wc21lect

Tuesday, October 17, 2017 1:59 PM

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Announcements

- Quiz 3 pick-up during office hours (Grainger 429)
  - Wednesday 4-9 pm (10/18)
  - Thursday 4-9 pm (10/19)

Quiz 4

- Upcoming deadlines:
- Wednesday (10/18) – Today!
  - PL HW14
- Thursday (10/19)
  - ME HW15

imgur.com/bsFJm

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Lecture Feedback Summary

I will…

- Be more organized and systematic
- Put more emphasis on key concepts
- Show more variety in examples
- Have more i-Clickers problems

It would be helpful if the class…

- Choose to engage — take notes. — ask Q's
- Be mindful of other students
- Take advantage of other resources

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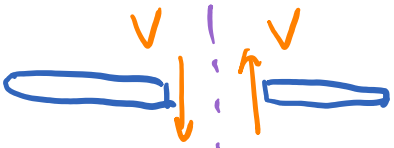
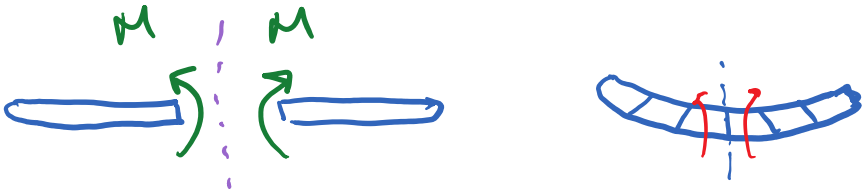
Internal Forces and Moment

Normal force (**N**): force perpendicular to the cut. (prevent translation between bodies)

Shear force (**V**): force parallel to the cut (prevent translation between bodies)



Bending moment (**M**): moment to prevent rotation and deformation.



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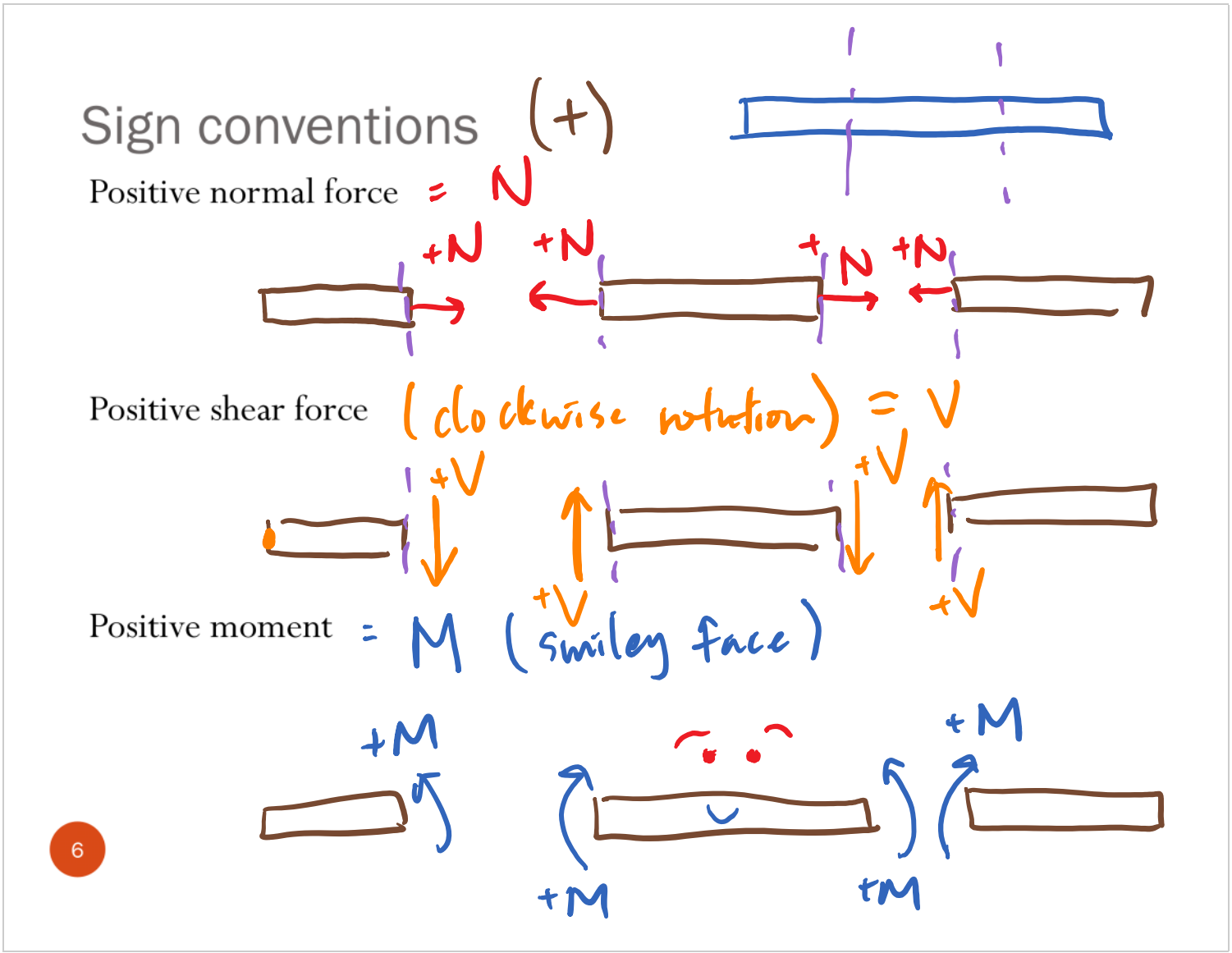
Sign conventions (+)
Positive normal force = N
+N
+N
+N
+N
Positive shear force (clockwise rotation) = V
+V
+V
+V
+V
Positive moment = M (smiley face)
+M
+M
+M
+M
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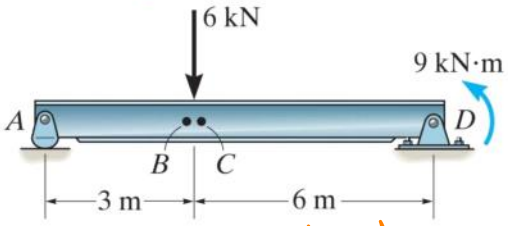
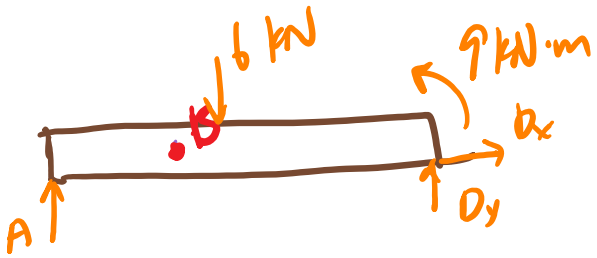
Procedure for analysis

