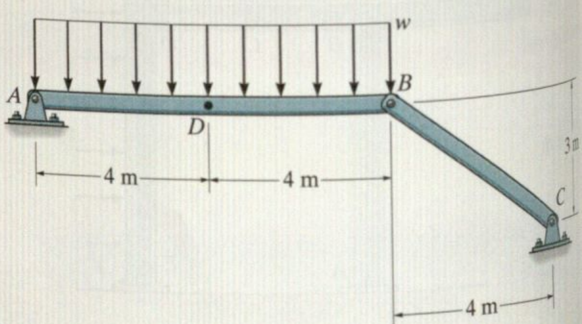
4–3. The boom DF of the jib crane and the column DE have a uniform weight of 50 lb/ft. If the hoist and load weigh 300 lb, determine the internal normal force, shear force, and bending moment in the crane at points A, B, and C.



Prob. 4–3

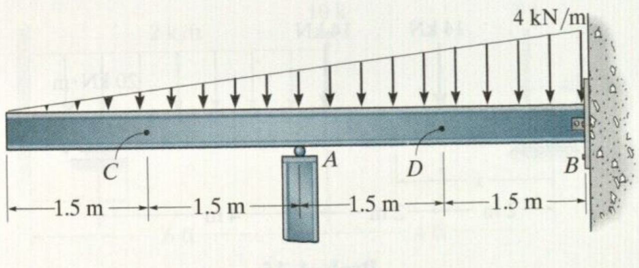
***4–4.** Determine the internal normal force, shear force, and bending moment at point D. Take $w = 150\ \text{N/m}$.

4–5. The beam AB will fail if the maximum internal moment at D reaches $800\ \text{N}\cdot\text{m}$ or the normal force in member BC becomes 1500 N. Determine the largest load w it can support.



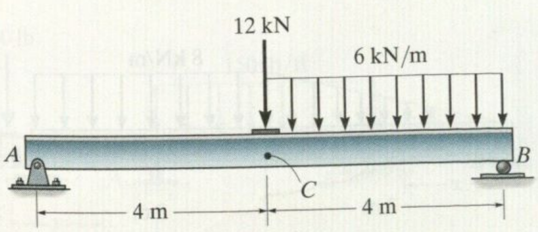
Probs. 4–4/5

4–6. Determine the internal normal force, shear 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.



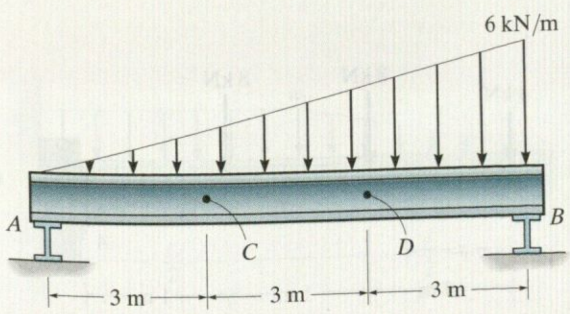
Prob. 4–6

4–7. Determine the internal normal force, shear force, and bending moment acting at point C, located just to the right of the 12-kN force.



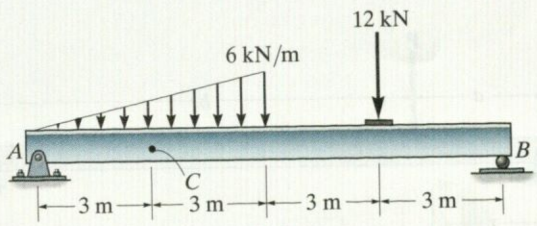
Prob. 4–7

***4–8.** Determine the internal normal force, shear 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.



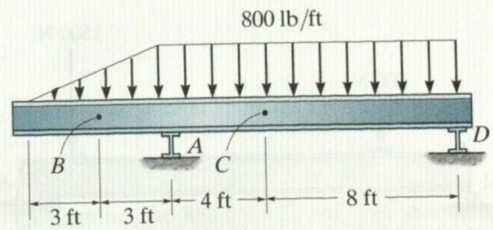
Prob. 4–8

4–9. Determine the internal normal force, shear force, and bending moment at point C.



