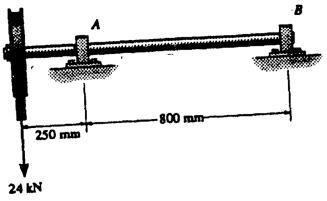
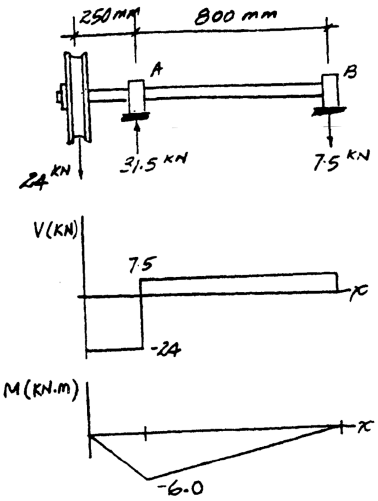
6–1. Draw the shear and moment diagrams for the shaft. The bearings at A and B exert only vertical reactions on the shaft.





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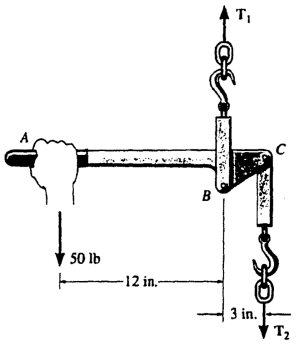
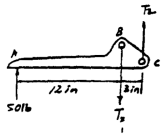
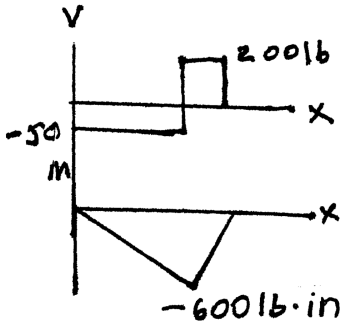
6–2 The load binder is used to support a load. If the force applied to the handle is 50 lb, determine the tensions T_1 and T_2 in each end of the chain and then draw the shear and moment diagrams for the arm ABC.

$$\zeta + \Sigma M_C = 0; \quad -50(15) + T_1(3) = 0$$
$$T_1 = 250 \text{ lb} \quad \textbf{Ans}$$

$$+\uparrow \Sigma F_y = 0; \quad 50 - 250 + T_2 = 0$$
$$T_2 = 200 \text{ lb} \quad \textbf{Ans}$$







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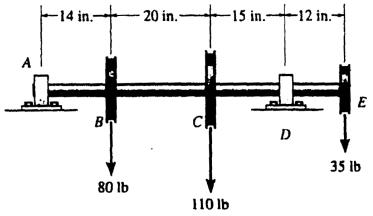
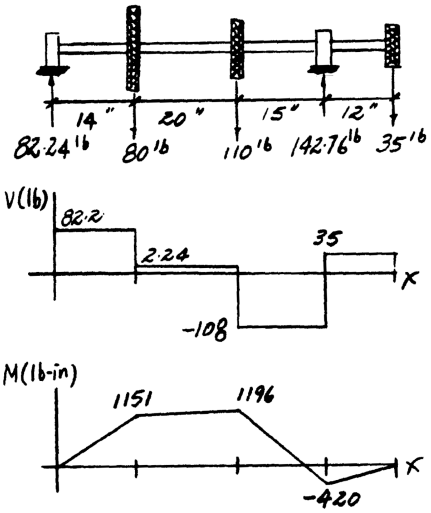
6–3 Draw the shear and moment diagrams for the shaft. The bearings at A and D exert only vertical reactions on the shaft. The loading is applied to the pulleys at B and C and E.





