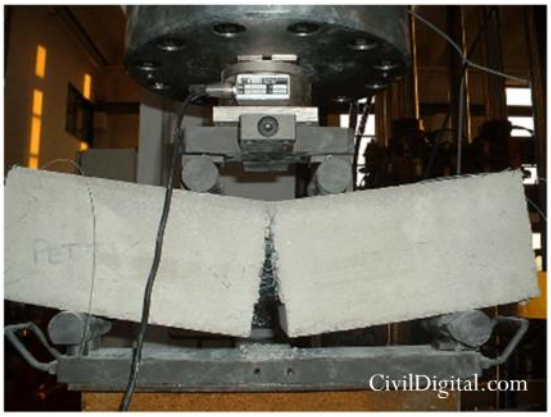
Announcements

- In-class Written Quiz 4 (No CBTF) – Friday, October 26
  - 50 minutes: arrive early – we will start on time!
  - Must attend registered lecture section.
  - Bring student ID card.
  - Closed book, closed notes. Calculators allowed.
  - Extra office hour by Dr. Richard Keane: Thu. (10/25), 7-10pm
  - DRES accommodations must be made with DRES office before Wednesday (10/24), schedule the quiz for Friday (10/26) afternoon.
  - Conflict quiz must be scheduled before Wednesday (10/24) upon excused absence request approval.

- ❑ Upcoming deadlines:
- Tuesday (10/23)
  - PL HW

1

Recap: Internal Forces and Moment

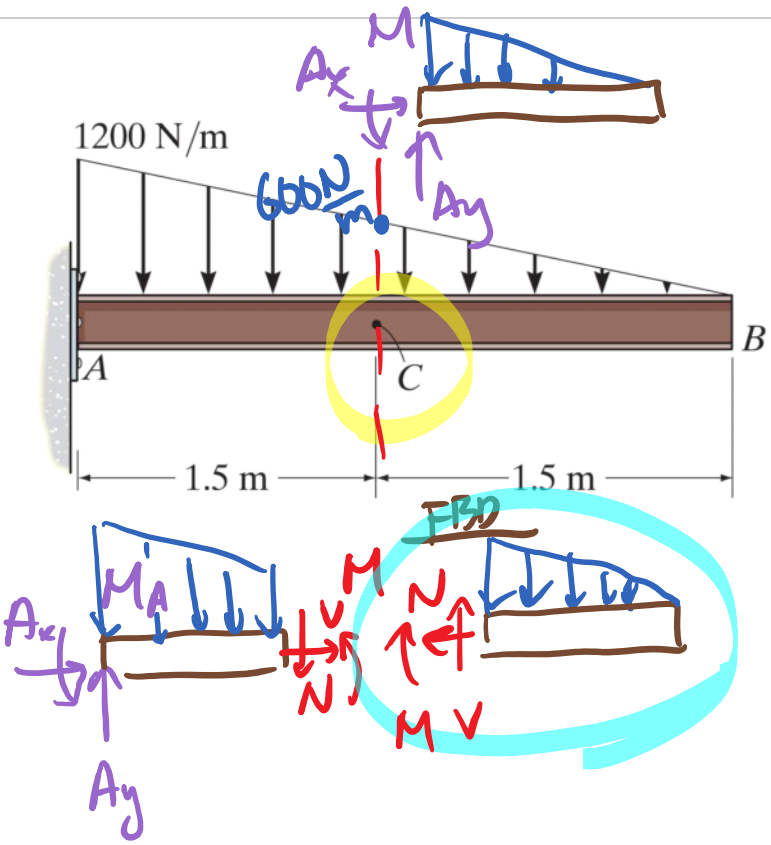


Normal Force (N)

Shear Force (V)

Bending Moment (M)

2



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

2.) FBD (no distributed loads)

