Shear-Force & Bending-Moment Diagrams
Distributed Loads

Learning Objectives

1) To evaluate the *shear-force* and *bending-moment* diagrams for systems with discrete loads.

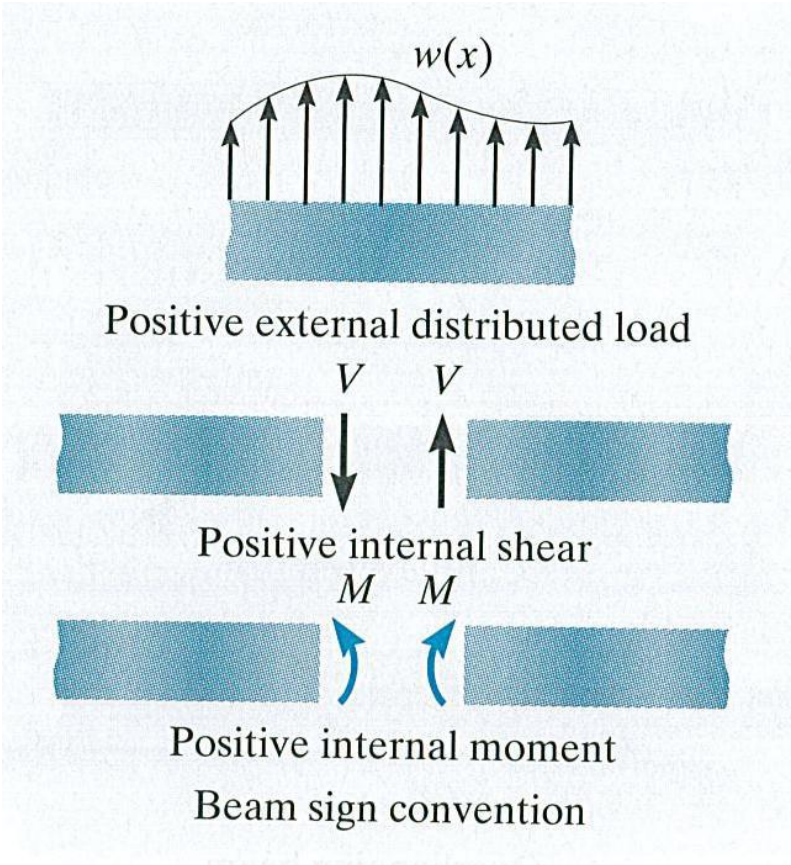
2) To do an *engineering estimate* of these quantities.

Beam Sign Convention

Distributed load -	An upward load is positive
Shear Force -	A positive internal shear force causes a clockwise rotation of beam segment. (i.e., it pushes a left-facing cross-section upward or a right-facing cross-section downward).
Bending Moment -	A positive internal moment causes compression in the top fibers of the segment (i.e., clockwise on a left-facing cross-section or counter-clockwise on a right-facing cross-section).

Procedure

1. Determine support reactions
2. Specify beam sections origin (left end) to between each discrete load (force or moment). Be sure V and M are shown acting in the positive sense.
3. Sum forces vertically to determine V
4. Sum moments at sectioned end to determine M. (This eliminates V from the moment equation).