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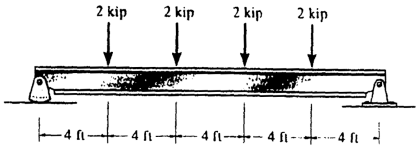
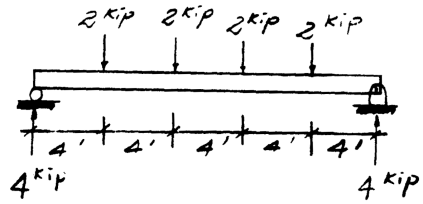
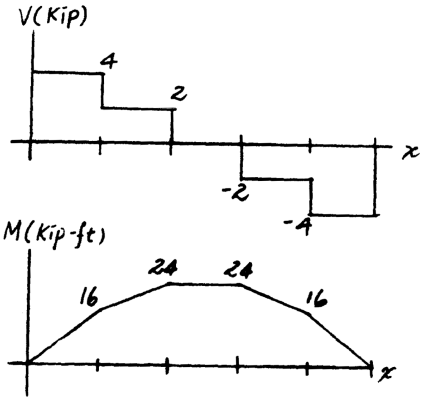
*6–4 Draw the shear and moment diagrams for the beam.







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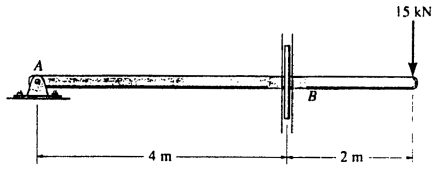
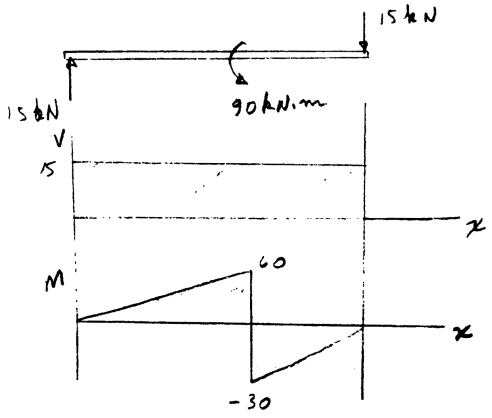
6–5 Draw the shear and moment diagrams for the rod. It is supported by a pin at A and a smooth plate at B. The plate slides within the groove and so it cannot support a vertical force, although it can support a moment.





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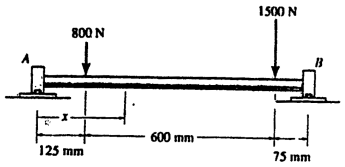
6–6. Draw the shear and moment diagrams for the shaft. The bearings at A and B exert only vertical reactions on the shaft. Also, express the shear and moment in the shaft as a function of x within the region 125 mm $< x <$ 725 mm.

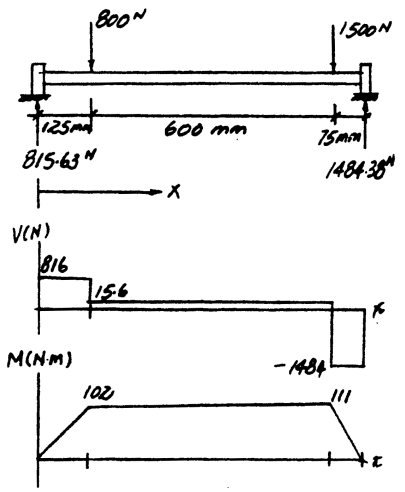


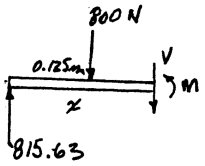
$+\uparrow \Sigma F_y = 0;$ $\quad 815.63 - 800 - V = 0$