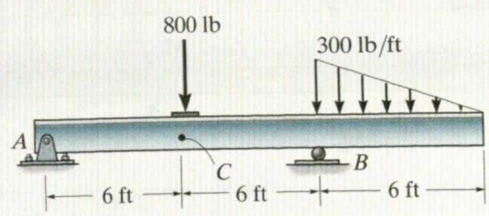
Prob. 4–9

4–10. Determine the internal normal force, shear force, and bending moment in the beam at points B and C. The support at A is a roller and D is pinned.



Prob. 4–10

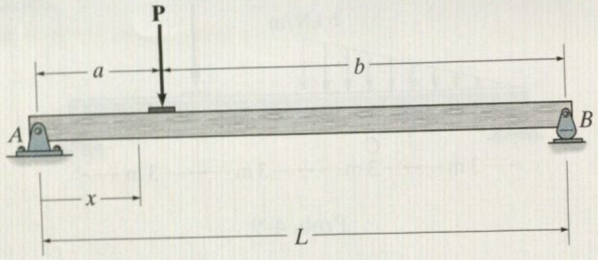
4–11. Determine the internal normal force, shear force, and bending moment in the beam at point C, located just to the left of the 800-lb force.



Prob. 4–11

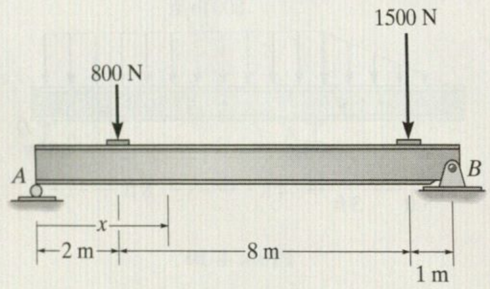
Sec. 4.2

***4–12.** Determine the shear and moment throughout the beam as a function of x.



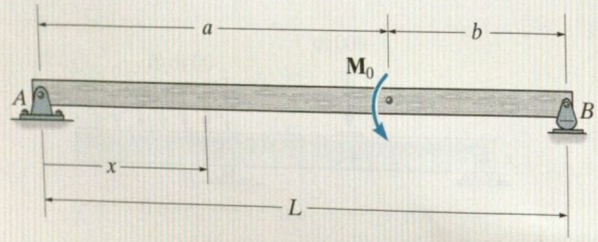
Prob. 4–12

4–13. Draw the shear and moment diagrams for the beam. Also, express the shear and moment in the beam as a function of x within the region $2 \text{ m} < x < 10 \text{ m}$.



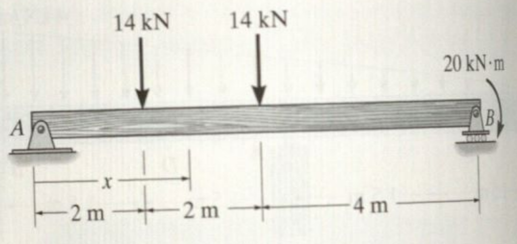
Prob. 4–13

4–14. Determine the shear and moment throughout the beam as a function of x.



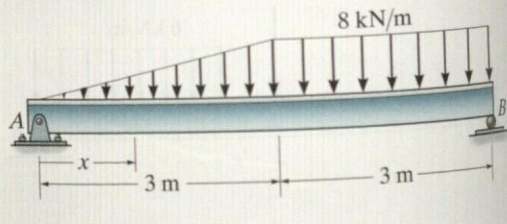
Prob. 4–14

4–15. Determine the shear and moment in the beam as a function of x, where $2 \text{ m} < x < 4 \text{ m}$.



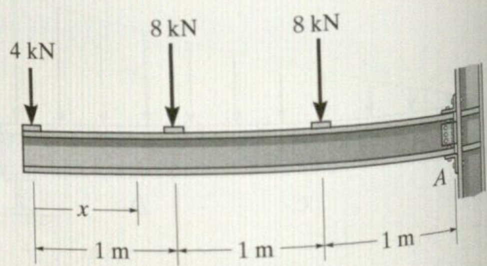
Prob. 4–15

***4–16.** Determine the shear and moment throughout the beam as a function of x.



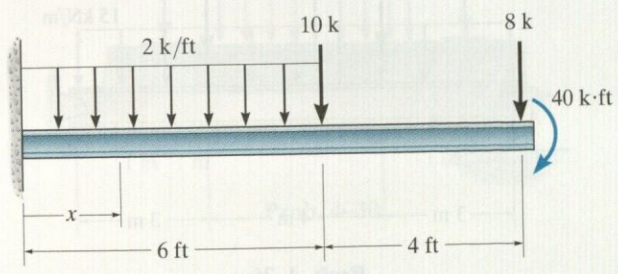
Prob. 4–16

4–17. Determine the shear and moment throughout the beam as a function of x.