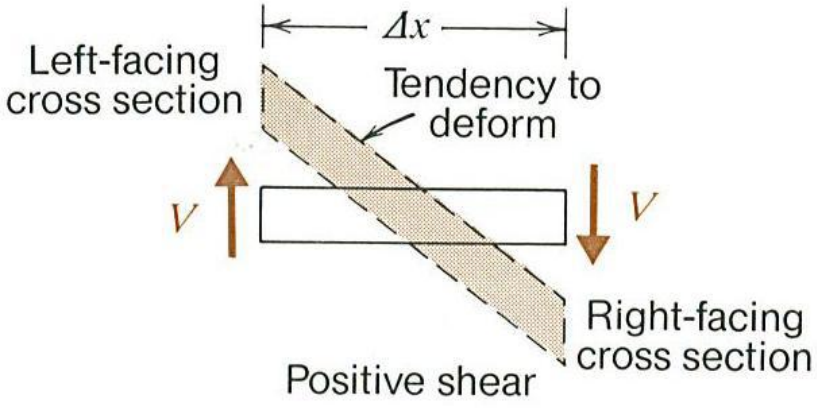


FIGURE 7a

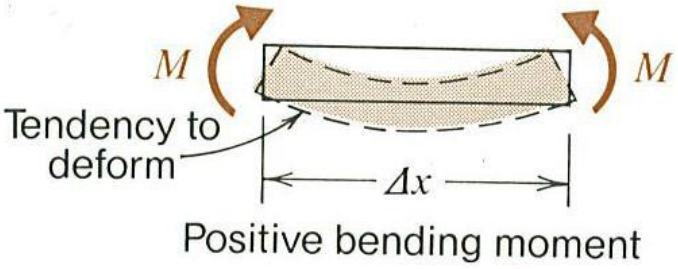


FIGURE 7b

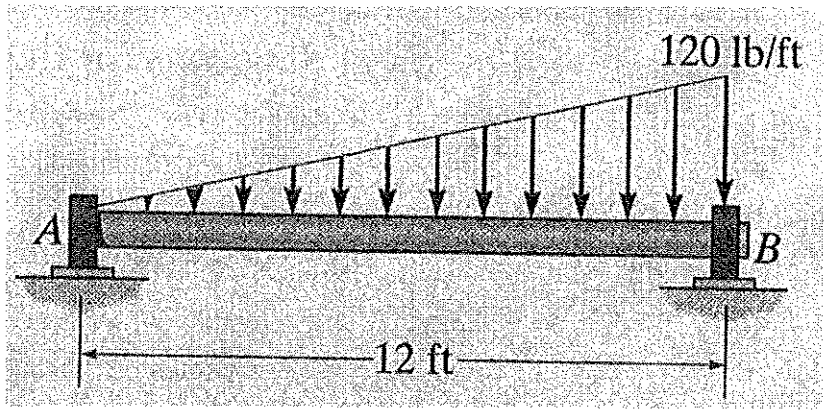
Shear-Force & Bending-Moment Diagrams
Distributed Loads
Example 1

Given: A simply supported beam has a triangular load distribution applied as shown.

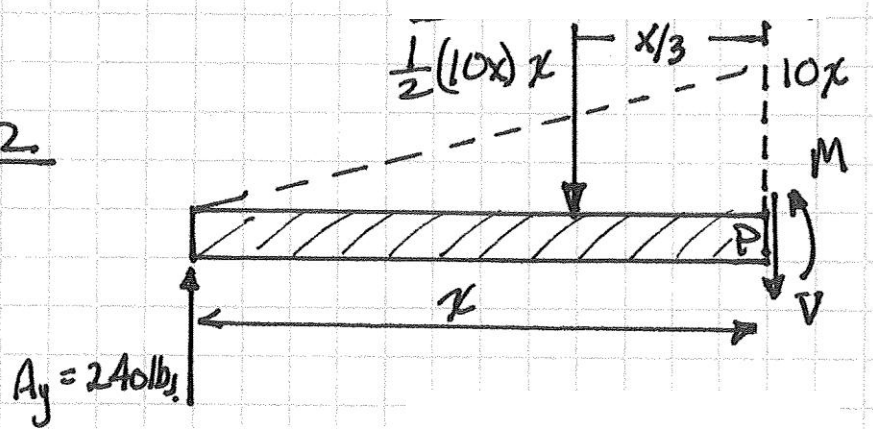
Find:

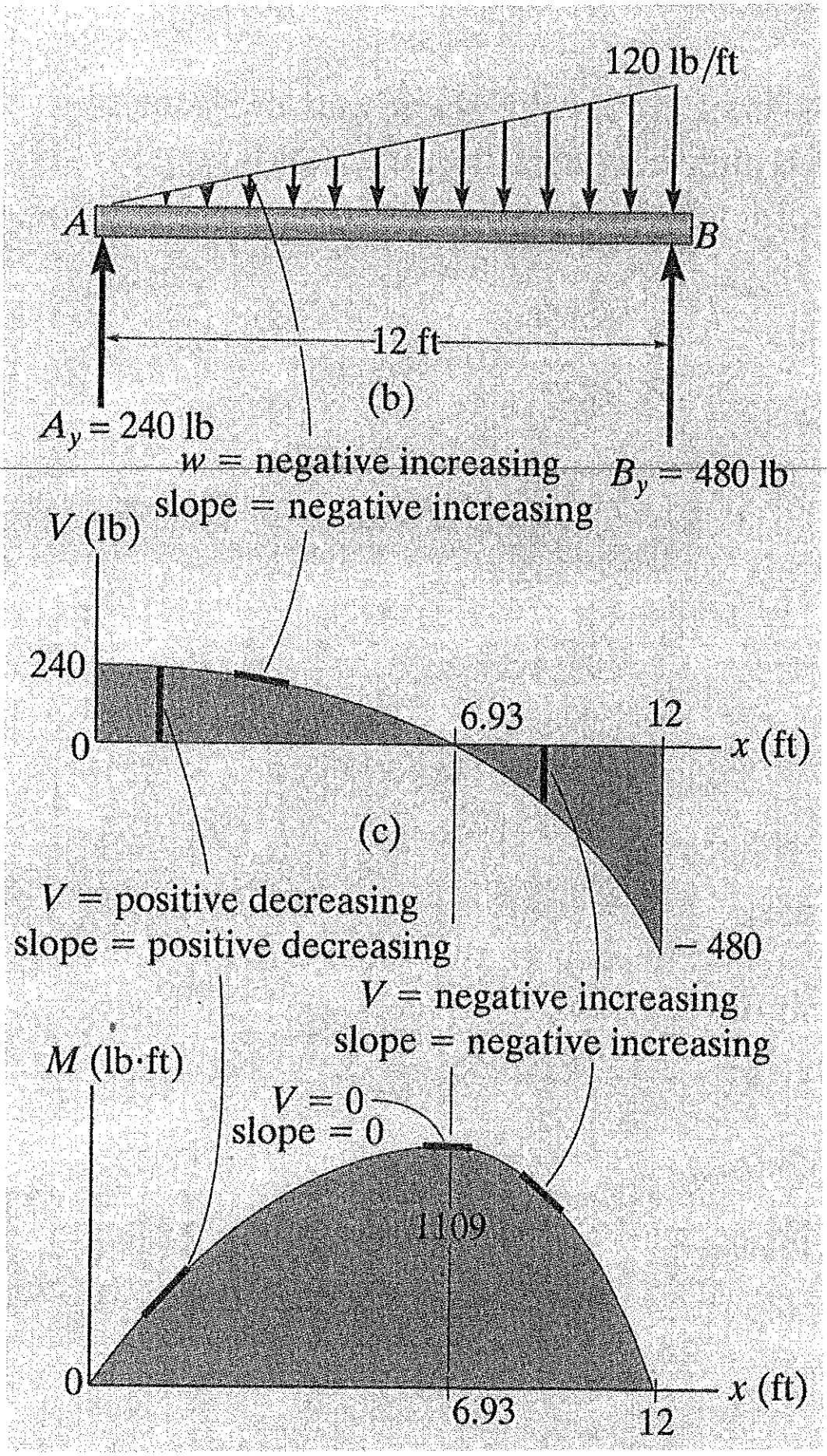
a) Determine the expressions for the shear-force (V) and the bending-moment (M) along the beam.

