Lec20

Thursday, November 5, 2020 9:54 AM

Lecture Objectives

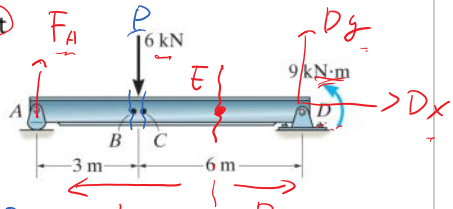
Internal Forces

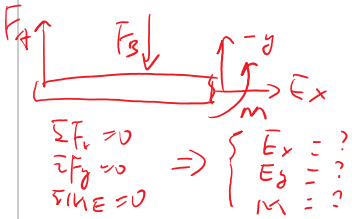
1

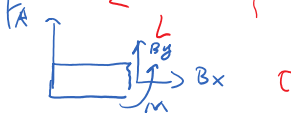
Procedure for analysis

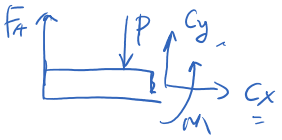
1. Find support reactions (free-body diagram of entire structure)
2. Pass an imaginary section through the member
3. Draw a free-body diagram of the segment that has the least number of loads on it
4. Apply the equations of equilibrium

Find the internal forces and moments at B (just to the left of P) and at C (just to the right of P)







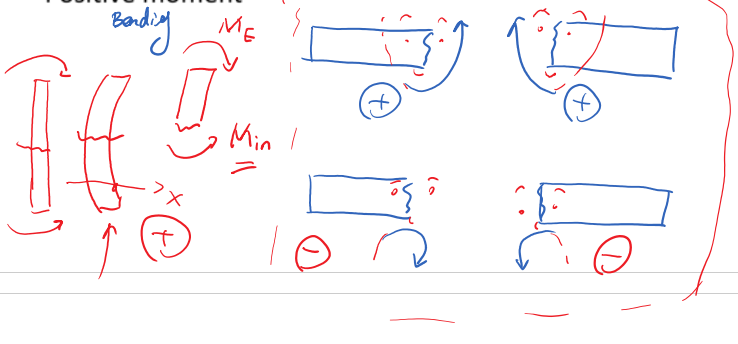


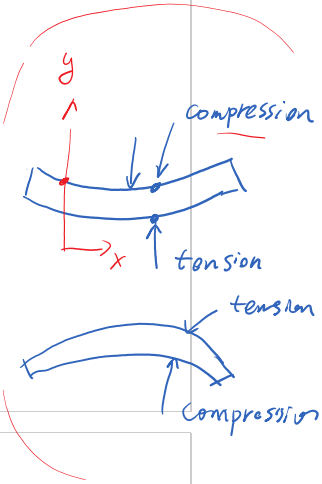
Sign conventions

Positive normal force

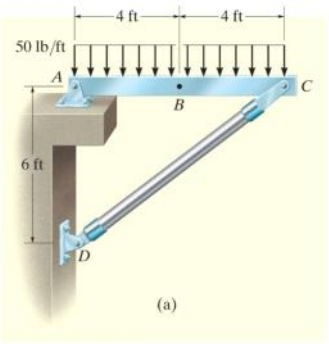
Positive shear force

Positive moment





Determine the normal force, shear force, and bending moment at *B*.



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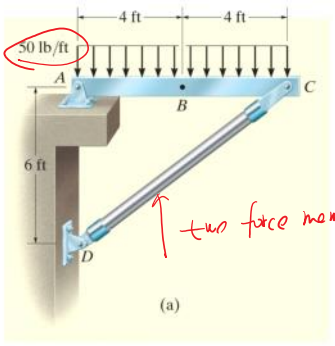
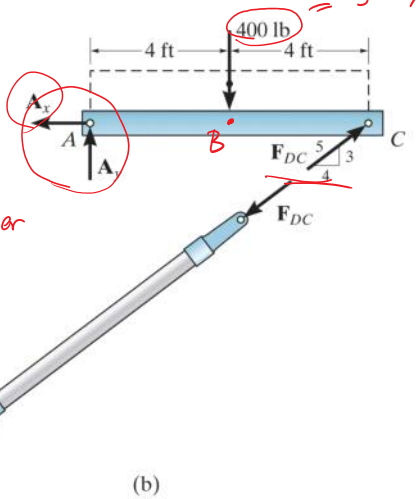


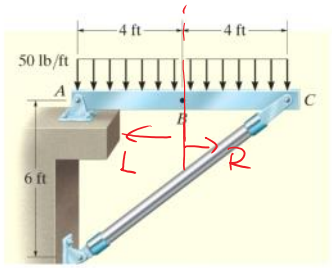
two force member

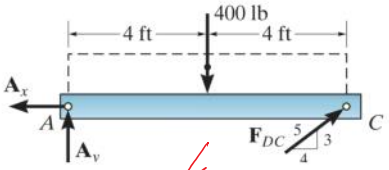


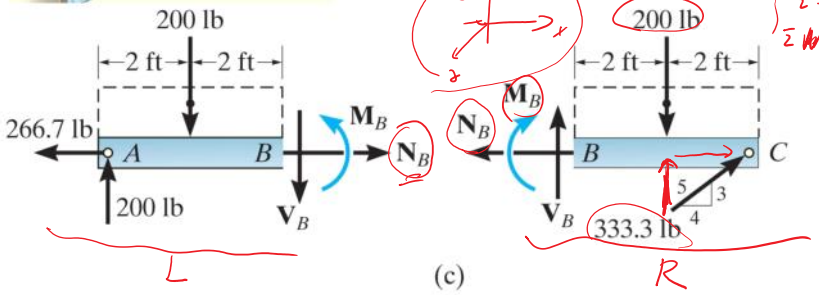
(b)