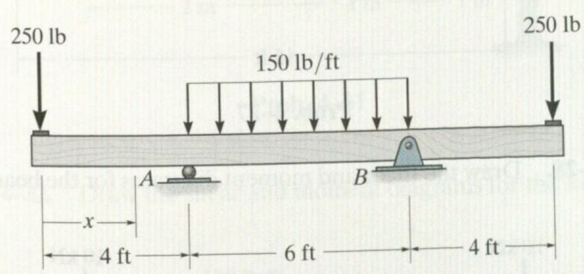
Prob. 4–17

4–18. Determine the shear and moment throughout the beam as functions of x.



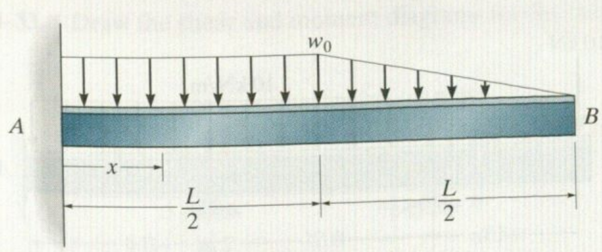
Prob. 4–18

4–19. Determine the shear and moment throughout the beam as functions of x.



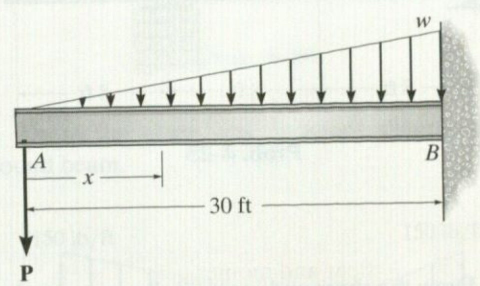
Prob. 4–19

***4–20.** Determine the shear and moment in the beam as functions of x.



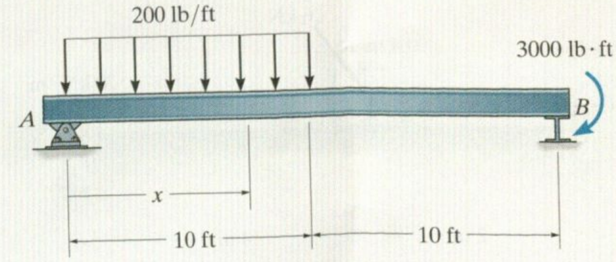
Prob. 4–20

4–21. Determine the shear and moment in the beam as a function of x.



Prob. 4–21

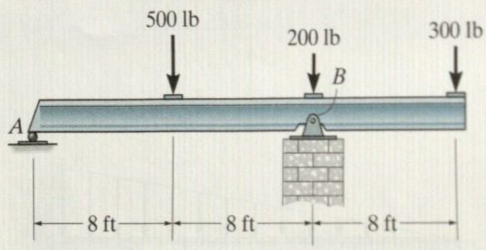
4–22. Determine the shear and moment throughout the beam as functions of x.



Prob. 4–22

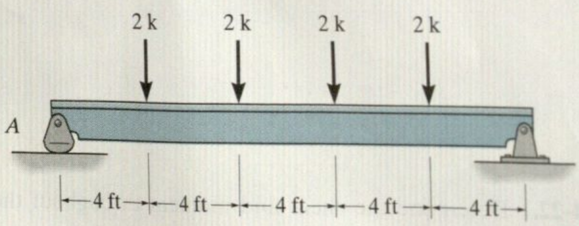
Sec. 4.3

4–23. Draw the shear and moment diagrams for the beam.