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

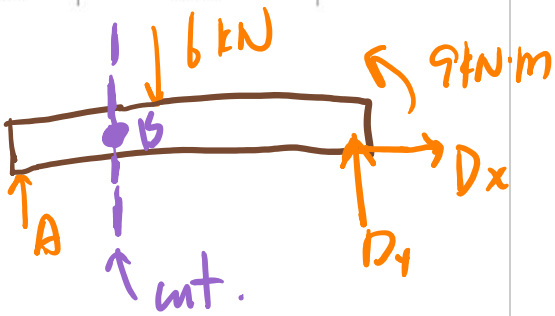
Example: Find the internal forces and moments at B (just to the left of P) and at C (just to the right of P)



1.) Find A, D_x, D_y



2)



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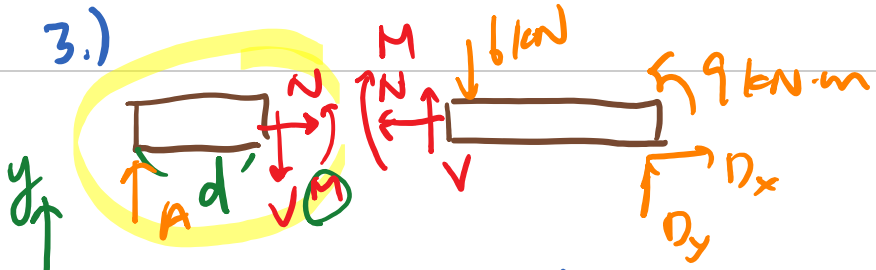
3.)



Choose left piece for least loads.

4.) Write EoE for the left piece

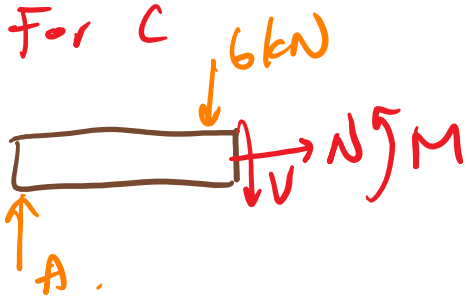
$$\Sigma F_x = N = 0$$

$$\Sigma F_y = A - V = 0$$

$$\Sigma M_A = -Vd + M = 0$$

Solve for N, V, M.

