SOLUTION

ME 323: Mechanics of Materials ***Homework Set H13***

Summer 2025 ***Assigned/Due: July 2/July 8***

Consider the loading on the beam shown below.

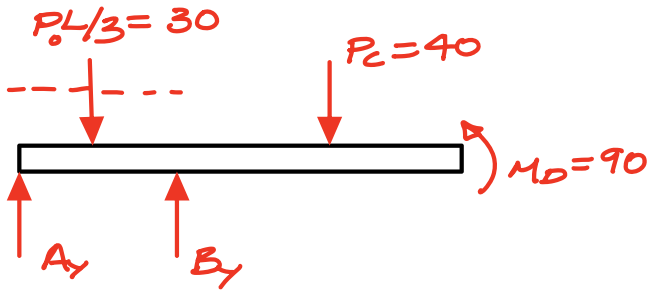
a) Determine the reactions at supports A and B.

b) Using the graphical construction method, determine the shear force $V(x)$ over the length of the beam. Sketch $V(x)$ in the plot axis shown below.

c) Using the graphical construction method, determine the bending moment $M(x)$ over the length of the beam. Sketch $M(x)$ in the plot axis shown below.

Use the following in your calculations: $L = 9\,ft$, $p_0 = 10\,kips/ft$, $P_C = 40\,kips$ and $M_D = 90\,ft \cdot kips$.

External reactions

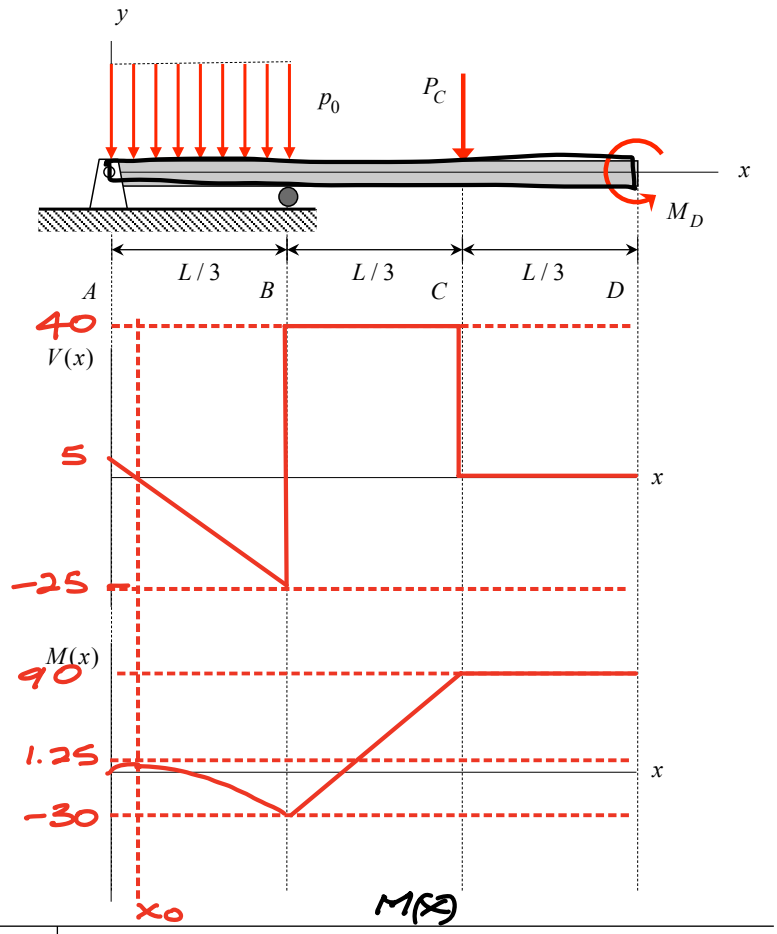


$$\Sigma M_A = -30\left(\frac{3}{2}\right) + B_y(3) - 40(6) + 90 = 0$$

$$\hookrightarrow B_y = 65\ kips$$

$$\Sigma F_y = A_y + B_y - 30 - 40 = 0$$

$$\hookrightarrow A_y = 5\ kips$$



V(x)

- $V(3^-) = V(0) + (-10)(3) = 5 - 30 = -25\ kips$
- $V(x_0) = V(0) + (-10)x_0 = 0$
  $\hookrightarrow x_0 = 5/10 = 0.5\,ft$
- $V(3^+) = V(3^-) + B_y = 40\ kips$
- $V(6^-) = V(3^+) - 40 = 0$
- $V(9) = V(6^-) = 0$ checks ✓ since $V = 0$ @ $x = 9\,ft$

M(x)

- $M(x_0) = M(0) + \frac{1}{2}(5)(0.5) = 1.25\ kip \cdot ft$
- $M(3) = M(x_0) + \frac{1}{2}(-25)(2.5)$
  $= 1.25 - 31.25$
  $= -30\ kip \cdot ft$
- $M(6) = M(3) + (40)(3)$
  $= -30 + 120 = 90\ kip \cdot ft$
- $M(9) = M(6) = 90\ kip \cdot ft$
  ℓ checks: $M(9) = M_D$