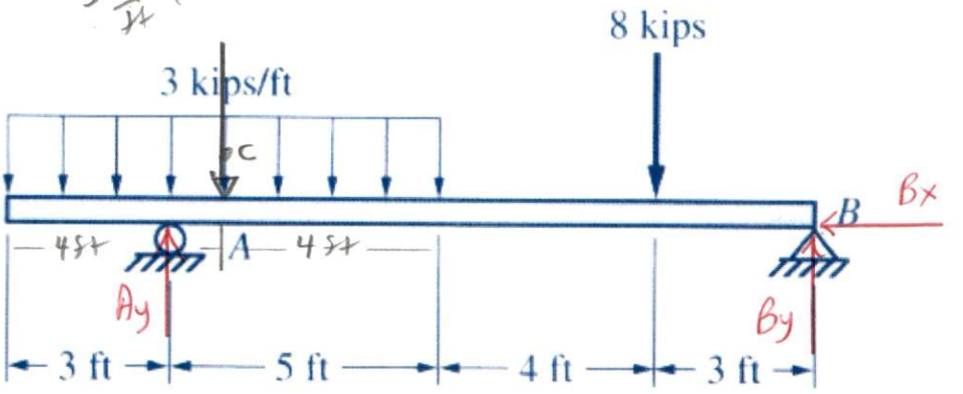
13-30

13-22 to 13-37 Refer to Figs. P13-22 to P13-37. Construct the shear force and the bending moment diagrams for the beam in each figure due to the loading shown by using the relationships among the load, shear, and moment diagrams.

$\frac{3\ kips}{ft}(8\ ft) = 24\ kips$



Solution.

FBD

Equilibrium Equations

$[\Sigma F_x = 0] \quad B_x = 0$

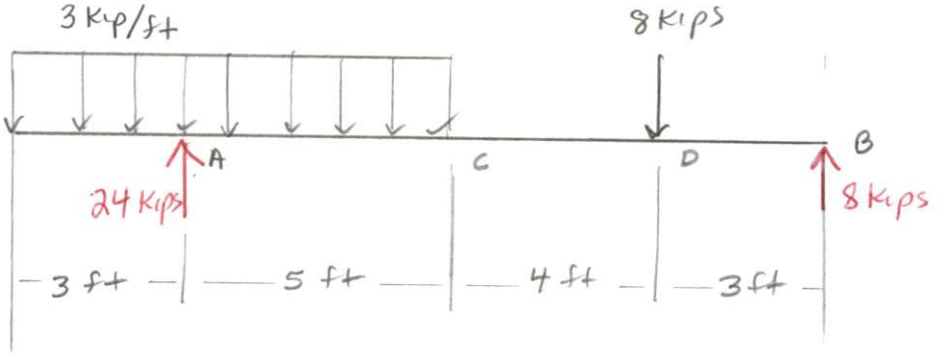
$[\Sigma M_A = 0] \quad -24\ kips(1\ ft) - 8\ kips(9\ ft) + B_y(12\ ft) = 0$

$B_y = \frac{96\ kip.ft}{12\ ft} = 8\ kips\ \uparrow$

$[\Sigma F_y = 0] \quad A_y - 24\ kips - 8\ kips + B_y = 0$

$A_y = 32\ kips - 8\ kips = 24\ kips\ \uparrow$

(Loading Diagram)



Shear (kips)

