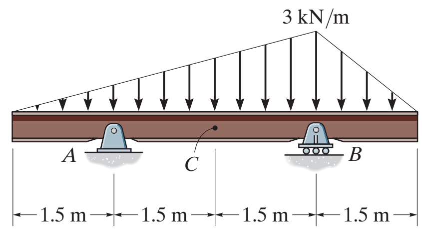
**7–3.** Determine the internal normal force, shear force, and moment at point $C$ in the double-overhang beam.




## SOLUTION

The intensity of the triangular distributed loading at $C$ can be computed using the similar triangles shown in Fig. $b$,

$$\frac{w_C}{3} = \frac{3}{4.5} \text{ or } w_C = 2 \text{ kN/m}$$

With reference to Fig. $a$,

$$\circlearrowleft + \Sigma M_B = 0; \quad \frac{1}{2}(3)(4.5)(1.5) - \frac{1}{2}(3)(1.5)(0.5) - A_y(3) = 0 \quad A_y = 3 \text{ kN}$$

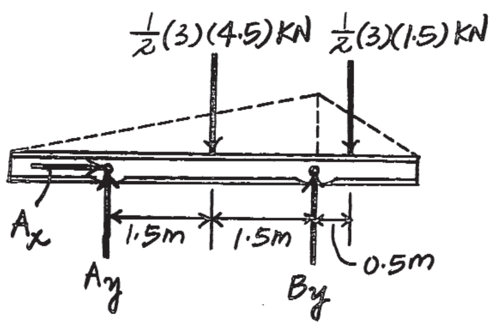
$$\overset{+}{\rightarrow} \Sigma F_x = 0; \quad A_x = 0$$

Using the results of $\mathbf{A}_x$ and $\mathbf{A}_y$ and referring to Fig. $c$,

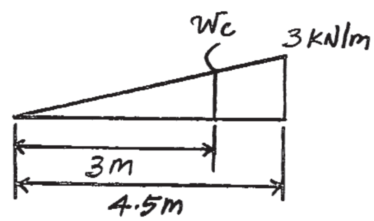
$$\overset{+}{\rightarrow} \Sigma F_x = 0; \quad N_C = 0$$ **Ans.**

$$+\uparrow \Sigma F_y = 0; \quad 3 - \frac{1}{2}(2)(3) - V_C = 0 \quad V_C = 0$$ **Ans.**

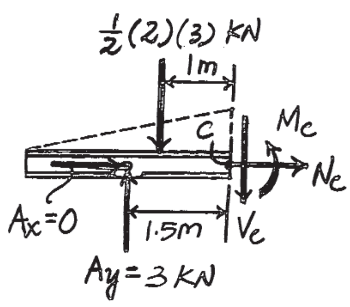
$$\circlearrowleft + \Sigma M_C = 0; \quad M_C + \frac{1}{2}(2)(3)(1) - 3(1.5) = 0 \quad M_C = 1.5 \text{ kN} \cdot \text{m}$$ **Ans.**




(a)




(b)

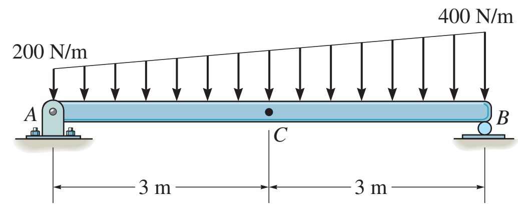



(c)

**Ans:**
$N_C = 0$
$V_C = 0$
$M_C = 1.5 \text{ kN} \cdot \text{m}$

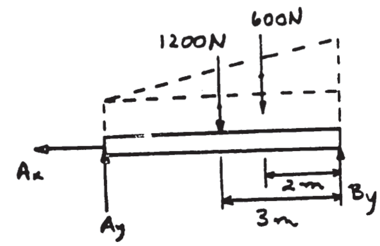
***7–16.**

Determine the internal normal force, shear force, and moment at point $C$ of the beam.




## SOLUTION

Beam:

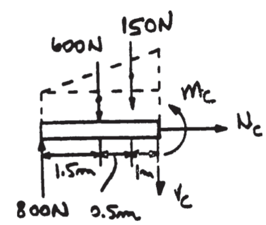



$\curvearrowleft + \Sigma M_B = 0; \qquad 600\,(2) + 1200\,(3) - A_y\,(6) = 0$

$A_y = 800\text{ N}$

$\xrightarrow{+} \Sigma F_x = 0; \qquad A_x = 0$

Segment $AC$:




$\xrightarrow{+} \Sigma F_x = 0; \qquad N_C = 0$ **Ans.**

$+\uparrow \Sigma F_y = 0; \qquad 800 - 600 - 150 - V_C = 0$

$V_C = 50\text{ N}$ **Ans.**

$\curvearrowleft + \Sigma M_C = 0; \qquad -800\,(3) + 600\,(1.5) + 150\,(1) + M_C = 0$