$F_R = (600\ N/m)(1.5m)\frac{1}{2}$

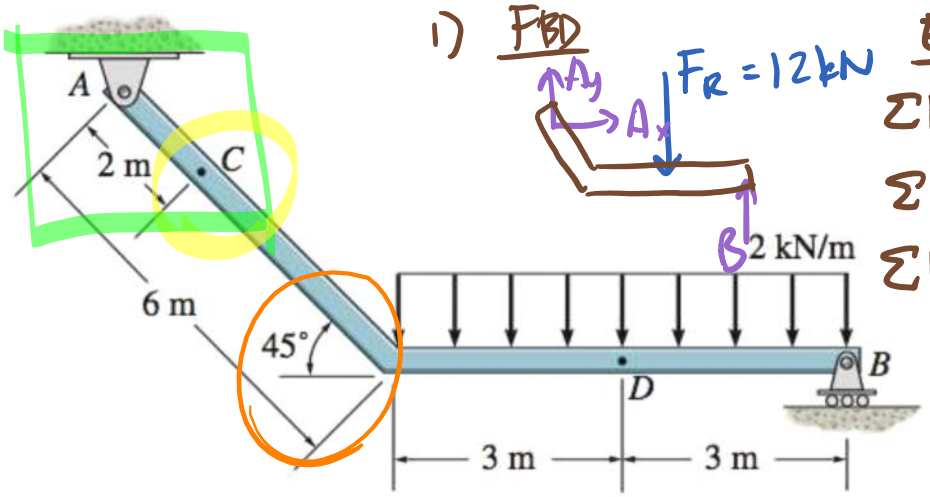
EoE

$\Sigma F_x = -N = 0$

$\Sigma F_y = V - F_R = 0$

$\Sigma M_C = -M - F_R(0.5m) = 0$

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



1) FBD

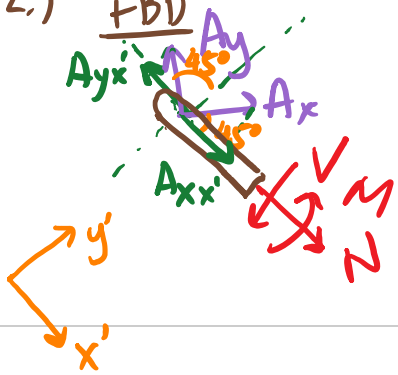
EoE

$\Sigma F_x = A_x = 0$

$\Sigma F_y = A_y - F_R + B$

$\Sigma M_A = -F_R(6\cos 45° + 3) + B(6\cos 45° + 6) = 0$

2.) FBD



EoE

$\Sigma F_{x'} = A_x \cos 45° - A_y \sin 45° + N = 0$

$\Sigma F_{y'} = A_x \sin 45° + A_y \cos 45° - V = 0$

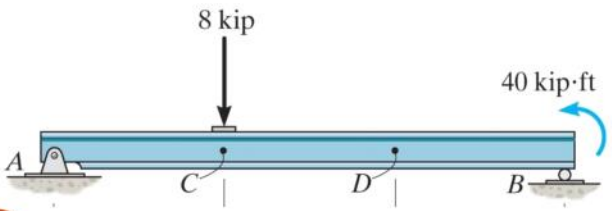
$\Sigma M_A = -V(2m) + M = 0$

Friday, October 19, 2018 11:56 AM

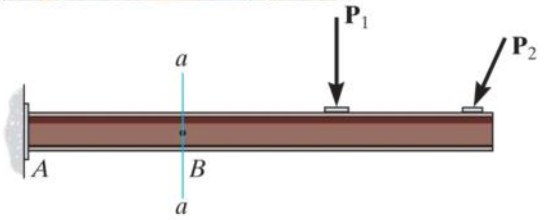
Shear and Moment Diagram

Beams: structural members designed to support loadings applied perpendicular to their axes.

Simply supported beam



Cantilever beam



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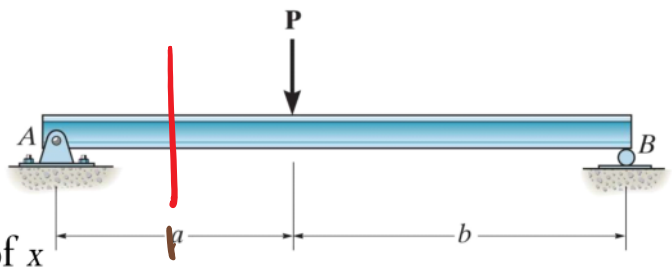
Shear and Moment Diagram

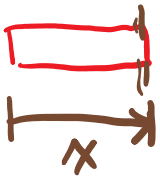
Goal: provide detailed knowledge of the variations of internal loadings (V and M) throughout the beam

Procedure

1. Find support reactions (free-body diagram of entire structure)
2. Specify coordinates x
3. Divide the beam into regions
4. Draw FBD of a segment
5. Apply equations of equilibrium to derive V and M as functions of x



always pick the left piece



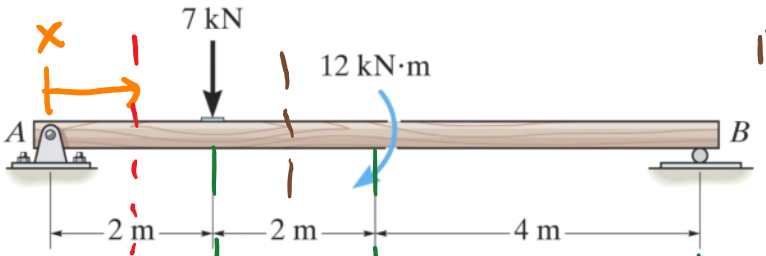
↑ always measure from the left end of the beam

