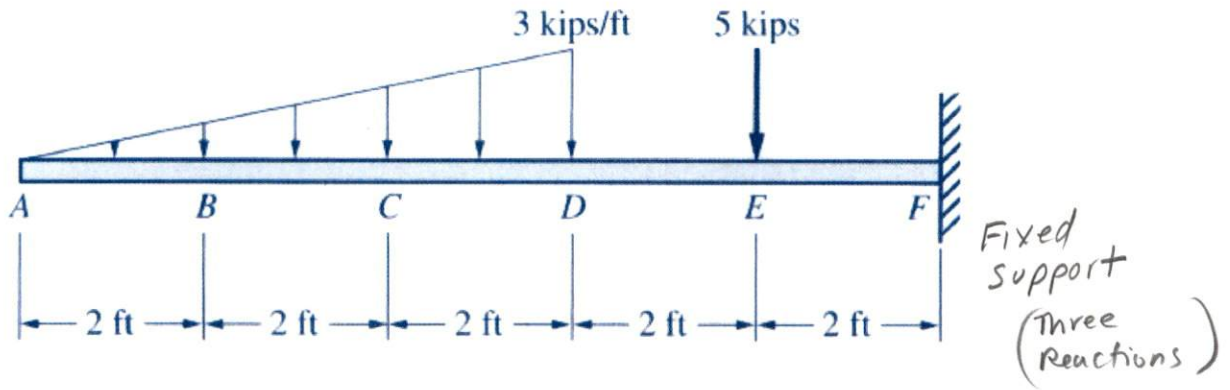
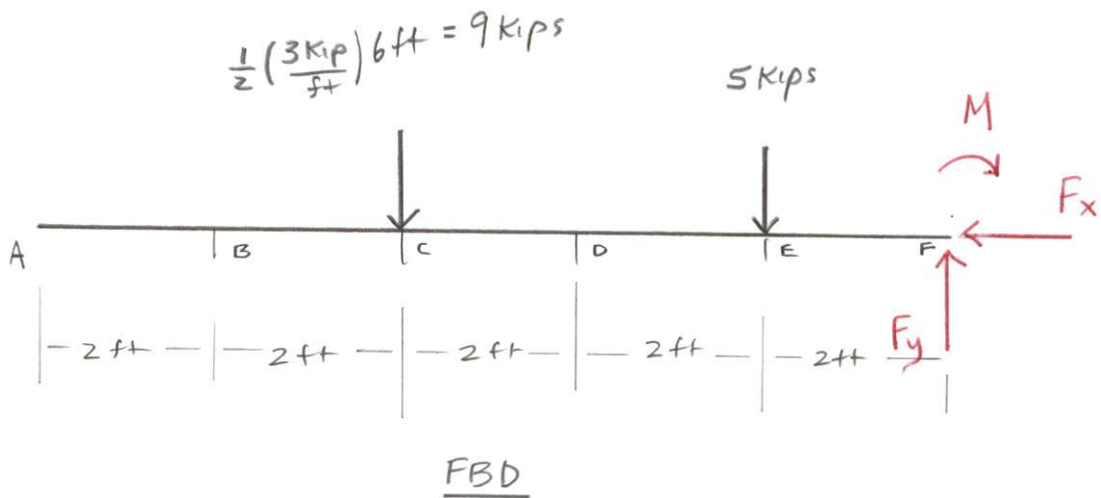


13-15

Determine the shear forces and bending moments at sections A, B, C, D, E, and F in Figs. P13-13 to P13-15.



Solution.