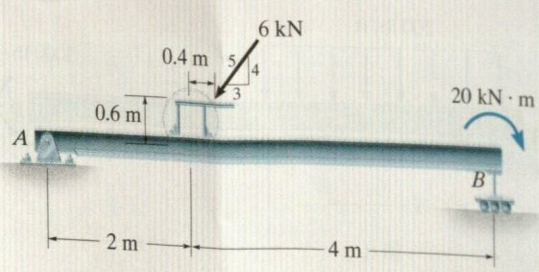
Prob. 4–23

***4–24.** Draw the shear and moment diagrams for the beam.



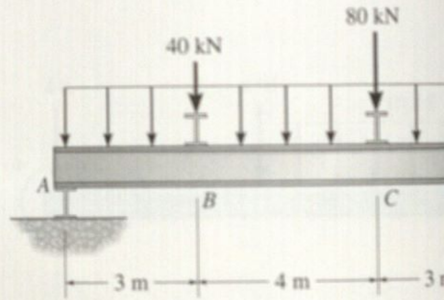
Prob. 4–24

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



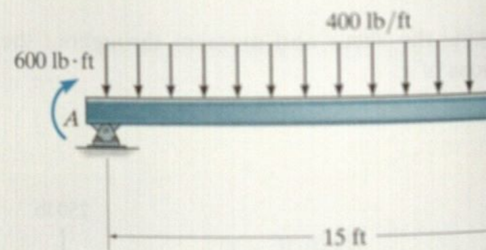
Prob. 4–25

4–26. Draw the shear and moment diagrams
Assume the support at *A* is a roller.



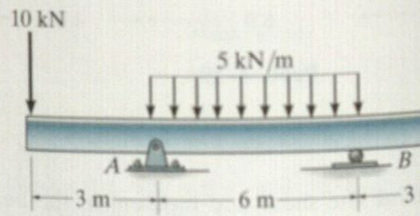
Prob. 4–26

4–27. Draw the shear and moment diagrams



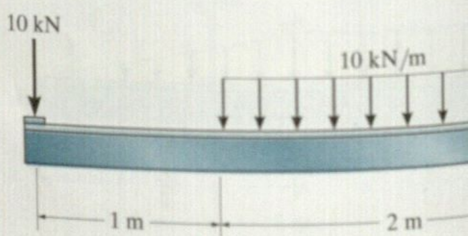
Prob. 4–27

***4–28.** Draw the shear and moment diagram



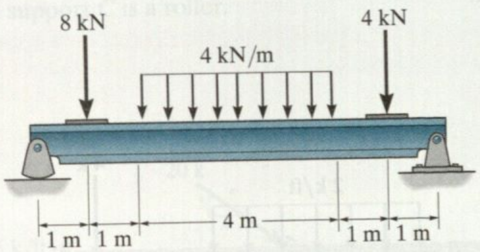
Prob. 4–28

4–29. Draw the shear and moment diagram



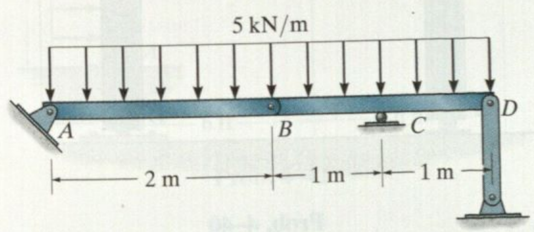
Prob. 4–29

4–30. Draw the shear and moment diagrams for the beam.



