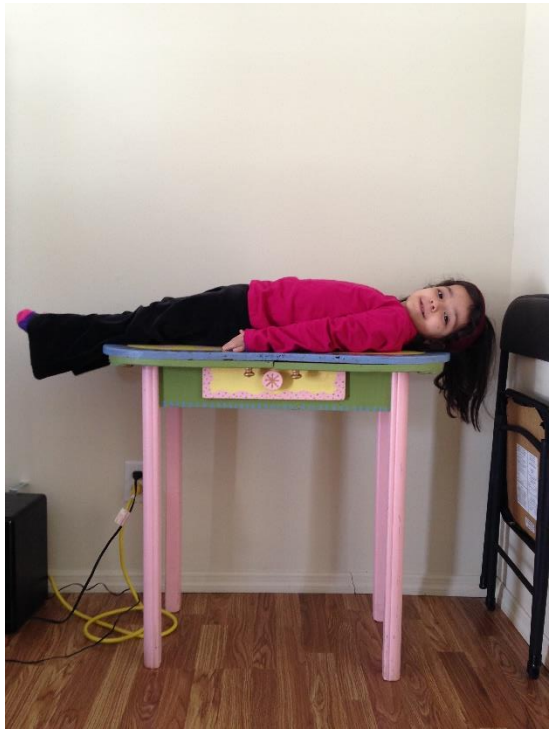
Chapter 7: Internal Forces



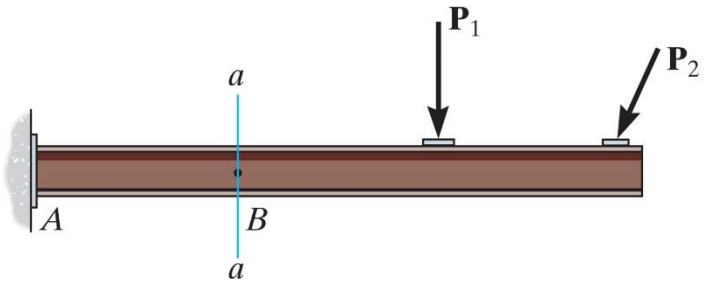
- Reaction forces in each leg approximately the same in both loading scenarios

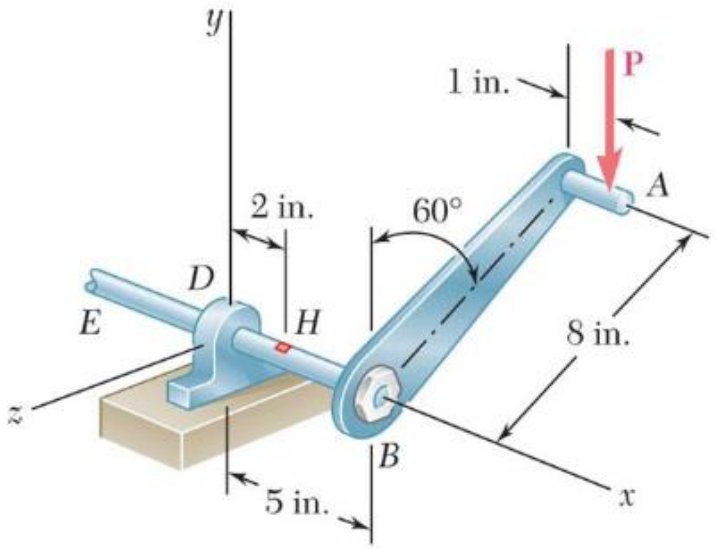
- However, each location of the table top experiences different values for the internal forces

