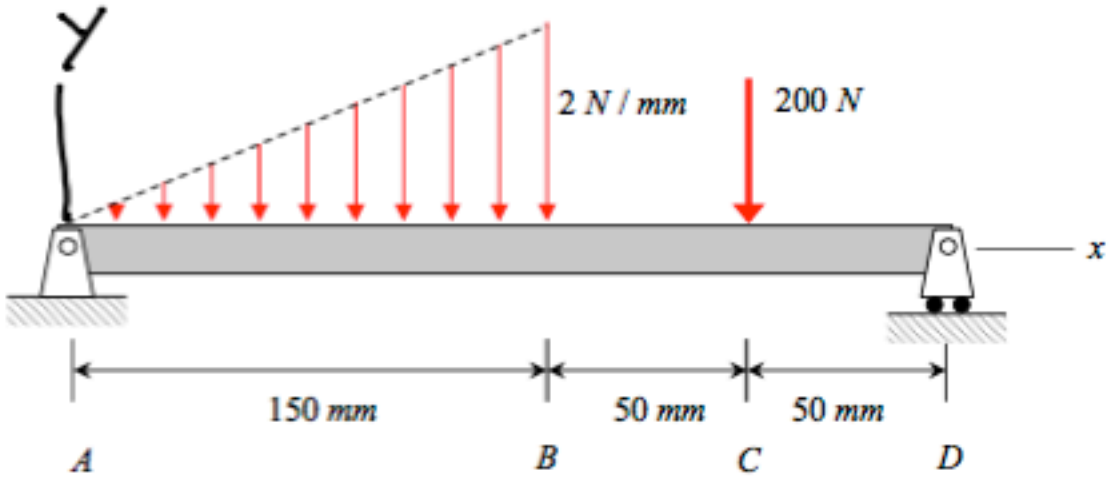
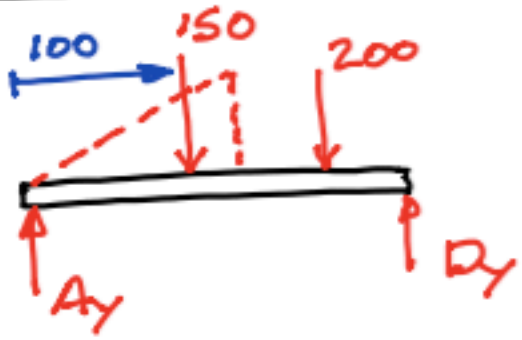
Example 9.5

Draw the shear force and bending moment diagrams in the plot axes below for the loaded beam shown.



External reactions

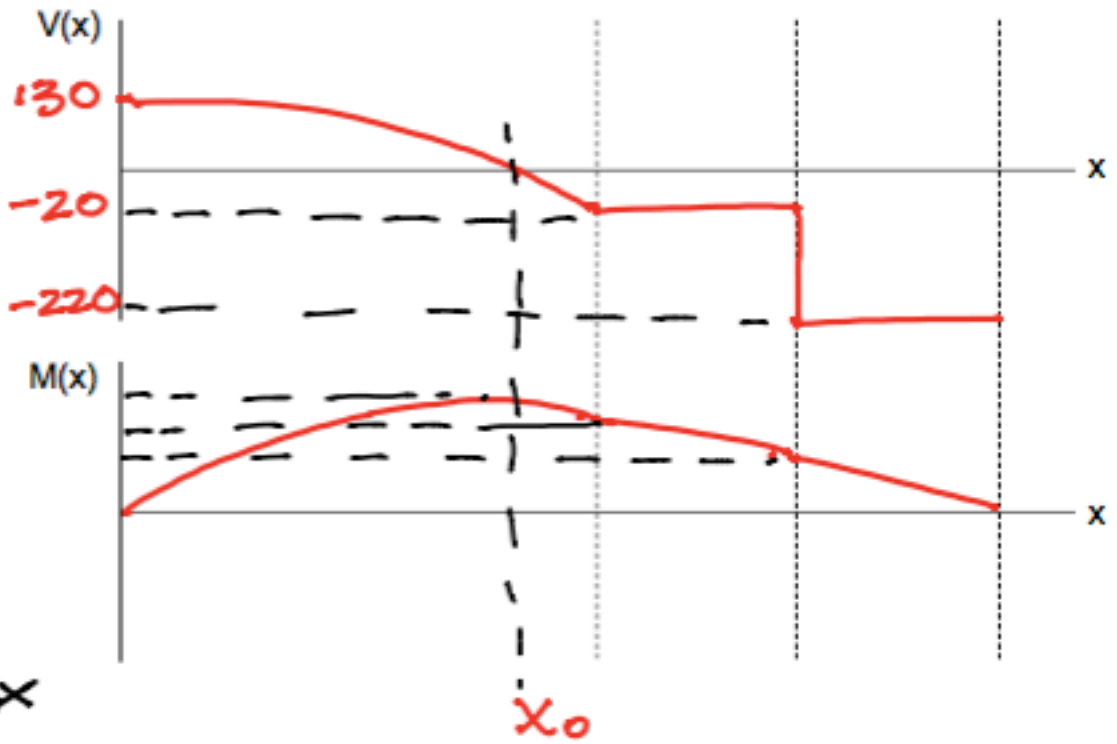


- $\Sigma M_A = -(150)(100) - (200)(200) + D_y(250) = 0$

↳ $D_y = 220\,N$

- $\Sigma F_y = A_y + D_y - 150 - 200 = 0$

↳ $A_y = 350 - D_y = 130$



AB

- $p(x) = -\frac{2}{150}x$
- $V(x) = V(0) + \int_0^x (-\frac{2}{150}x)\,dx$

$= A_y - \frac{2}{300}x^2$

$V(150) = 130 - \frac{1}{150}(150)^2 = -20$

- $V(x_0) = 0 = 130 - \frac{1}{150}x_0^2 \Rightarrow x_0 = 139.6\,mm$
- $M(x) = \cancel{M(0)}^{0} + \int_0^x (130 - \frac{1}{150}x^2)\,dx$

$= 130x - \frac{1}{450}x^3$

$M(150) = (130)(150) - \frac{150^3}{450} = 12000\,N\text{-}mm$

- $M(x_0) = (130)(139.6) - \frac{1}{450}(139.6)^3 = 12{,}102\,N\text{-}mm$

BC

- $V(200^-) = V(150) = -20$
- $M(200) = M(150) + (-20)(50) = 12000 - 1000 = 11000$

CD

- $V(200^+) = V(200^-) - 200 = -220$
- $V(250) = V(200^+) = -220$
- $M(250) = M(200) + (-220)(60)$

$= 11000 - 11000 = 0$ (✓ checks)