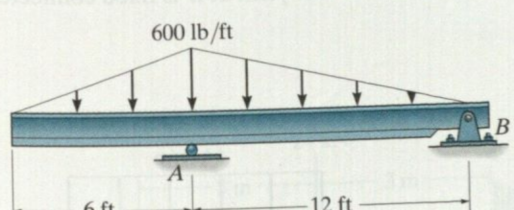
Prob. 4–30

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



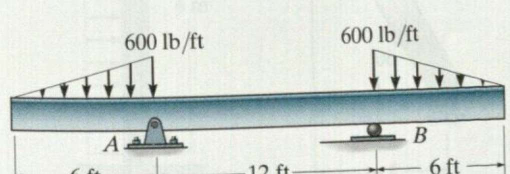
Prob. 4–31

***4–32.** Draw the shear and moment diagrams for the beam.



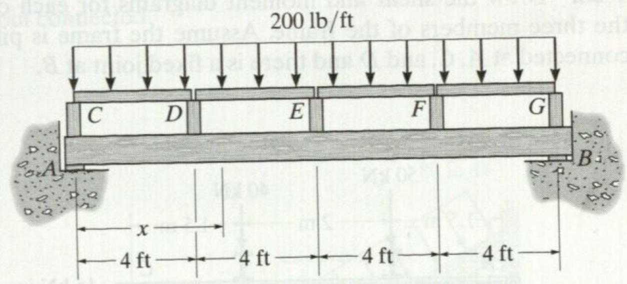
Prob. 4–32

4–33. Draw the shear and moment diagrams for the beam.



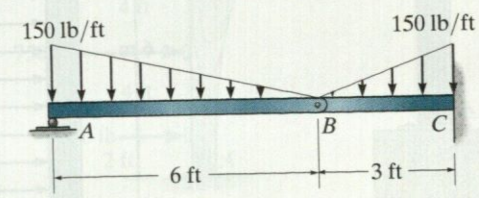
Prob. 4–33

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



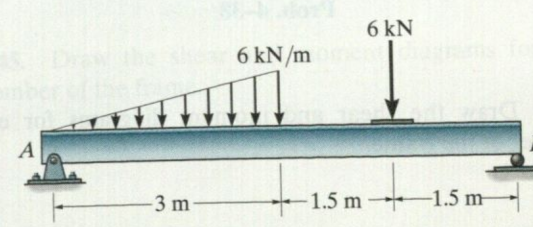
Prob. 4–34

4–35. Draw the shear and moment diagrams for the compound beam.



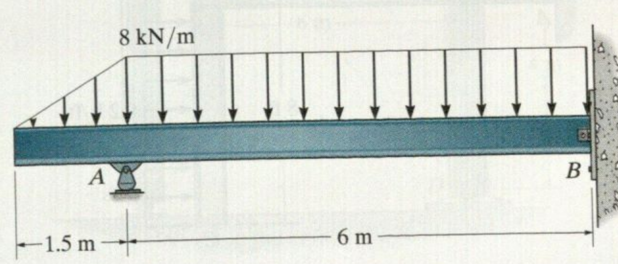
Prob. 4–35

***4–36.** Draw the shear and moment diagrams for the beam.



Prob. 4–36

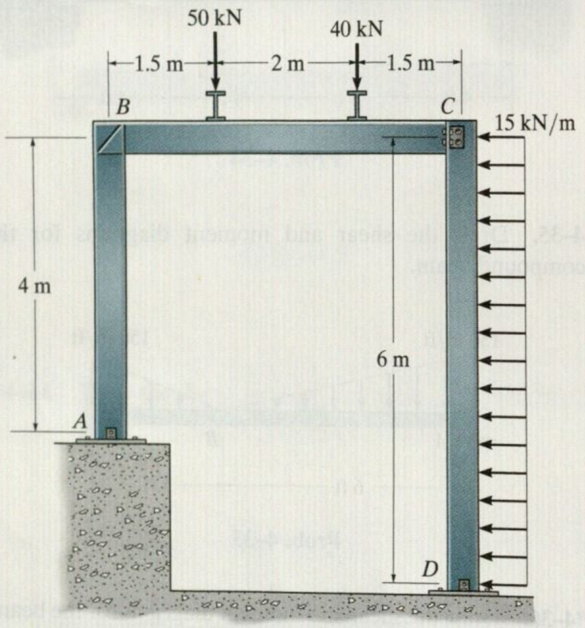
4–37. Draw the shear and moment diagrams for the beam. Assume the support at B is a pin.



Prob. 4–37

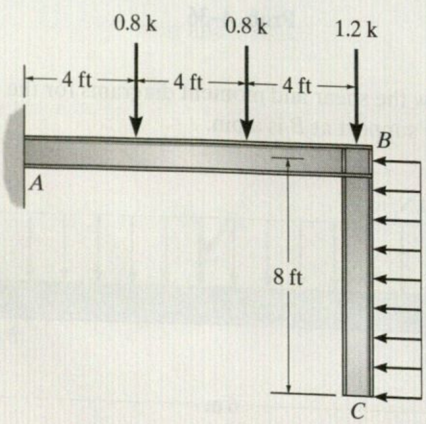
Sec. 4.4

4–38. 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.