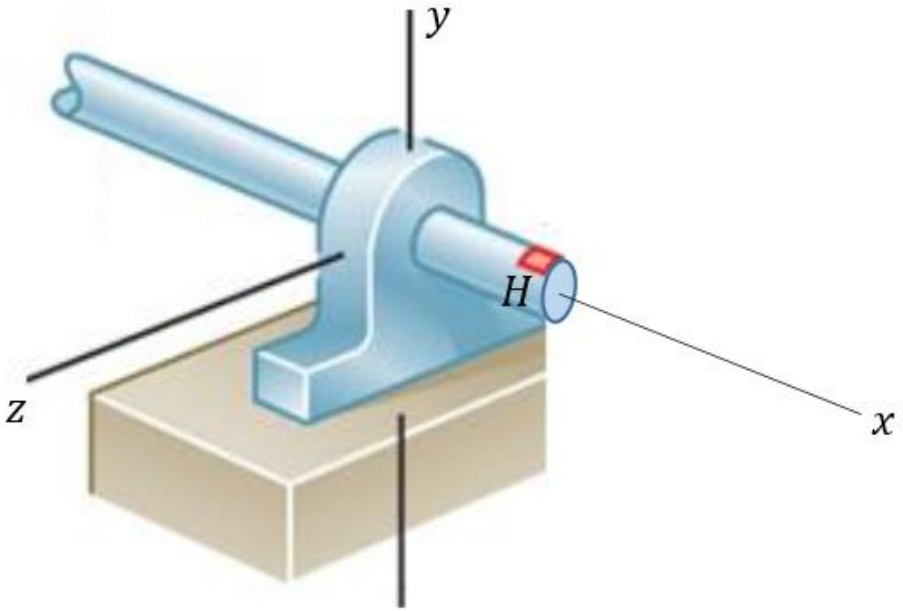
Internal loadings developed in structural members

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

Cutting members at internal points reveal **internal forces and moments.**




y
1 in.
P
A
2 in.
60°
D
E
H
8 in.
z
B
5 in.
x

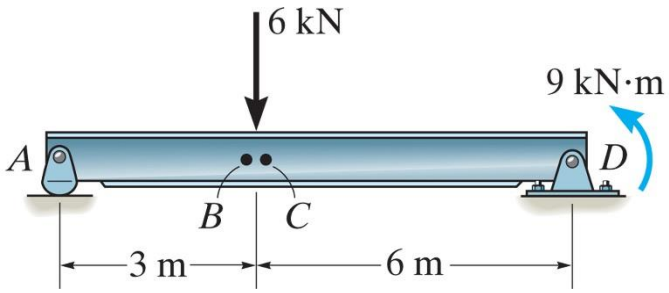

y
H
z
x

Sign conventions:

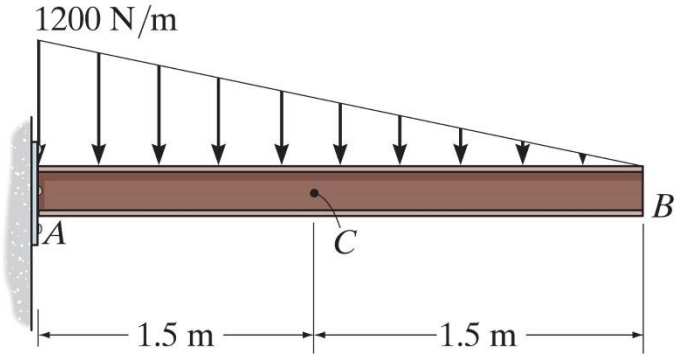
Procedure for analysis:

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

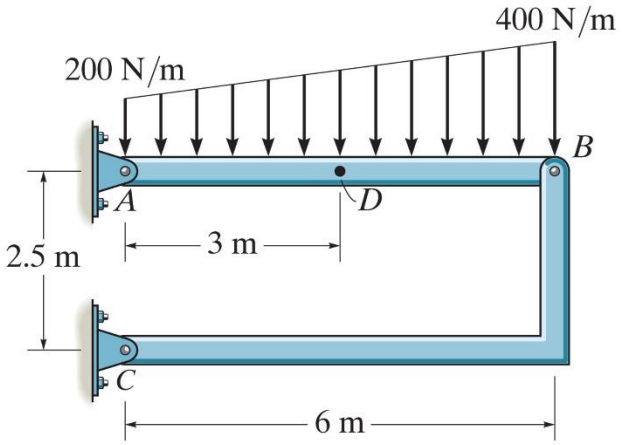
Find the internal forces and moments at B (just to the left of P) and at C (just to the right of P)