$V = 15.6\ \text{N}$ **Ans**

$\zeta + \Sigma M = 0;$ $\quad M + 800(x - 0.125) - 815.63\,x = 0$

$M = (15.6x + 100)\ \text{N} \cdot \text{m}$ **Ans**





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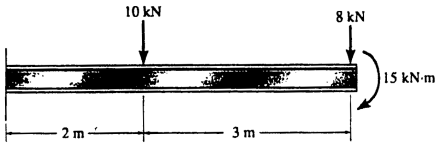
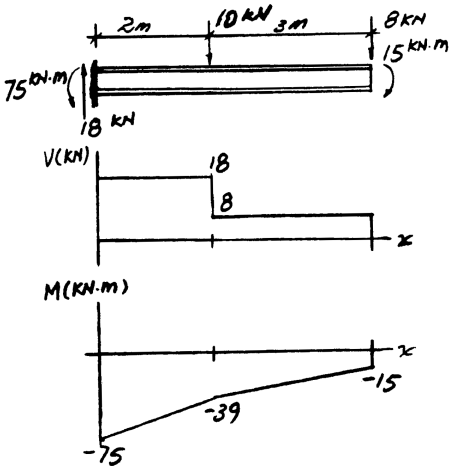
6–7 Draw the shear and moment diagrams for the beam.





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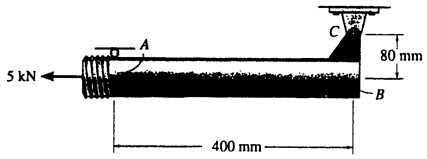
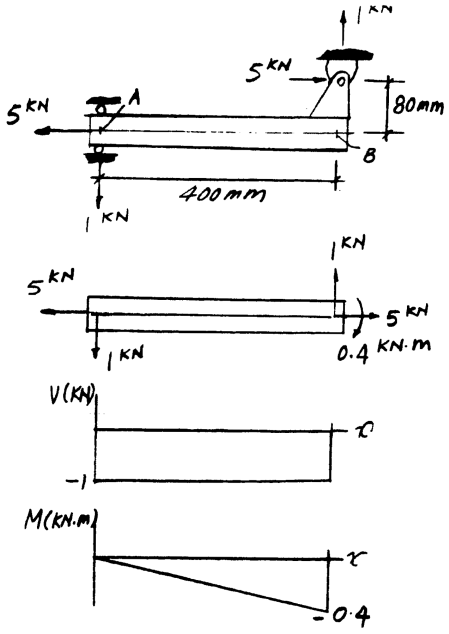
***6–8** Draw the shear and moment diagrams for the pipe. The end screw is subjected to a horizontal force of 5 kN. *Hint:* The reactions at the pin C must be replaced by equivalent loadings at point B on the axis of the pipe.





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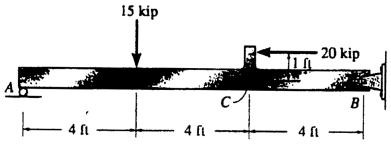
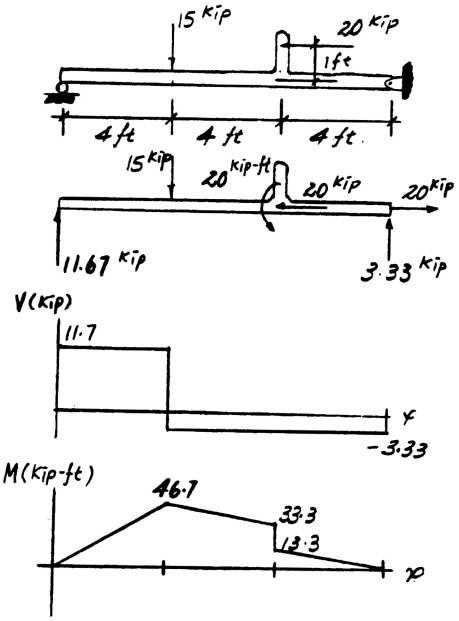
6–9 Draw the shear and moment diagrams for the beam. *Hint:* The 20-kip load must be replaced by equivalent loadings at point *C* on the axis of the beam.