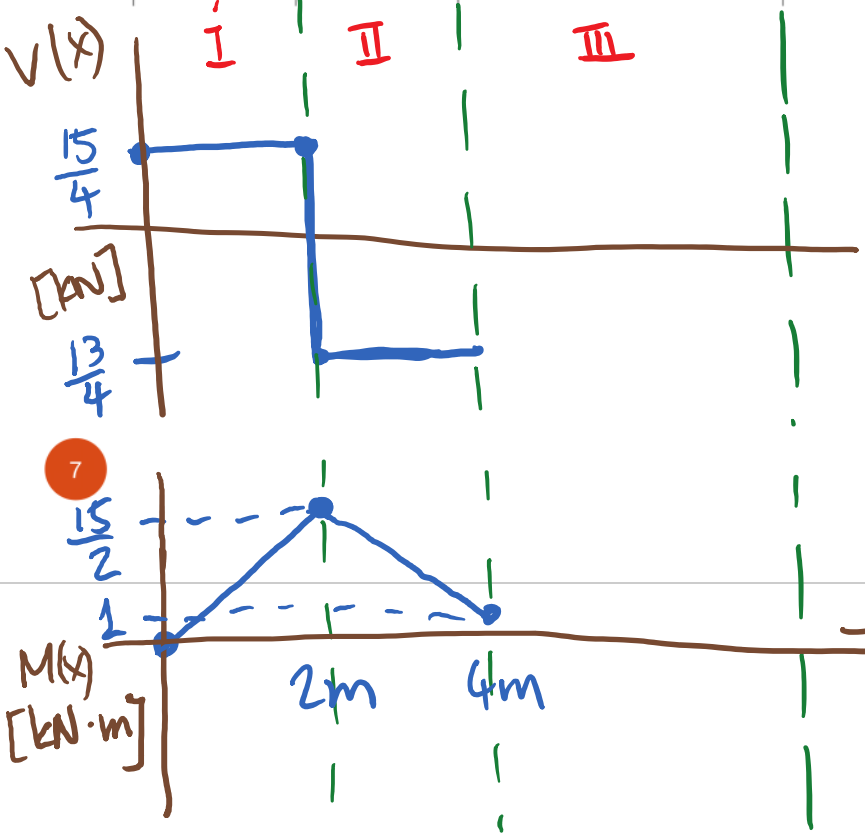
6

→ Repeat steps 4 & 5 for each "region" from step 3.

Shear and Moment Diagram

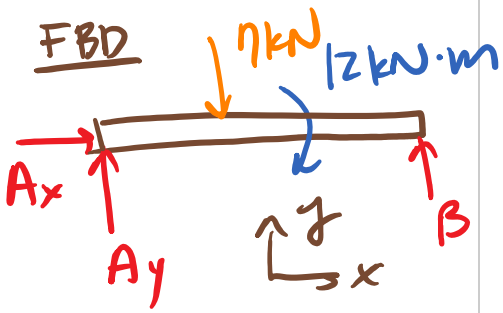
Draw the shear and moment diagrams for the beam.





1) Find rxn support.

FBD



EoE

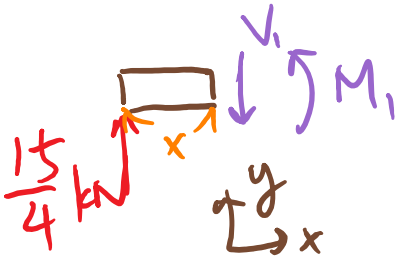
$\Sigma F_y = A_y - 7\,kN + B = 0$

$\Sigma M_A = (-7\,kN)(2m) - 12\,kN\cdot m + B(8m) = 0$

$\rightarrow B = \frac{26}{8}\,kN = \frac{13}{4}\,kN$

$A_y = \left(7 - \frac{26}{8}\right)kN = \frac{15}{4}\,kN$

I. FBD



EoE

$\Sigma F_y = A_y - V_1 = 0$

$\rightarrow V_1 = A_y = V_1(x)$

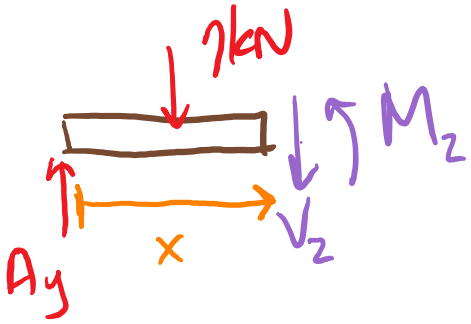
$\Sigma M_A = -V \cdot x + M_1 = 0$

$\rightarrow M_1 = V_1 \cdot x = \boxed{A_y x = M_1(x)}$

- Find the value of M_1 at $x = 2m$:

$M(2m) = \frac{15}{4}(2)\ kN \cdot m$

II. FBD



EoE

$\Sigma_i F_y = A_y - 7kN - V_2 = 0$

$\rightarrow V_2 = A_y - 7kN = \frac{-13}{4}\ kN$

$\Sigma M_A = -(7kN)(2m) - V_2 x + M_2 = 0$

$\rightarrow M_2 = 14kN \cdot m + \left(\frac{-13}{4}\right)x.$

- Find M_2 at $x = 2m$ and $x = 4m$

$M_2(2m) = 14 - \frac{13}{4}(2) = \frac{15}{2}\ kN \cdot m$

$M_2(4m) = 14 - \frac{13}{4}(4) = 1\ kN \cdot m$