Announcements

- Check course schedule for assignments, activities and written exams dates (especially if you're in TAM 210)

❑ Upcoming deadlines:

- Friday (10/19)
  - Written Assignment
- Tuesday (10/23)
  - PrairieLearn HW

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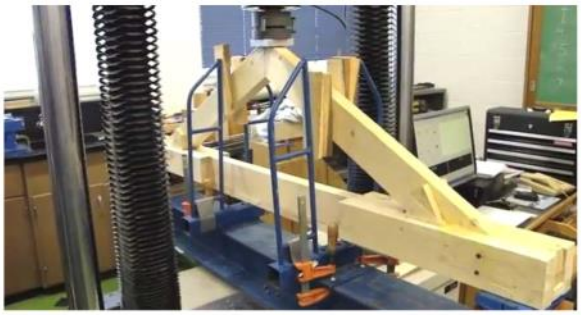
Recap: Internal Loadings

Structural Design: need to know the loading acting within the member in order to be sure the material can resist this loading



Objective

- Determine the internal loadings in members using the method of sections

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Internal Forces and Moment

Normal force (**N**):

Shear force (**V**):

Bending moment (**M**):

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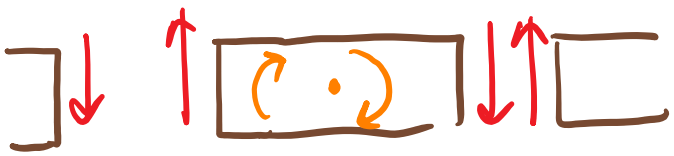
Sign conventions

Positive normal force

* Pointing away from the body

Positive shear force



* creates a clockwise rotation on the body

Positive moment

* smiley face ☺

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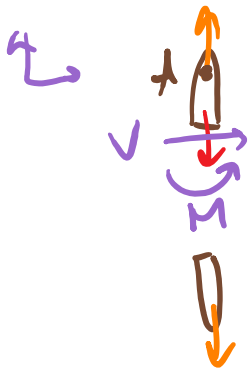

$\Sigma F_x = \boxed{V = 0}$

ΣF_y

$\Sigma M_A = M + Vd = 0$

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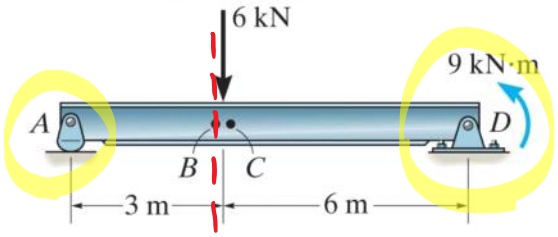
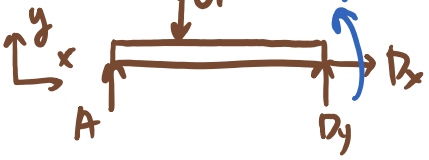
Procedure for analysis

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

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



1) FBD



EoE

$\Sigma F_x = \boxed{D_x = 0}$ $\Sigma F_y = A - 6kN + D_y = 0 \rightarrow \boxed{D_y = 1kN}$

$\Sigma M_D = (6kN)(6m) - A(9m) + 9kN\cdot m = 0$

$\rightarrow \boxed{A = 5kN}$

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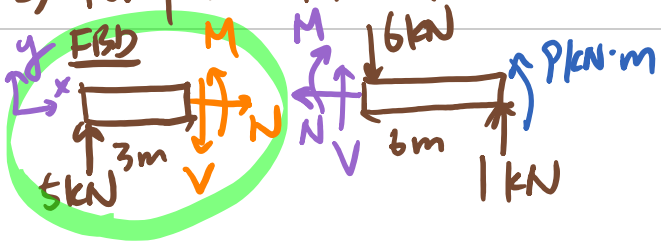
2) For point B, make a cut at ! B.