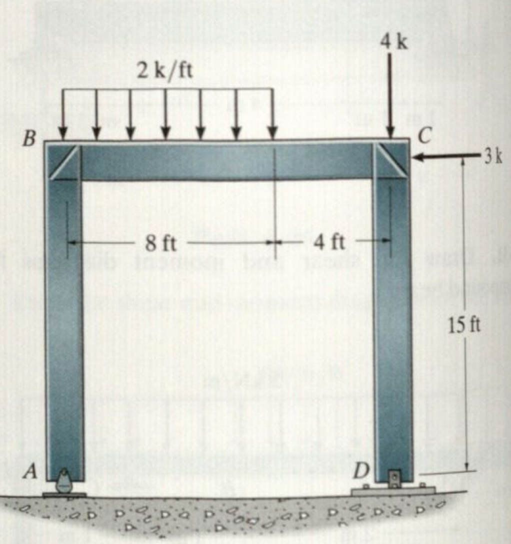
Prob. 4–38

4–39. Draw the shear and moment diagrams for each member of the frame.



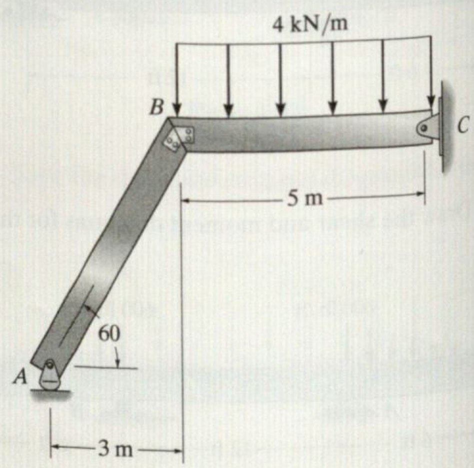
Prob. 4–39

***4–40.** Draw the shear and moment diagrams for each member of the frame. Assume A is a rocker, and D is pinned.



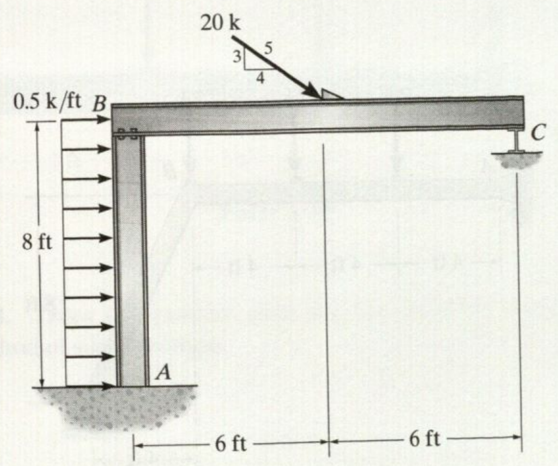
Prob. 4–40

4–41. Draw the shear and moment diagrams for each member of the frame. The joint at B is fixed connected.



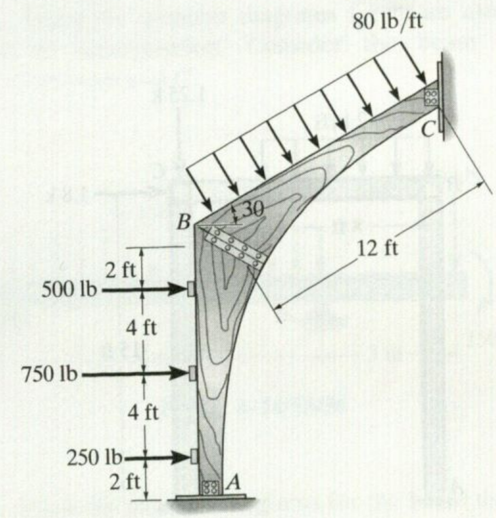
Prob. 4–41

4–42. 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.



