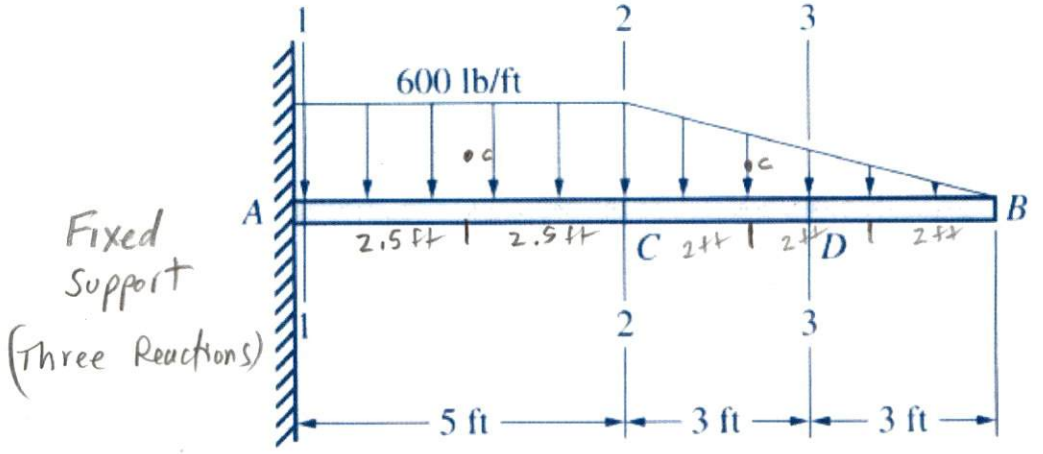
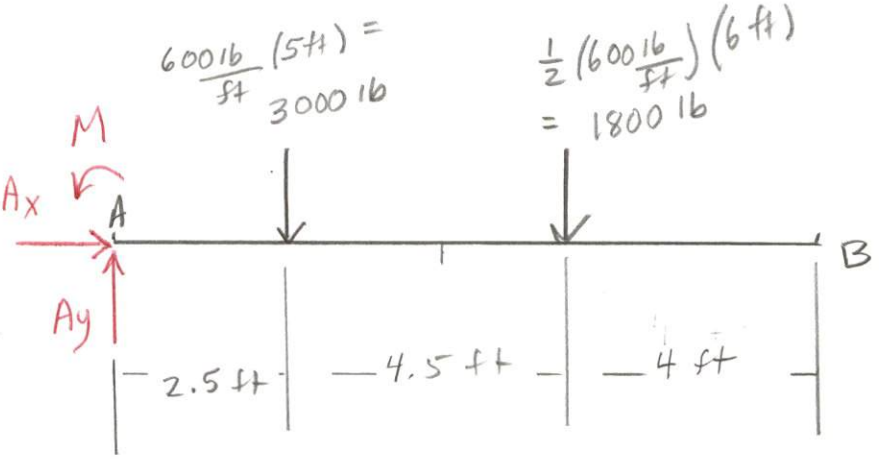
13-11

Refer to Figs. P13-7 to P13-12. Use the rules for finding shear forces and bending moments to determine the shear forces and bending moments in each figure at sections 1-1, 2-2, and 3-3.



Solution.



FBD

ccw +M ↺
cw −M ↻

Equilibrium Equations

$[\Sigma F_x = 0]$ $A_x = 0$

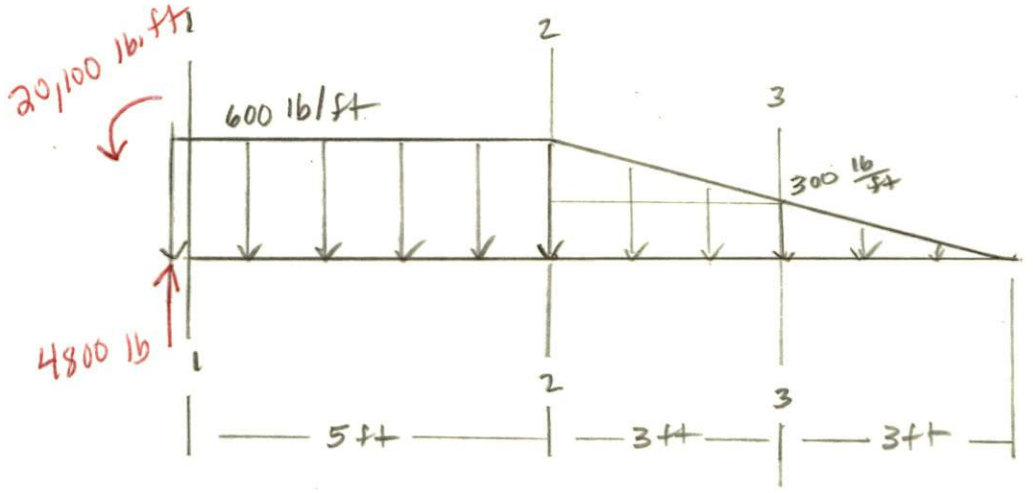
$[\Sigma F_y = 0]$ $A_y - 3000\,lb - 1800\,lb = 0$

$A_y = 4800\,lb \uparrow$

$[\Sigma M_A = 0]$ $M - 3000\,lb(2.5\,ft) - 1800\,lb(7\,ft) = 0$

$M = 3000\,lb(2.5\,ft) + 1800\,lb(7\,ft)$

$= 20{,}100\,lb\cdot ft$ ↺



Loading Diagram

Shear Force (V) (From Left end of Beam)

$V_{1-1} = +4800\ lb$

$V_{2-2} = +4800\ lb - \frac{600\ lb}{ft}(5\ ft) = +1800\ lb$

$V_{3-3} = +4800\ lb - \frac{600\ lb}{ft}(5\ ft) - \frac{1}{2}(3\ ft)\left(300\ lb/ft\right) - \frac{300\ lb}{ft}(3\ ft)$

$= 4800\ lb - 3000\ lb - 450\ lb - 900\ lb$

$= +450\ lb$

OR From the Right

$V_{3-3} = +\frac{1}{2}\left(300\ \frac{lb}{ft}\right)(3\ ft) = +450\ lb$

Bending Moment

$M_{1-1} = -20,100\ lb.ft$

$M_{2-2} = -20,100\ lb.ft + 4800\ lb\,(5\ ft) - \frac{600\ lb}{ft}(5ft)(2.5\ ft)$

$= -3600\ lb.ft$

From the Right

$M_{3-3} = -\frac{1}{2}\left(300\ \frac{lb}{ft}\right)(3ft) = -450\ lb.ft$