Find the internal forces and moments at C

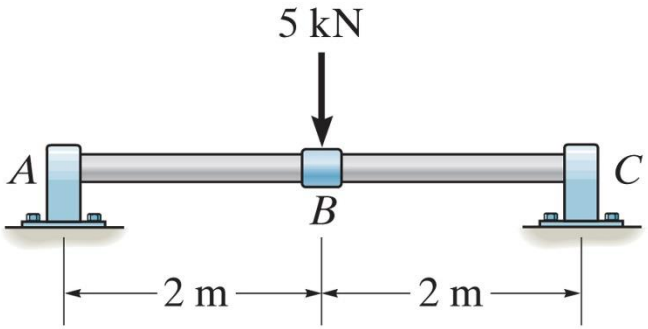


Find the internal forces and moments at D

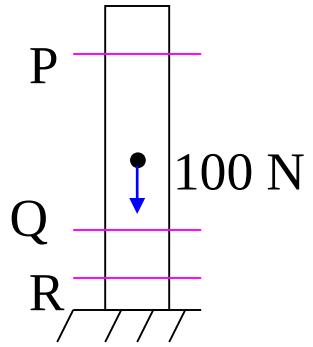


Shear and Moment Equations and Diagrams

The variation in shear force $V(x)$ and bending moment $M(x)$ along a beam is often of interest. The relations for $V(x)$ and $M(x)$ are found from force and moment equilibrium, respectively



1. A column is loaded with a vertical 100 N force. At which sections are the internal loads the same?



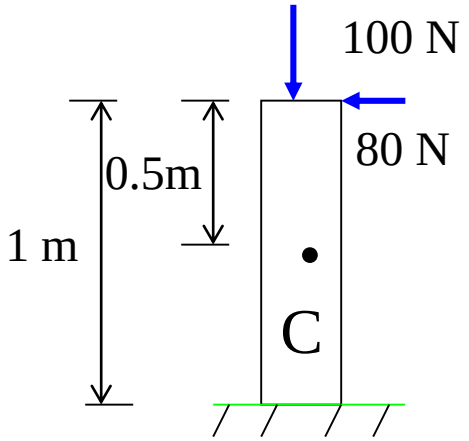
A) P, Q, and R

B) P and Q

C) Q and R

D) None of the above.

2. Determine the magnitude of the internal loads (normal, shear, and bending moment) at point C.

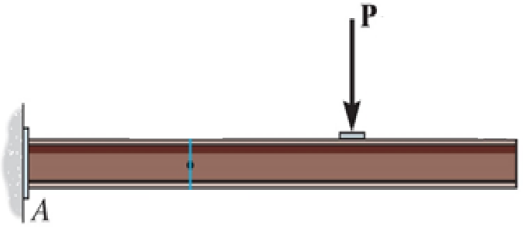


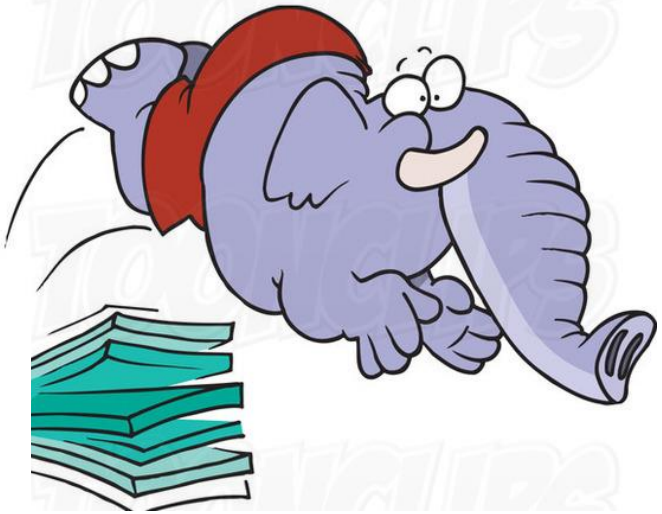
A) (100 N, 80 N, 80 N m)

B) (100 N, 80 N, 40 N m)

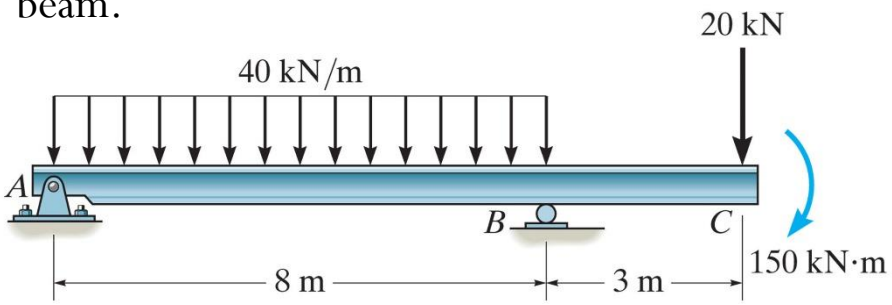
C) (80 N, 100 N, 40 N m)

D) (80 N, 100 N, 0 N m)


P
A



Obtain the expressions for V(x) and M(x) and draw the shear and bending moment diagram for the beam.