For C



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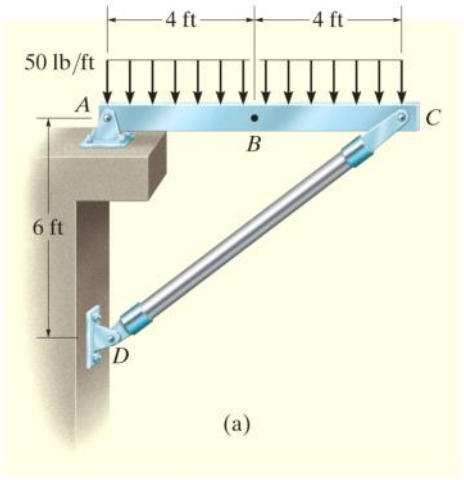
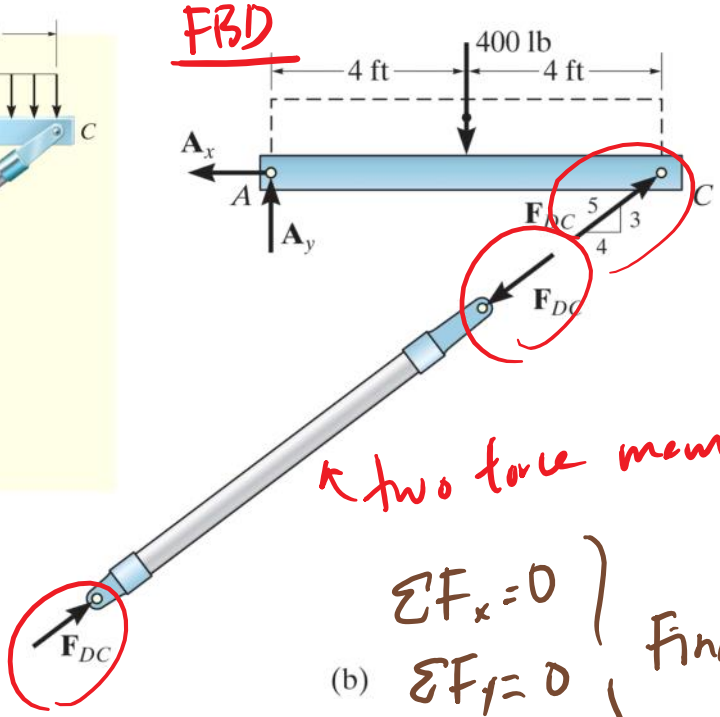
Determine the normal force, shear force, and bending moment at *B*.



FBD



(b)

← two force member : known force direction

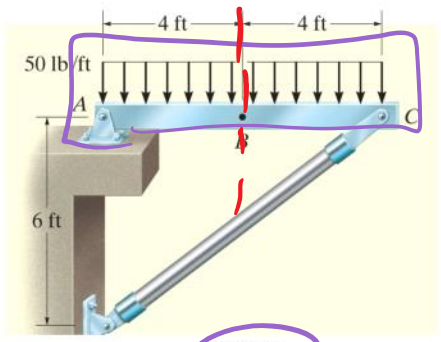
$\Sigma F_x = 0$

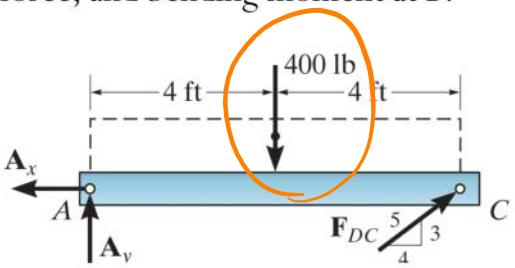
$\Sigma F_y = 0$

$\Sigma M_A = 0$

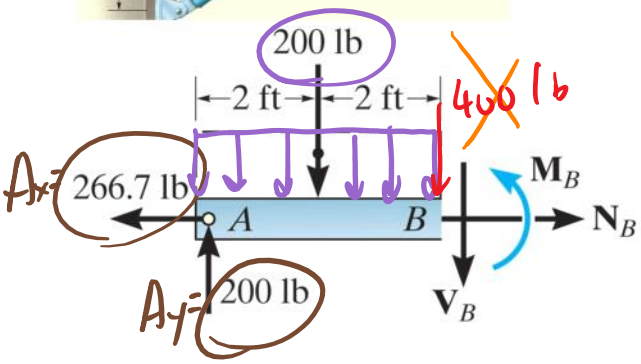
Find A_x, A_y, F_{DC}

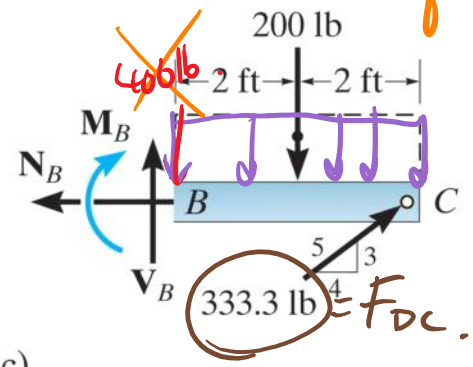
Determine the normal force, shear force, and bending moment at B.





