

Shear and Moment Functions

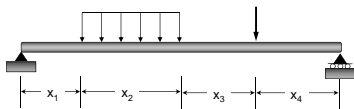
- **Beams** are structural members which carry lateral loading (perpendicular to the bending axis).
- To design a beam, a detailed knowledge of the variation of the axial force, **A**, shear force, **V**, and the bending moment, **M**, through out the member is required.

Shear and Moment Functions

- Typically, axial force is not considered since:
 1. in most cases the loading is perpendicular to the beam; and
 2. the beam's resistance to shear and bending moment is more critical.
- The variation of the shear and moment along the beam may be written as a function of the position, x .

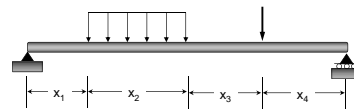
Shear and Moment Functions

- In general, the shear and moment functions are discontinuous at points where the type and magnitude of the loading changes.



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- Therefore, the variation of the internal shear and moment should be determined for each region between any two discontinuities of loading.



Shear and Moment Functions

- **Procedure for analysis** - the following is a procedure for determining the variation of shear and moment in a member using the method of sections:

1. Determine the support reactions for the structure.

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- **Procedure for analysis** - the following is a procedure for determining the variation of shear and moment in a member using the method of sections:

2. Keeping all external loadings in their exact locations, make a imaginary "cut" through the member at a point within the region where the shear and moment functions are desired.

Shear and Moment Functions

➤ **Procedure for analysis** - the following is a procedure for determining the variation of shear and moment in a member using the method of sections:

3. Draw the corresponding free-body diagram of one of the "cut" segments indicating the unknown reactions **V** and **M** acting in their positive (+) directions

Shear and Moment Functions

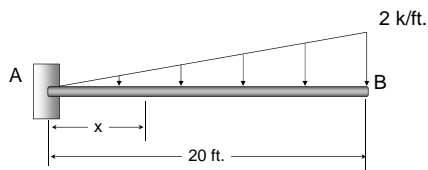
➤ **Procedure for analysis** - the following is a procedure for determining the variation of shear and moment in a member using the method of sections:

4. Apply the equations of equilibrium.

The moment equation should be summed at the cut section.

Shear and Moment Functions

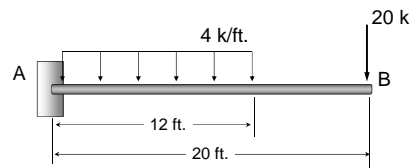
➤ **Example:** Consider the following beam



Determine the internal shear and moment as a function of x

Shear and Moment Functions

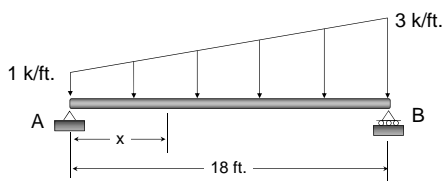
➤ **Example:** Consider the following beam



Determine the internal shear and moment as a function of x

Shear and Moment Functions

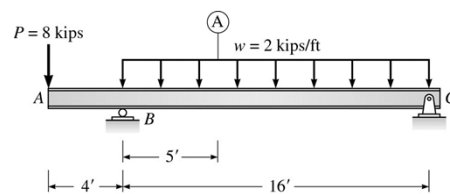
➤ **Example:** Consider the following beam



Determine the internal shear and moment as a function of x

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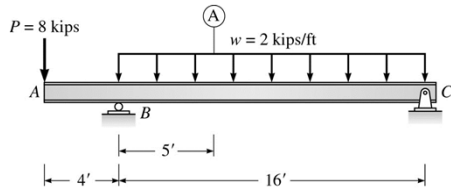
➤ **Example:** Consider the following beam



1. Determine the internal shear and moment as a function of x using an origin at end A and evaluate the moment at section A.

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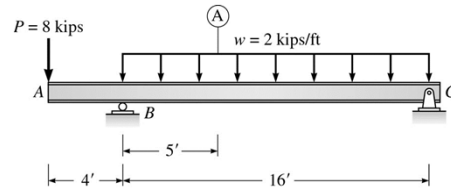
➤ **Example:** Consider the following beam



2. Locate the point of zero shear between B and C.

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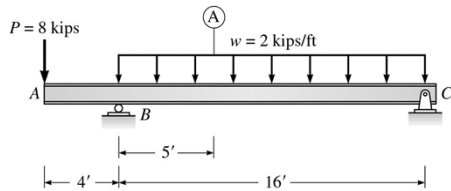
➤ **Example:** Consider the following beam



3. Evaluate the maximum moment between B and C.

Shear and Moment Functions

➤ **Example:** Consider the following beam



4. Determine the internal shear and moment as a function of x using an origin at C and evaluate the moment at section A.

End of Internal Loads – Part 2

Any questions?