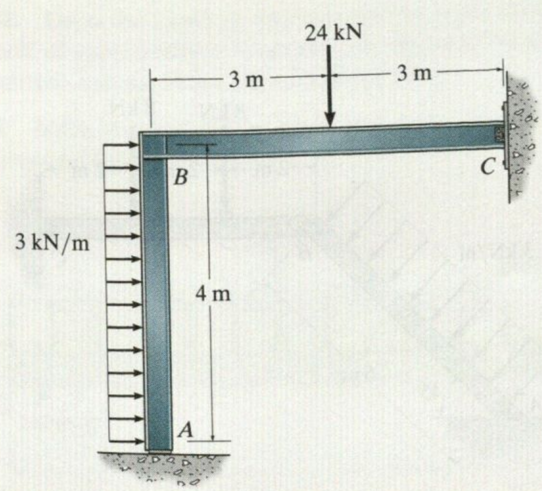
Prob. 4–42

***4–44.** Draw the shear and moment diagrams for each member of the frame. Assume the joints at A, B, and C are pin connected.



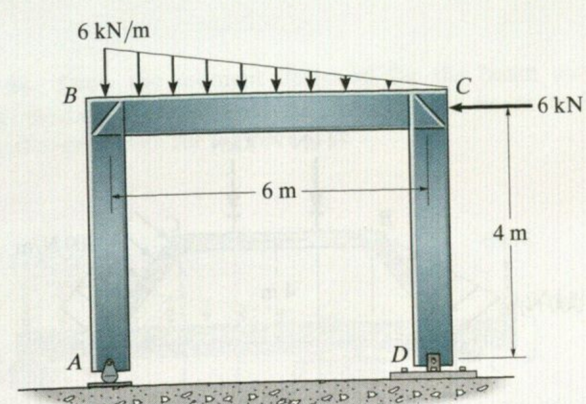
Prob. 4–44

4–43. Draw the shear and moment diagrams for each member of the frame. Assume the frame is roller supported at A and pin supported at C.



Prob. 4–43

4–45. Draw the shear and moment diagrams for each member of the frame.

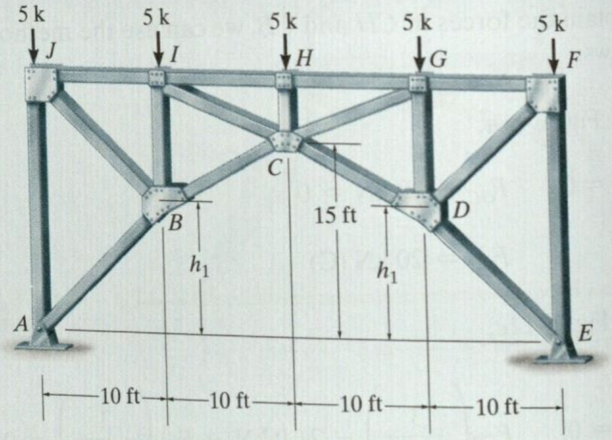


Prob. 4–45

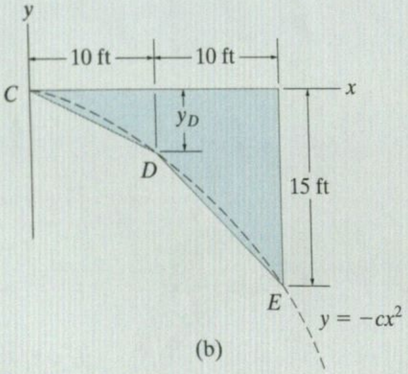
5

EXAMPLE 5.6

The three-hinged trussed arch shown in Fig. 5–12a supports the symmetric loading. Determine the required height h_1 of the joints B and D, so that the arch takes a funicular shape. Member HG is intended to carry no force.



(a)



(b)

Fig. 5–12

SOLUTION

For a symmetric loading, the funicular shape for the arch must be *parabolic* as indicated by the dashed line (Fig. 5–12b). Here we must find the equation which fits this shape. With the x, y axes having an origin at C, the equation is of the form $y = -cx^2$. To obtain the constant c, we require