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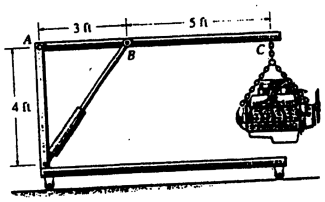
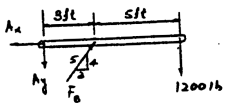
6-10. The engine crane is used to support the engine, which has a weight of 1200 lb. Draw the shear and moment diagrams of the boom ABC when it is in the horizont position shown.

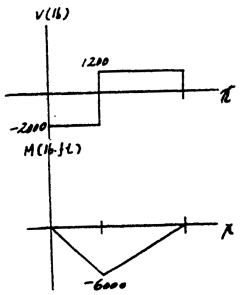


$$\zeta + \Sigma M_A = 0; \quad \frac{4}{5}F_B(3) - 1200(8) = 0; \quad F_B = 4000 \text{ lb}$$

$$+\uparrow \Sigma F_y = 0; \quad -A_y + \frac{4}{5}(4000) - 1200 = 0; \quad A_y = 2000 \text{ lb}$$

$$\pm \Sigma F_x = 0; \quad A_x - \frac{3}{5}(4000) = 0; \quad A_x = 2400 \text{ lb}$$





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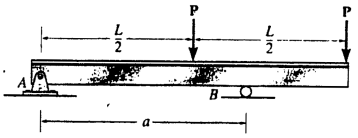
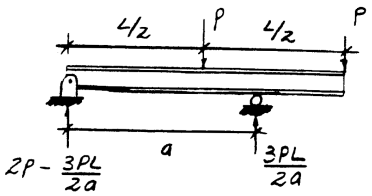
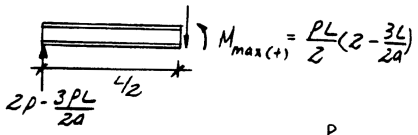
6–11 Determine the placement distance a of the roller support so that the largest absolute value of the moment is a minimum. Draw the shear and moment diagrams for this condition.





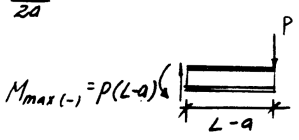
To get absolute minimum moment;

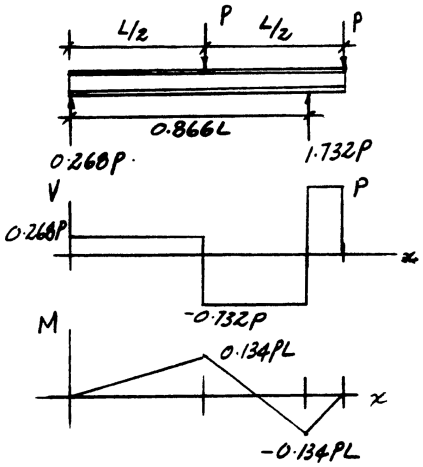


$$M_{\max\,(+)} = M_{\max\,(-)}$$

$$\frac{PL}{2}\left(2-\frac{3L}{2a}\right) = P(L-a)$$

$$a = \frac{\sqrt{3}}{2}L = 0.866\,L \qquad \textbf{Ans}$$





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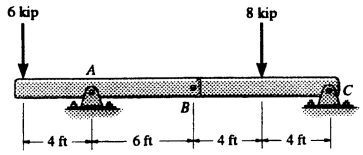
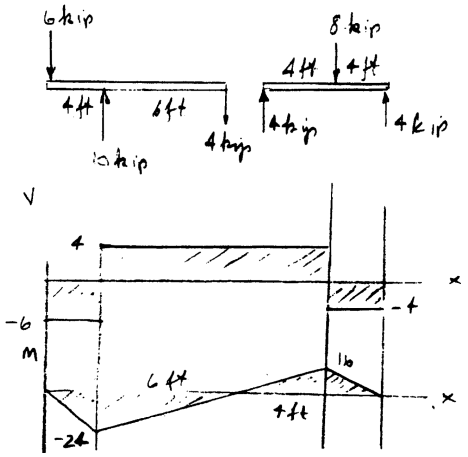
***6–12** Draw the shear and moment diagrams for the compound beam which is pin connected at B.