$V_{A-} = -\frac{3\ kip}{ft}(3\ ft) = -9\ kips$

$V_{A+} = -9\ kips + 24\ kips = +15\ kips$

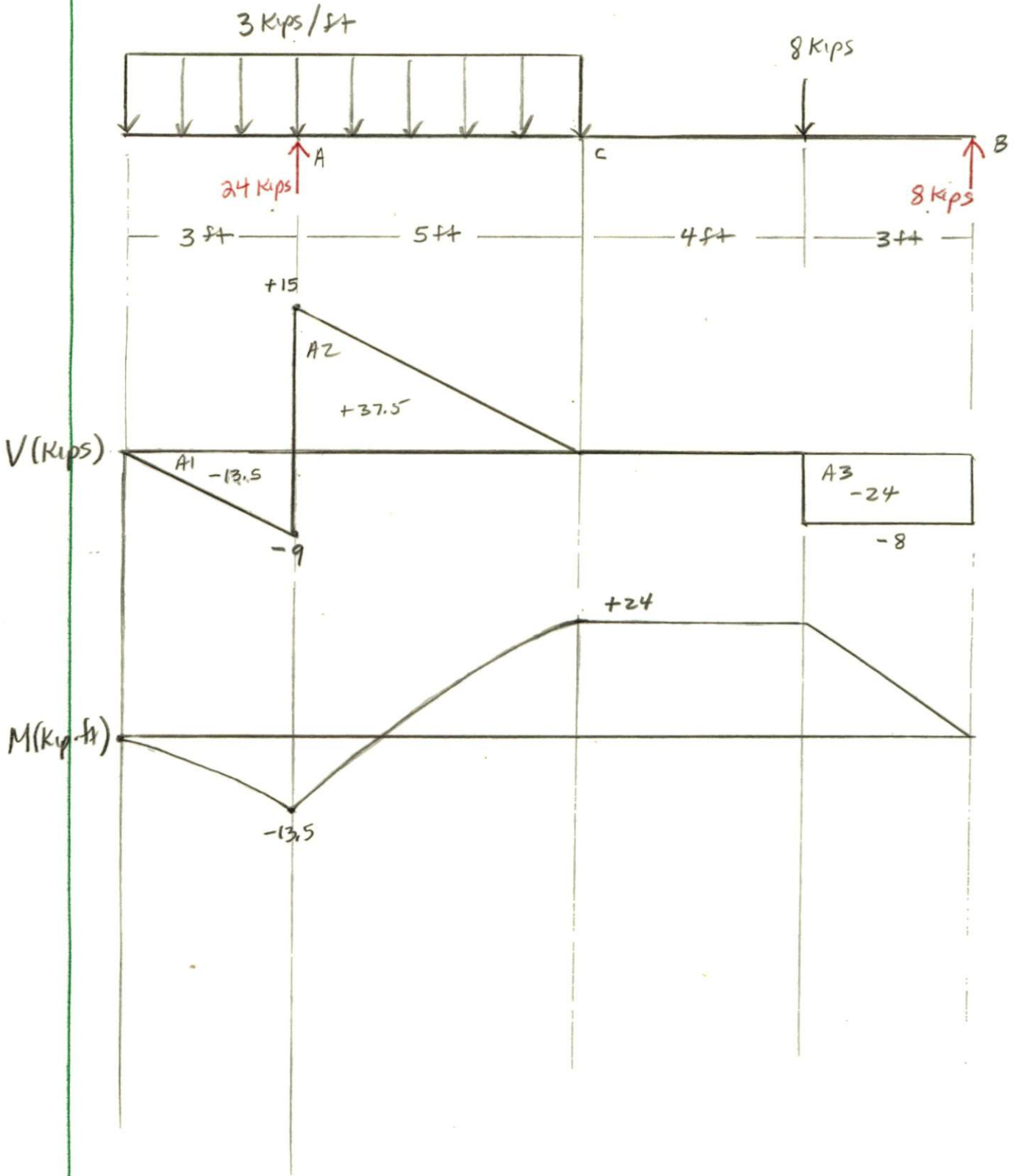
$V_C = +15\ kips - \frac{3\ kips}{ft}(5\ ft) = +15\ kips - 15\ kips = 0$

$V_{D-} = 0$

$V_{D+} = -8\ kips$

$V_{B-} = -8\ kips$

$V_{B+} = -8\ kips + 8\ kips = 0$



Internal Bending Moment (area under Shear Curve)

$A1 = \frac{1}{2}(3ft)(-9\,Kips) = -13.5\ Kip\cdot ft$

$A2 = \frac{1}{2}(5ft)(+15\,Kips) = +37.5\ Kip\cdot ft$

$A3 = 3ft(-8\,Kips) = -24\ Kip\cdot ft$