$M_C = 1350\text{ N}\cdot\text{m} = 1.35\text{ kN}\cdot\text{m}$ **Ans.**

**Ans:**

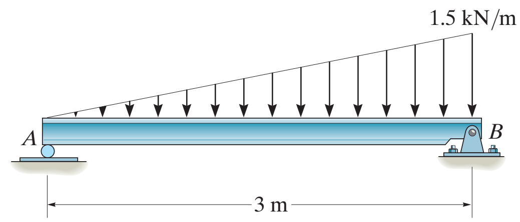
$N_C = 0$

$V = 50\text{ N}$

$M_C = 1.35\text{ kN}\cdot\text{m}$

**7–53.**

Draw the shear and moment diagrams for the beam.




## SOLUTION

$+\uparrow \Sigma F_y = 0; \qquad 0.75 - \frac{1}{2}x\,(0.5x) - V = 0$

$V = 0.75 - 0.25x^2$

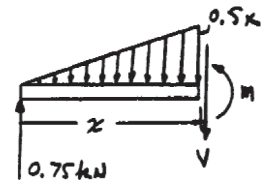
$V = 0 = 0.75 - 0.25x^2$

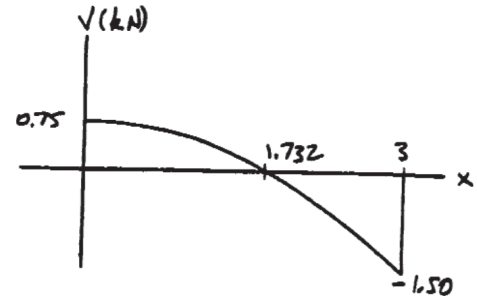
$x = 1.732\text{ m}$

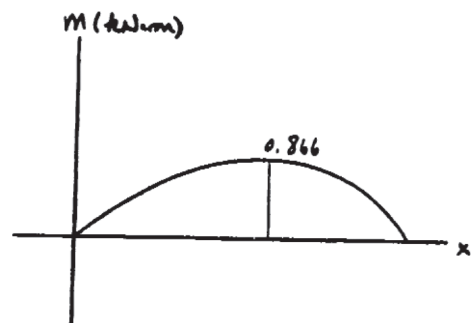
$\zeta + \Sigma M = 0; \qquad M + \left(\frac{1}{2}\right)(0.5\,x)\,(x)\left(\frac{1}{3}\,x\right) - 0.75\,x = 0$

$M = 0.75\,x - 0.08333\,x^3$

$M_{max} = 0.75(1.732) - 0.08333(1.732)^3 = 0.866$



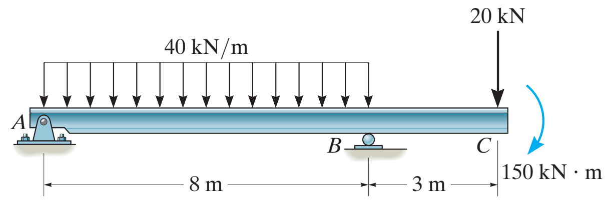




**Ans:**
$x = 1.732\text{ m}$
$M_{max} = 0.75(1.732) - 0.08333(1.732)^3 = 0.866$

***7–56.**

Draw the shear and moment diagrams for the beam.




## SOLUTION

$0 \leq x < 8$

$+\uparrow \Sigma F_y = 0; \quad 133.75 - 40x - V = 0$

$V = 133.75 - 40x$ **Ans.**

$\circlearrowleft + \Sigma M = 0; \quad M + 40x\left(\frac{x}{2}\right) - 133.75x = 0$

$M = 133.75x - 20x^2$ **Ans.**

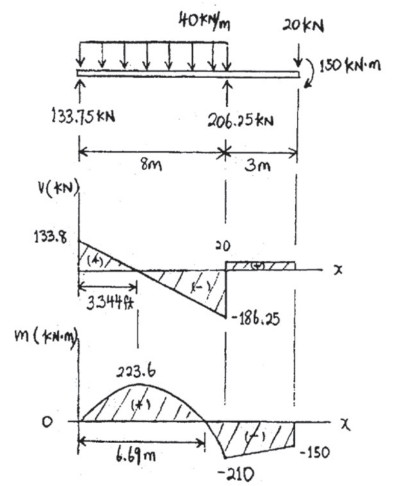
$8 < x \leq 11$

$+\uparrow \Sigma F_y = 0; \quad V - 20 = 0$

$V = 20$ **Ans.**

$\circlearrowleft + \Sigma M = 0; \quad M + 20(11 - x) + 150 = 0$

$M = 20x - 370$ **Ans.**




**Ans:**
For $0 \leq x < 8$ m
$V = (133.75 - 40x)$ kN
$M = (133.75x - 20x^2)$ kN·m
For $8\text{ m} < x \leq 11$ m
$V = 20$ kN
$M = (20x - 370)$ kN·m