Shear and Moment Functions

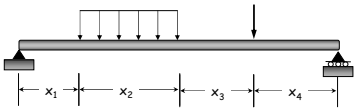
- ***Beams*** are structural members which carry lateral loading (perpendicular to the bending axis).
- To design a beam, a detailed knowledge of the variation of the axial force, ***A***, shear force, ***V***, and the bending moment, ***M***, through out the member is required.

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*.

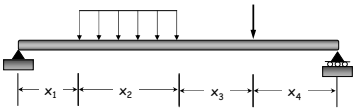
Shear and Moment Functions

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



Shear and Moment Functions

- 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.

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:
  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

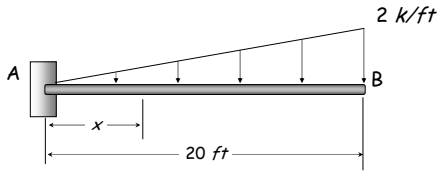
- **Procedure for analysis** - the following is a procedure for determining the variation of shear and moment in a member using the method of sections:

  4. Apply the equations of equilibrium.

     The moment equation should be summed at the cut section.

Shear and Moment Functions

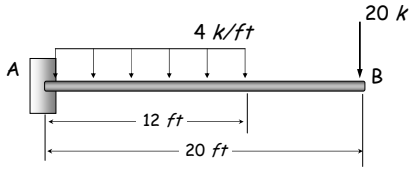
- **Example:** Consider the following beam



Determine the internal shear and moment as a function of x (see p. 23 in notes).

Shear and Moment Functions

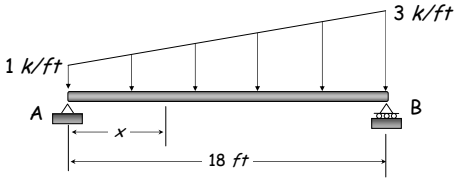
- **Example:** Consider the following beam



Determine the internal shear and moment as a function of x (see p. 24 in notes).

Shear and Moment Functions

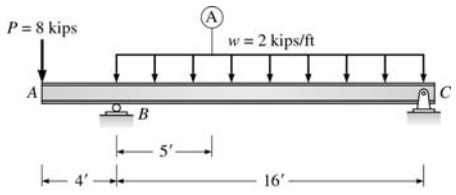
- **Example:** Consider the following beam



Determine the internal shear and moment as a function of x (see p. 25 in notes).

Shear and Moment Functions

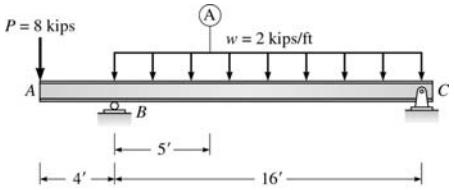
- **Example:** Consider the following beam



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.

Shear and Moment Functions

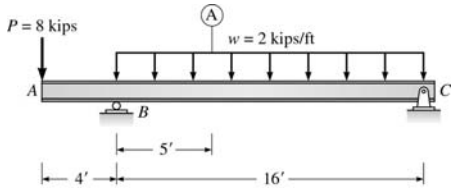
- **Example:** Consider the following beam



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

Shear and Moment Functions

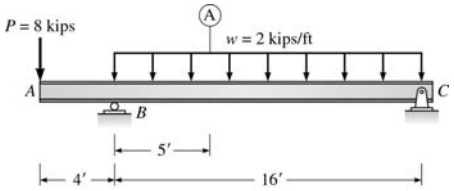
- **Example:** Consider the following beam



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?