$\Sigma F_x = 0$
$\Sigma F_y = 0$ $\Rightarrow$ $F_{DC} = ?$, $A_x = ?$, $A_y = ?$
$\Sigma M_A = 0$

Determine the normal force, shear force, and bending moment at B.







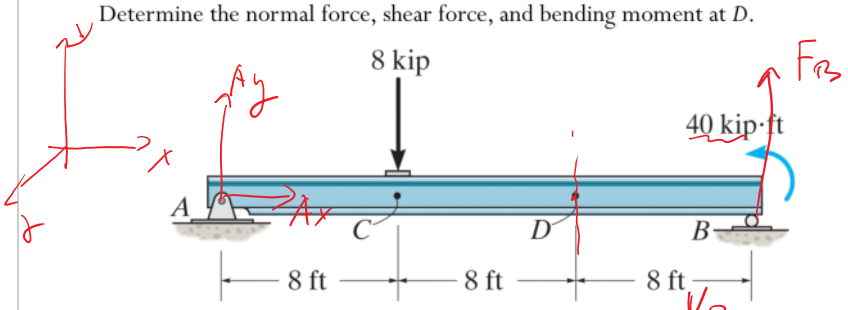
L (c) R

$\Sigma F_x = 0$
$\Sigma F_y = 0$ $\Rightarrow$
$\Sigma M_B = 0$

$$\begin{cases} -N_B + 333.3\,\frac{4}{5} = 0 \\ -200 + V_B + 333.3\,\frac{3}{5} = 0 \\ -M_B - 200 \cdot 2 + 333.3 \cdot \frac{3}{5} \cdot 4 = 0 \end{cases}$$

$\Rightarrow$ $N_B = ?$ (+), $V_B = ?$, $M_B = ?$

Determine the normal force, shear force, and bending moment at D.

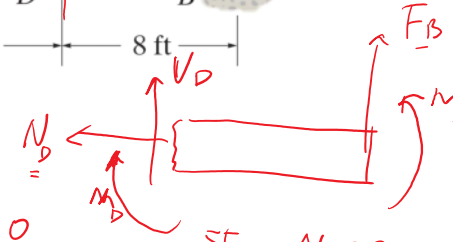


$\Sigma F_x = A_x = 0$

$\Sigma F_y = A_y - 8 + F_B = 0$

$\Sigma M_A = -8 \cdot 8 + F_B \cdot 24 + 40 = 0$

$\Rightarrow \begin{cases} A_y = ? \\ F_B = ? \end{cases}$

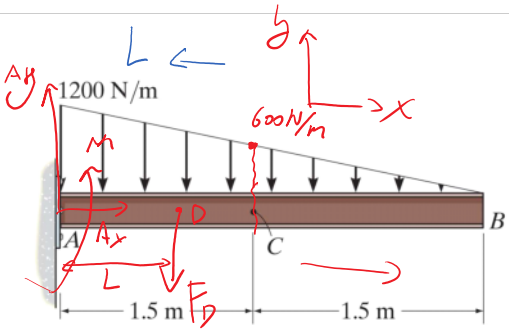


$\Sigma F_x = N_D = 0$

$\Sigma F_y = F_B + V_D = 0$

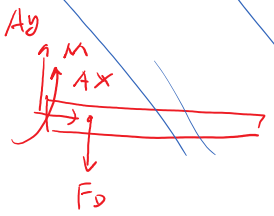
$\Sigma M_D = -M_D + F_B \cdot 8 + M = 0$

$\Rightarrow \begin{cases} V_D = ? \\ M_D = ? \end{cases}$



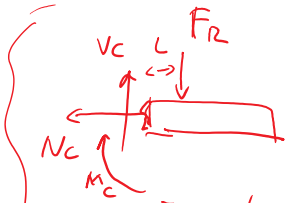
$F_D = \frac{1}{2} 1200 \cdot 3 = 1800N$

$L = \frac{1}{3} 3 = 1m$



$\Rightarrow \begin{cases} A_x = 0 \\ A_y = F_D \\ M = F_D \cdot L \end{cases}$

Determine the normal force, shear force, and bending moment at C of the beam.



$F_R = \frac{1}{2} \cdot 600 \cdot 1.5 = 450N$

$L = \frac{1}{3} \cdot 1.5 = 0.5\ m$

$N_C = ?$

$V_C = ?$

$M_C = ?$

Determine the normal force, shear force, and bending moment at C.