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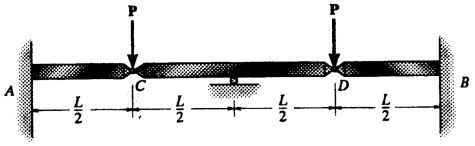
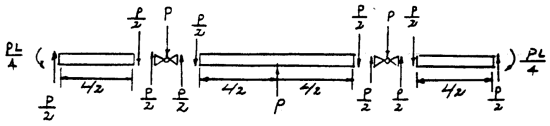
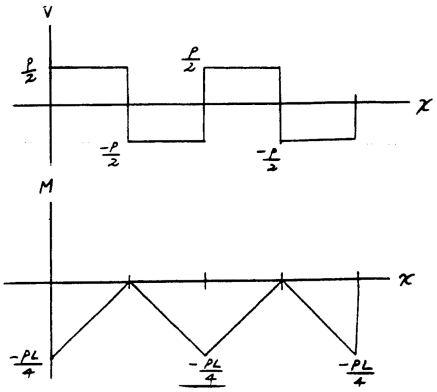
6–13 The bars are connected by pins at C and D. Draw the shear and moment diagrams for the assembly. Neglect the effect of axial load.







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Because of the number and variety of potential correct solutions to this problem, no solution is being given.

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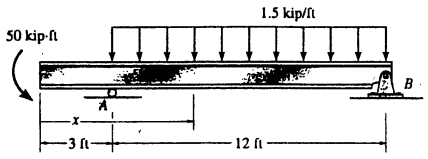
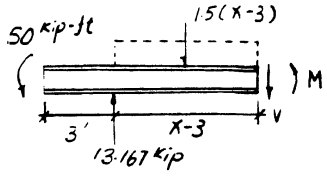
6–15 Draw the shear and moment diagrams for the beam. Also, determine the shear and moment in the beam as functions of x, where 3 ft $< x \leq$ 15 ft.





$+\uparrow \Sigma F_y = 0; \quad -V - 1.5(x-3) + 13.167 = 0$

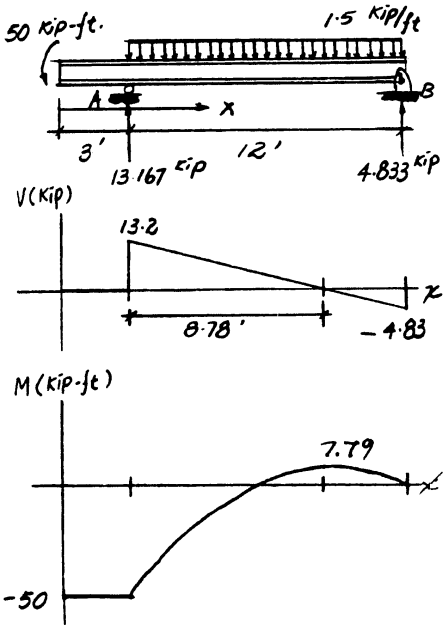
$$V = 17.7 - 1.5\,x \quad \textbf{Ans}$$

$\zeta+ \Sigma M = 0; \quad M + 1.5(x-3)\dfrac{(x-3)}{2} + 50 - 13.167(x-3) = 0$

$$M = -0.75x^2 + 17.7x - 96.25 \quad \textbf{Ans}$$

$$V = 0 \text{ at } x = \frac{17.7}{1.5} = 11.778 \text{ ft}$$

$$M_{max} = -0.75(11.778)^2 + 17.7(11.778) - 96.25 = 7.79 \text{ ft} \quad \textbf{Ans}$$