EoE for left piece

$\Sigma F_x = \boxed{N = 0}$

$\Sigma F_y = 5kN - V = 0 \rightarrow \boxed{V = 5kN}$

$\Sigma M_A = -V(3m) + M = 0$

$\boxed{M = 3V = 15\ kN\cdot m}$

Find V using the right piece

EoE

$\Sigma F_y = V - 6kN + 1kN = 0$

$\rightarrow \boxed{V = +5\ kN}$

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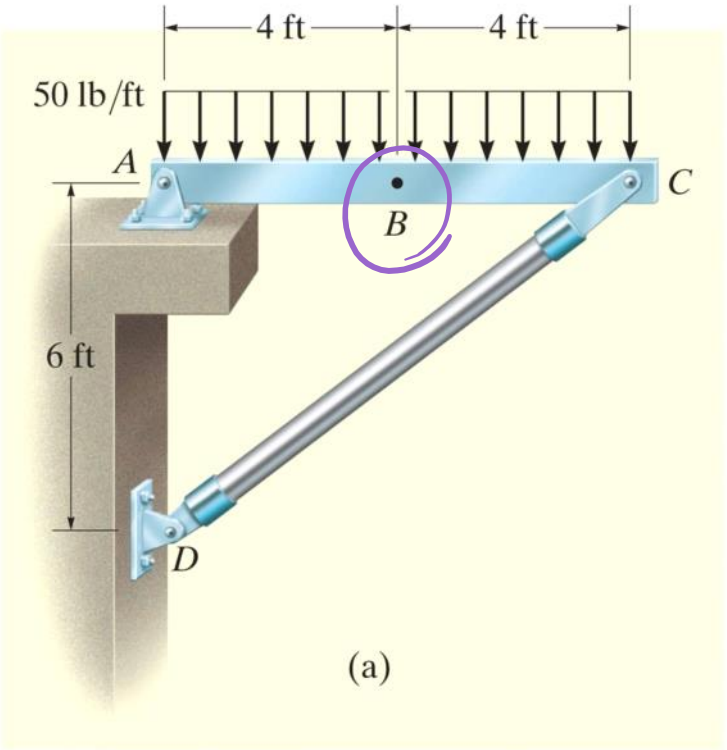
Determine the normal force, shear force, and bending moment at *B*.



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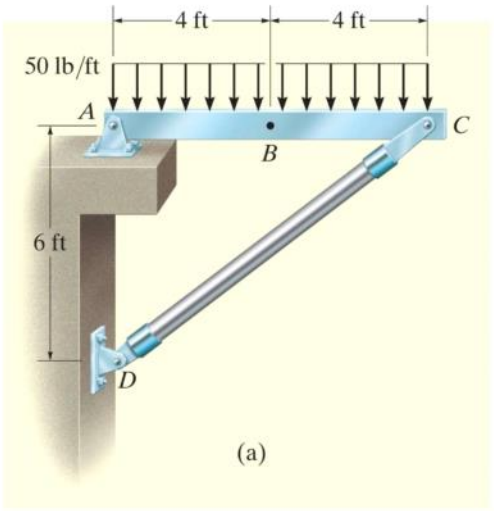
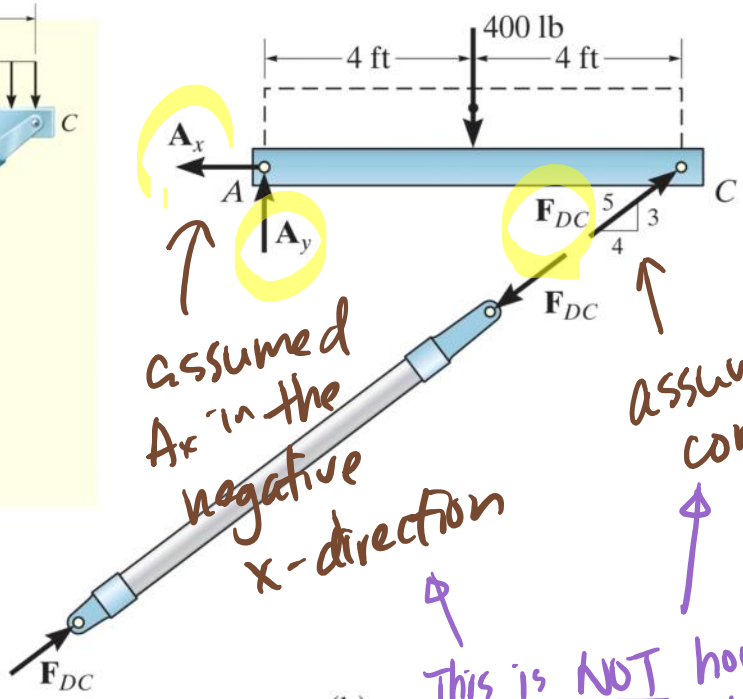
Determine the normal force, shear force, and bending moment at *B*.