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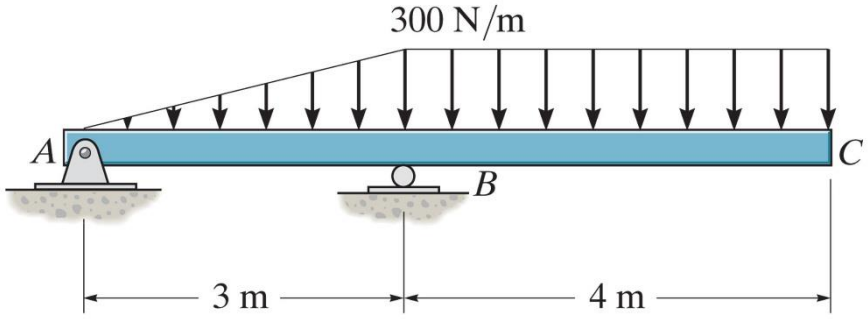
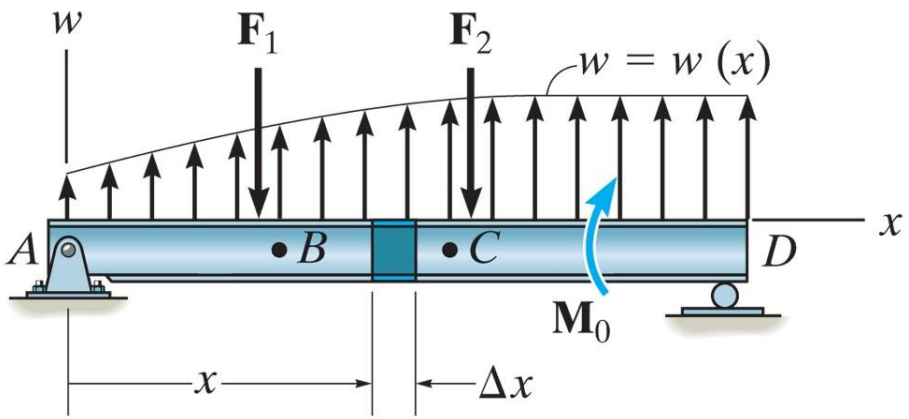
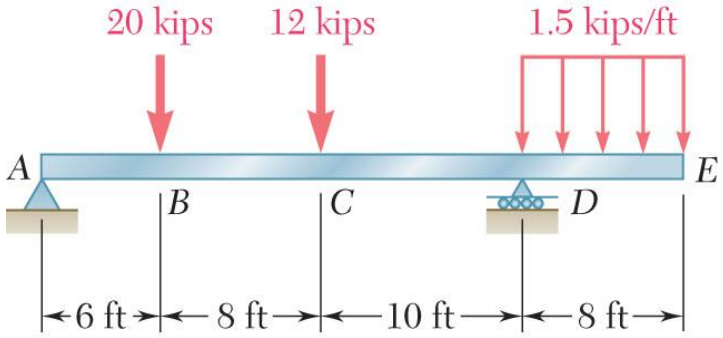


Relations Among Load, Shear and Bending Moments



Draw the shear and bending moment diagrams for the beam and loading shown.



