Shear and Moment Functions

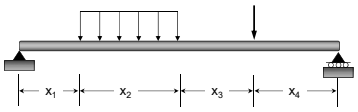
- ***Beams*** are structural members which carry lateral loading (perpendicular to the bending axis).
- To design a beam, a detailed knowledge of the variation of the axial force, ***A***, shear force, ***V***, and the bending moment, ***M***, through out the member is required.

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*.

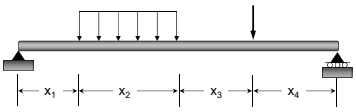
Shear and Moment Functions

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

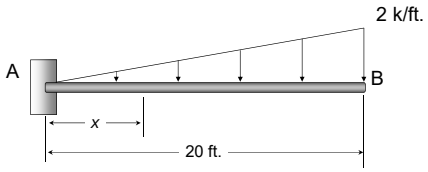
Procedure for analysis - the following is a procedure for determining the variation of shear and moment in a member using the method of sections:

4. Apply the equations of equilibrium.

   The moment equation should be summed at the cut section.

Shear and Moment Functions

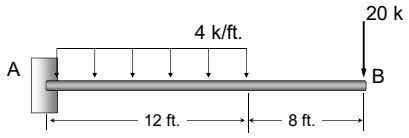
Example: Consider the following beam



Determine the internal shear and moment as a function of ***x***

Shear and Moment Functions

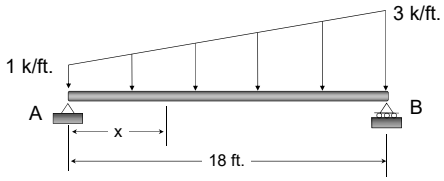
Example: Consider the following beam



Determine the internal shear and moment as a function of ***x***

Shear and Moment Functions

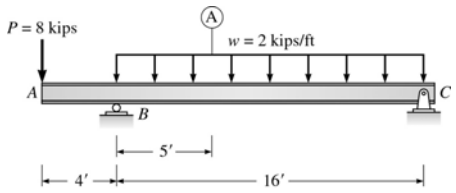
Example: Consider the following beam



Determine the internal shear and moment as a function of ***x***

Shear and Moment Functions

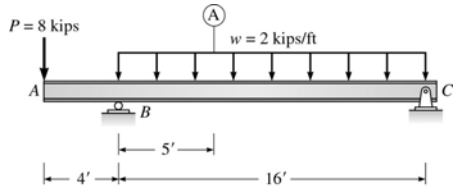
Example: Consider the following beam



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

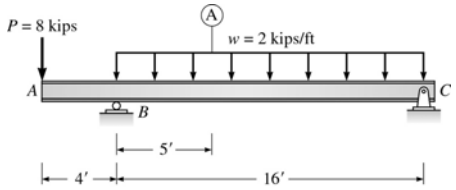
Example: Consider the following beam



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*.

End of Internal Loads – Part 2

Any questions?