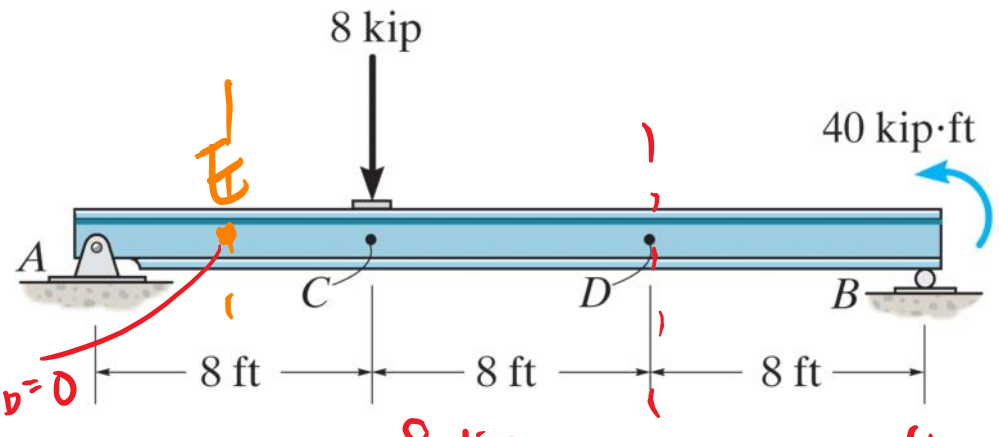
Note: Do NOT use equivalent forces on the segments.





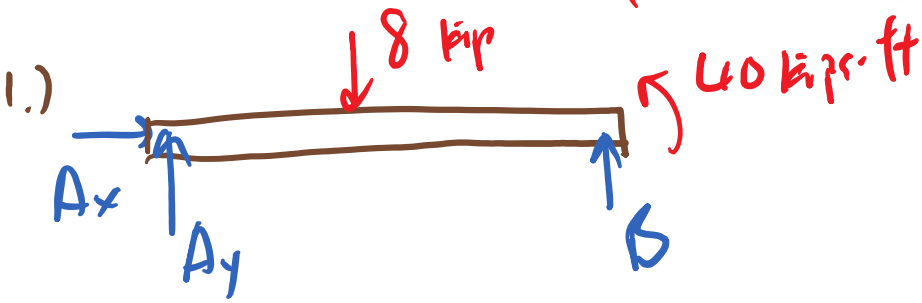
(c)

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



$N_E = N_D = 0$

1.)



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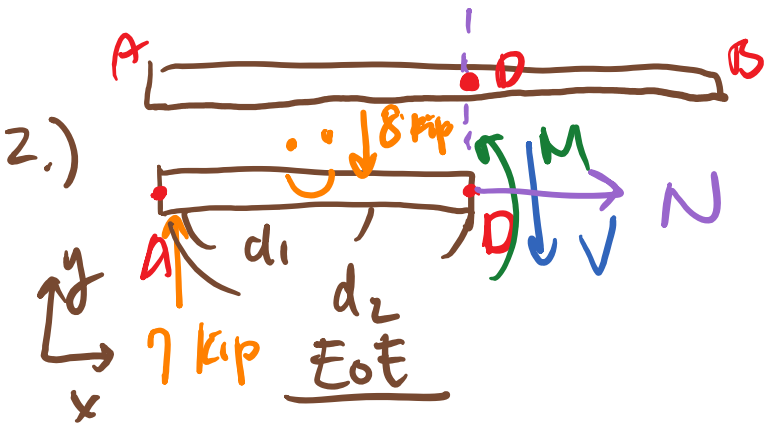
$\Sigma F_x = 0$ $\Sigma F_y = 0$ $\Sigma M_A = 0$ $\Rightarrow$ $A_x = 0$, $A_y = 7$ kip, $B = 1$ kip.

2.)



$\Sigma F_x = N = 0$

$$\Sigma F_y = A - 8\,\text{kip} - V = 0$$

$$\boxed{V = A - 8\,\text{kips} = -1\,\text{kip}}$$

or $\boxed{V = 1\,\text{kip} \uparrow}$

$$\Sigma M_A = M - 8 d_1 - V d_2 = 0$$

$$\boxed{M = 48\ \text{kips-ft}}$$