$$-(15\text{ ft}) = -c(20\text{ ft})^2$$

$$c = 0.0375/\text{ft}$$

Therefore,

$$y_D = -(0.0375/\text{ft})(10\text{ ft})^2 = -3.75\text{ ft}$$

So that from Fig. 5–12a,

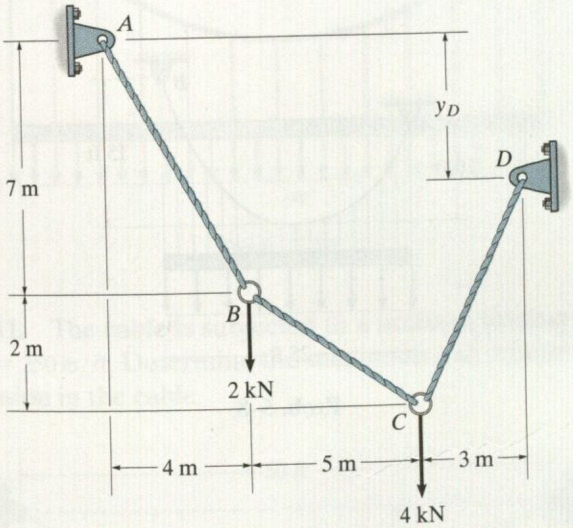
$$h_1 = 15\text{ ft} - 3.75\text{ ft} = 11.25\text{ ft} \qquad \textit{Ans.}$$

Using this value, if the method of joints is now applied to the truss, the results will show that the top cord and diagonal members will all be zero-force members, and the symmetric loading will be supported *only by the bottom cord* members AB, BC, CD, and DE of the truss.

PROBLEMS

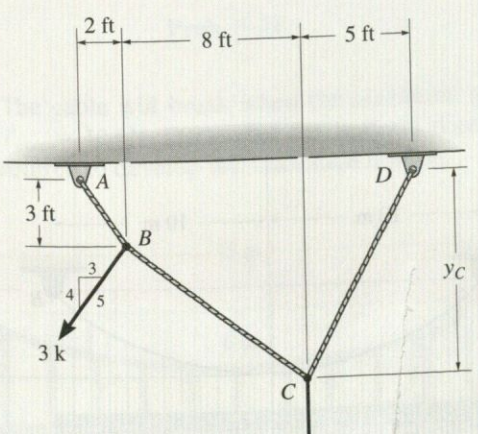
Sec. 5.1–5.2

5–1. Determine the tension in each segment of the cable and the distance y_D.



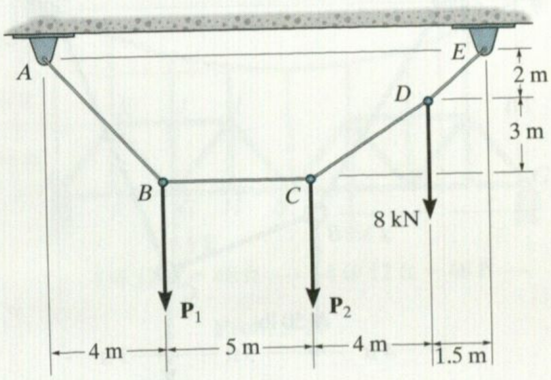
Prob. 5–1

5–2. The cable supports the loading shown. Determine the magnitude of the vertical force **P** so that $y_C = 6$ ft.



Prob. 5–2

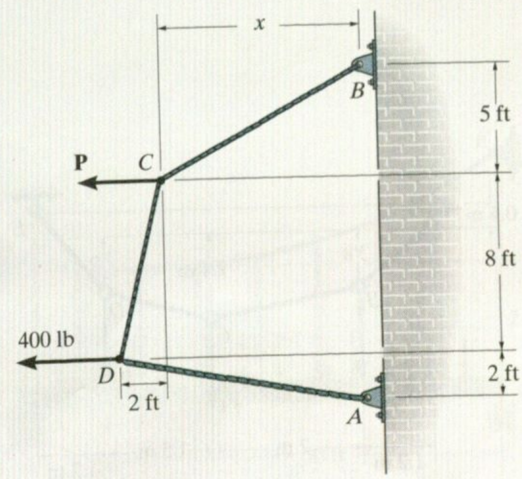
5–3. Determine the forces P_1 and P_2 needed to hold the cable in the position shown, i.e., so segment BC remains horizontal.



Prob. 5–3

***5–4.** The cable supports the loading shown. Determine the distance x and the tension in cable BC. Set $P = 100$ lb.

5–5. The cable supports the loading shown. Determine the magnitude of the horizontal force **P** so that $x = 6$ ft.



Probs. 5–4/5