assumed A_x in the negative x-direction

assumed compression

This is NOT how we recommend you to solve problems, it's for illustration only.

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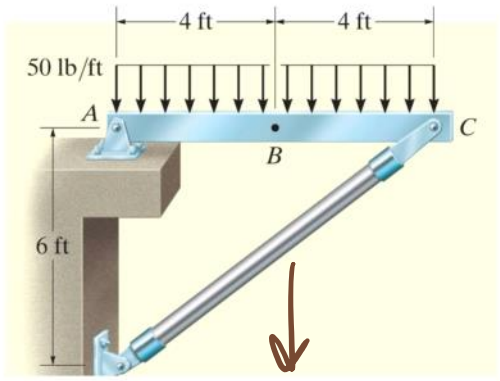
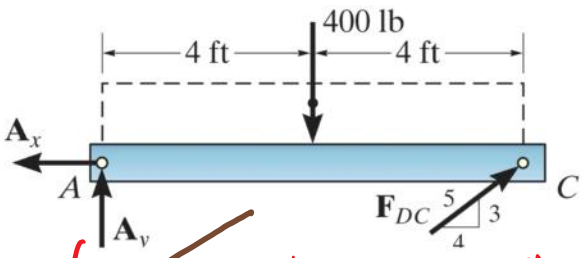
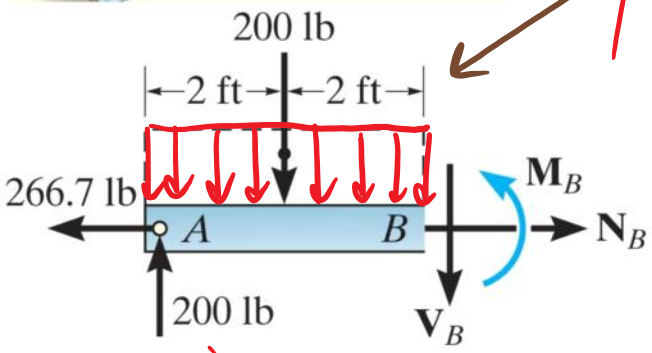
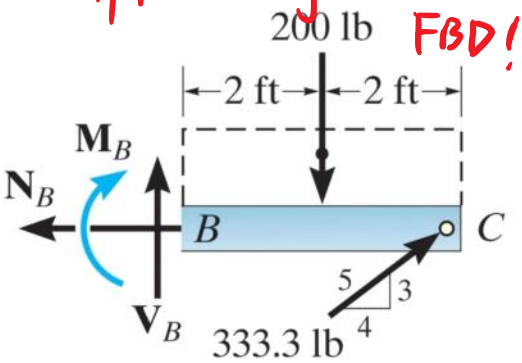
Determine the normal force, shear force, and bending moment at *B*.