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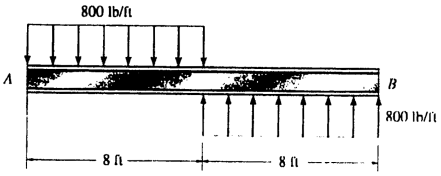
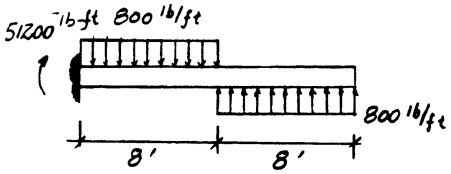
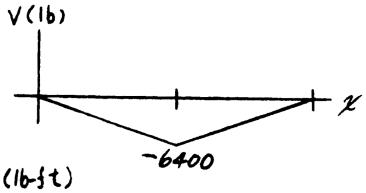
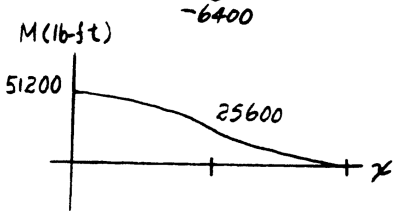
***6–16** Draw the shear and moment diagrams for the beam.









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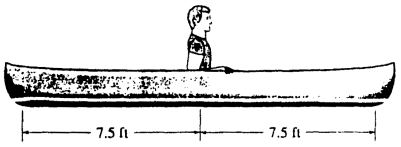
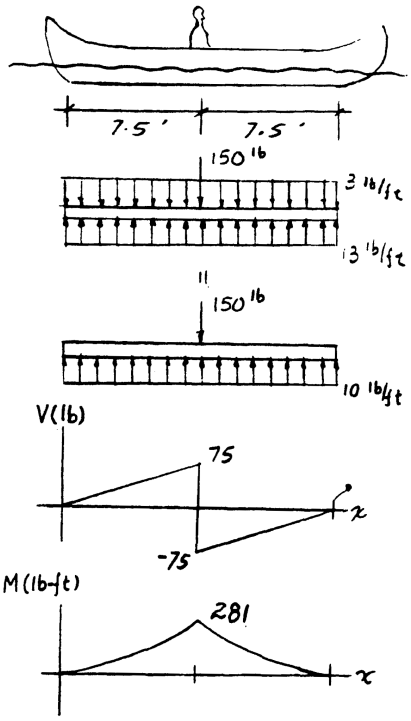
6–17 The 150-lb man sits in the center of the boat, which has a uniform width and a weight per linear foot of 3 lb/ft. Determine the maximum bending moment exerted on the boat. Assume that the water exerts a uniform distributed load upward on the bottom of the boat.





$M_{max} = 281 \text{ lb} \cdot \text{ft}$ **Ans**

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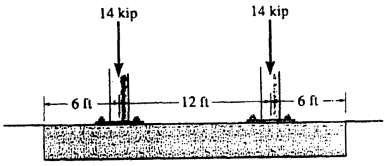
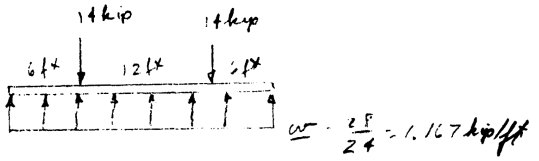
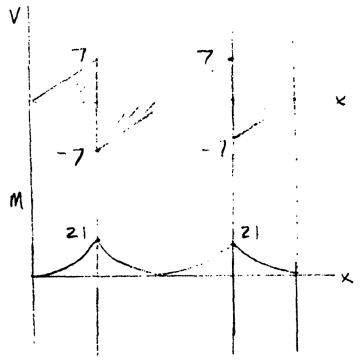
6–18 The footing supports the load transmitted by the two columns. Draw the shear and moment diagrams for the footing if the reaction of soil pressure on the footing is assumed to be uniform.







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