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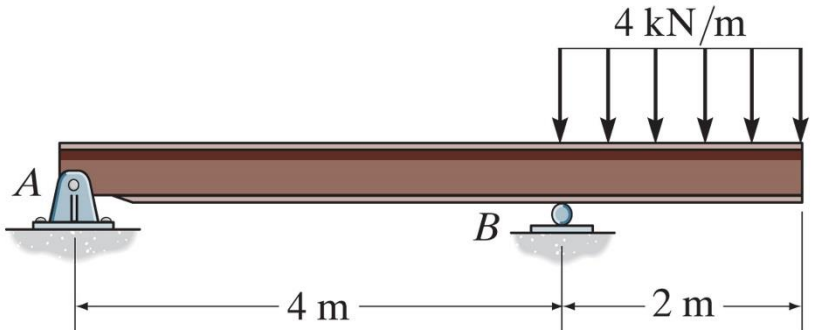

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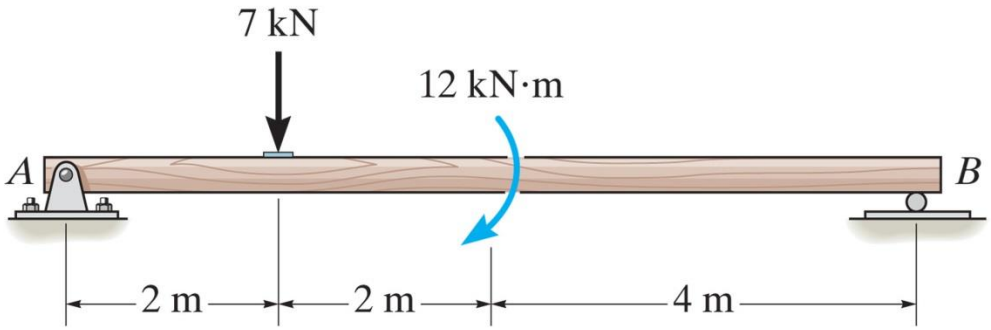

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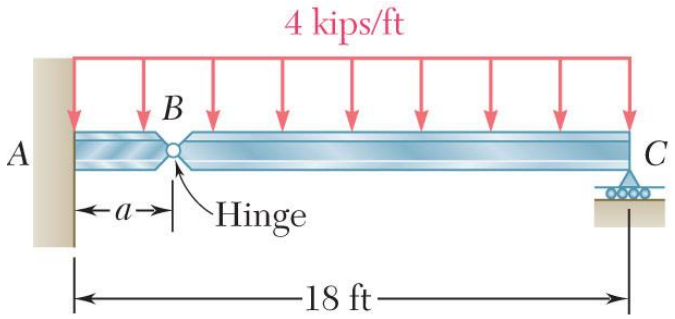

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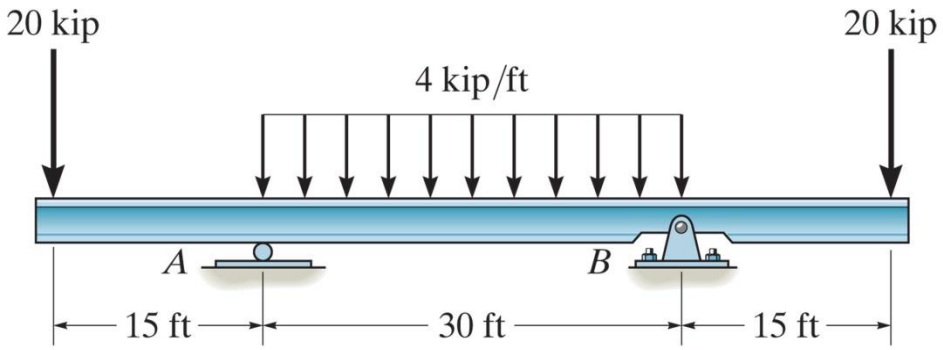

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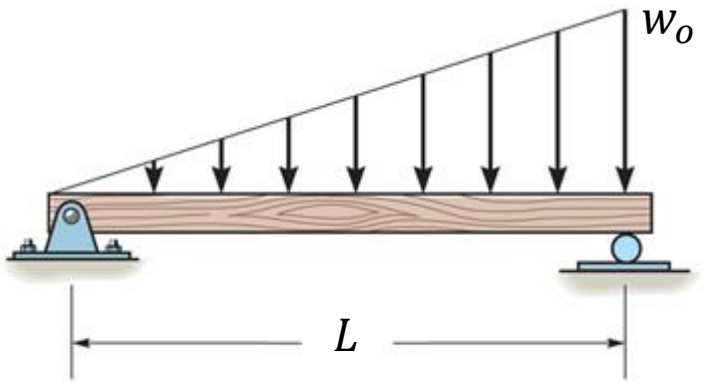

$w_o = 120$ lb/ft
$L = 12$ ft