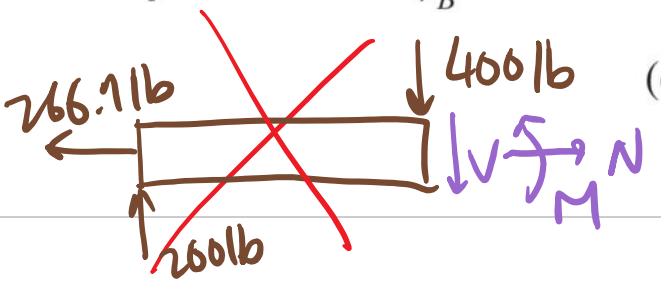




Do not use the "equivalent" system to generated the section FBD!







(c)

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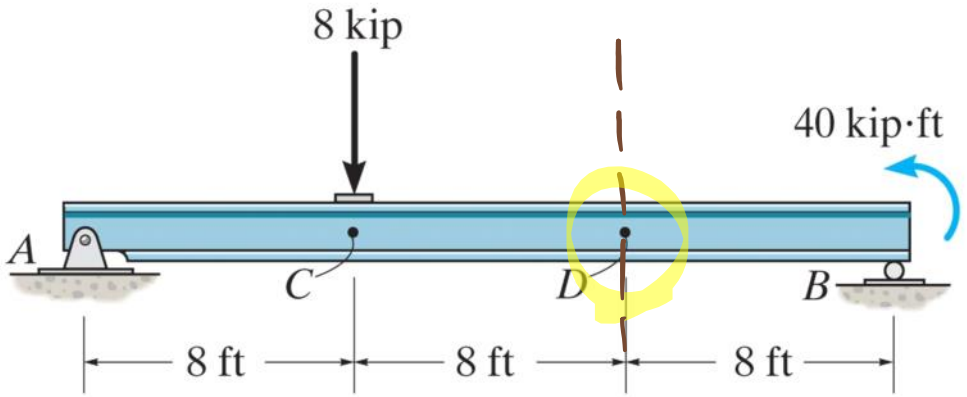
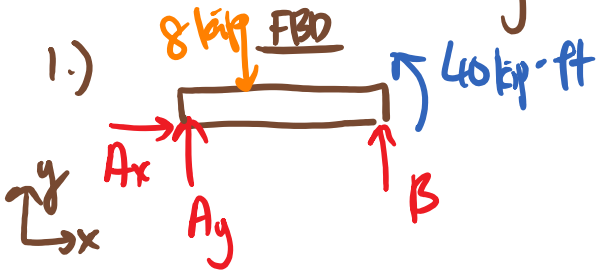
Determine the normal force, shear force, and bending moment at D.



* Focus on the right piece → we only need B support.

1.) 8 kip FBD



EoE

$\Sigma M_A = -8\,\text{kip}(8\,\text{ft}) + B(24\,\text{ft}) + 40\,\text{kip}\cdot\text{ft} = 0$

$\rightarrow \boxed{B = 1\,\text{kip}}$

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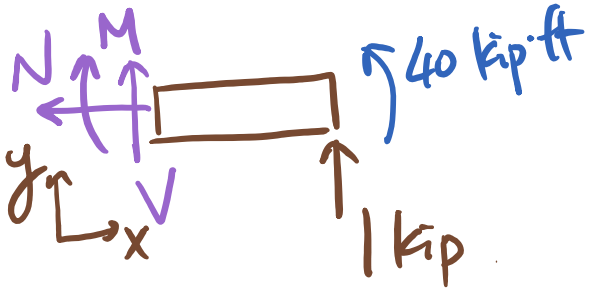
2) FBD (right piece)



EoE

$\Sigma F_x = -N = 0$

$\Sigma F_y = V + 1\,\text{kip} = 0$

$\Sigma M_B = 40\,\text{kip ft} - M - V(8\,\text{ft}) = 0$

$\rightarrow \boxed{N = 0}$ $\boxed{V = -1\,\text{kip}}$

$\boxed{M = 48\,\text{kip}\cdot\text{ft}}$