Equilibrium Equations

ccw + M ↺
cw - M ↻

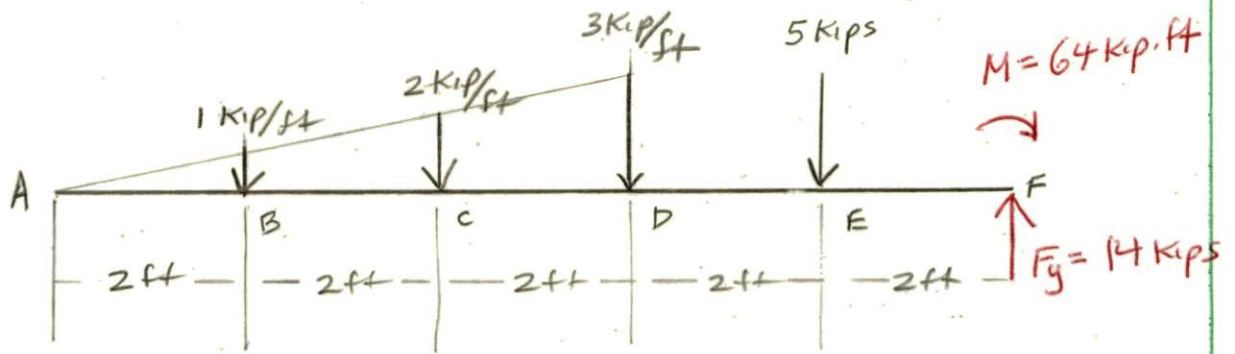
$$[\sum F_x = 0] \quad F_x = 0$$

$$[\sum F_y = 0] \quad -9 \text{ kips} - 5 \text{ kips} + F_y = 0$$

$$F_y = 14 \text{ kips} \uparrow$$

$$[\sum M_F = 0] \quad 9 \text{ kips} (6 \text{ ft}) + 5 \text{ kips} (2 \text{ ft}) - M = 0$$

$$M = -64 \text{ kips} \cdot \text{ft} \curvearrowright$$



Shear Force (V) (From Left)

$$V_A = 0$$

$$V_B = -\frac{1}{2} \left(\frac{1 \text{ kip}}{\text{ft}} \right) (2 \text{ ft}) = -1 \text{ kip}$$

$$V_C = -\frac{1}{2} \left(\frac{2 \text{ kip}}{\text{ft}} \right) (4 \text{ ft}) = -4 \text{ kips}$$

$$V_D = -\frac{1}{2} \left(\frac{3 \text{ kip}}{\text{ft}} \right) (6 \text{ ft}) = -9 \text{ kips}$$

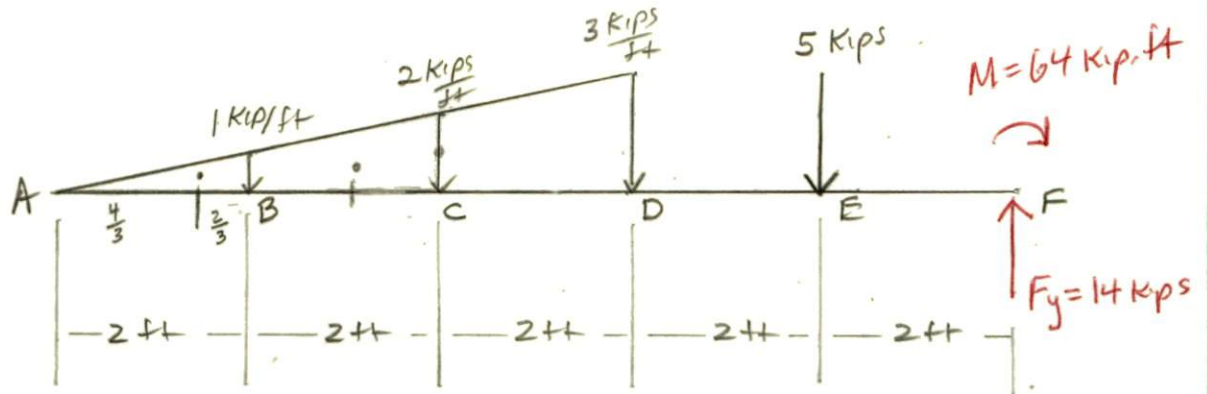
$$V_{E-} = -9 \text{ kips}$$

$$V_{E+} = -9 \text{ kips} - 5 \text{ kips} = -14 \text{ kips}$$

$$V_{F-} = -14 \text{ kips}$$

$$V_{F+} = -14 \text{ kips} + 14 \text{ kips} = 0$$

Bending Moment (M)



$$M_A = 0$$

$$M_B = -\frac{1}{2} \left(\frac{1 \text{ kip}}{\text{ft}} \right) (2 \text{ ft}) \left(\frac{2 \text{ ft}}{3} \right) = -0.667 \text{ kip-ft}$$

$$M_C = -\frac{1}{2} \left(\frac{2 \text{ kips}}{\text{ft}} \right) (4 \text{ ft}) \left(\frac{4 \text{ ft}}{3} \right) = -5.33 \text{ kip-ft}$$

$$M_D = -\frac{1}{2} \left(\frac{3 \text{ kips}}{\text{ft}} \right) (6 \text{ ft}) \left(\frac{6 \text{ ft}}{3} \right) = -18 \text{ kip-ft}$$

$$M_E = -\frac{1}{2} \left(\frac{3 \text{ kip}}{\text{ft}} \right) (6 \text{ ft}) \left(\frac{6 \text{ ft}}{3} + 2 \text{ ft} \right) = -36 \text{ kip-ft}$$

$$M_F = -64 \text{ kip-ft} \quad (\text{From Right})$$