b) Sketch the shear-force and bending-moment diagrams for beam shown.



Segment 1: $0 < x < 12$




120 lb/ft
A
B
12 ft
(b)
$A_y = 240$ lb
$B_y = 480$ lb
w = negative increasing
slope = negative increasing
V (lb)
240
0
6.93
12
x (ft)
(c)
V = positive decreasing
slope = positive decreasing
− 480
V = negative increasing
slope = negative increasing
M (lb·ft)
$V = 0$
slope = 0
1109
0
6.93
12
x (ft)

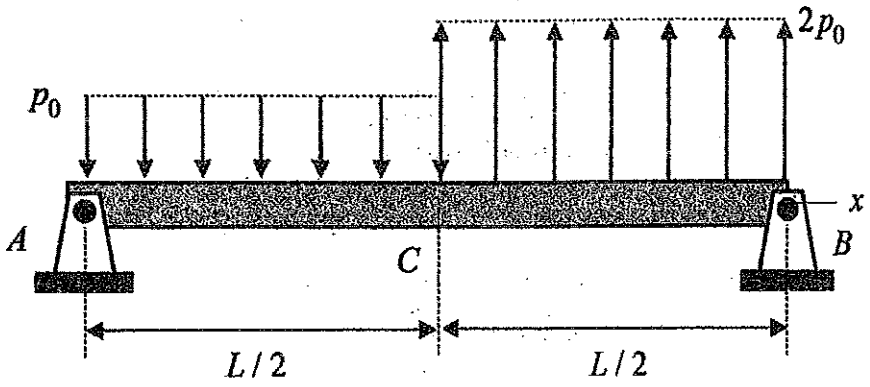
Shear-Force & Bending-Moment Diagrams
Distributed Loads
Example 2

Given: Draw the shear-force and bending-moment diagrams for the loaded beam shown below. Use the following parameters: L = 4m, and p_0 = 500N/m.

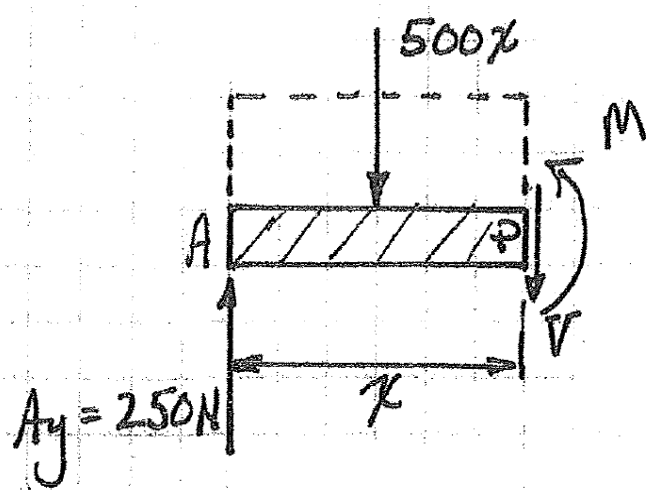
Find:

a) Determine the expressions for the shear force (V) and the bending moment (M) for each section of beam AB.

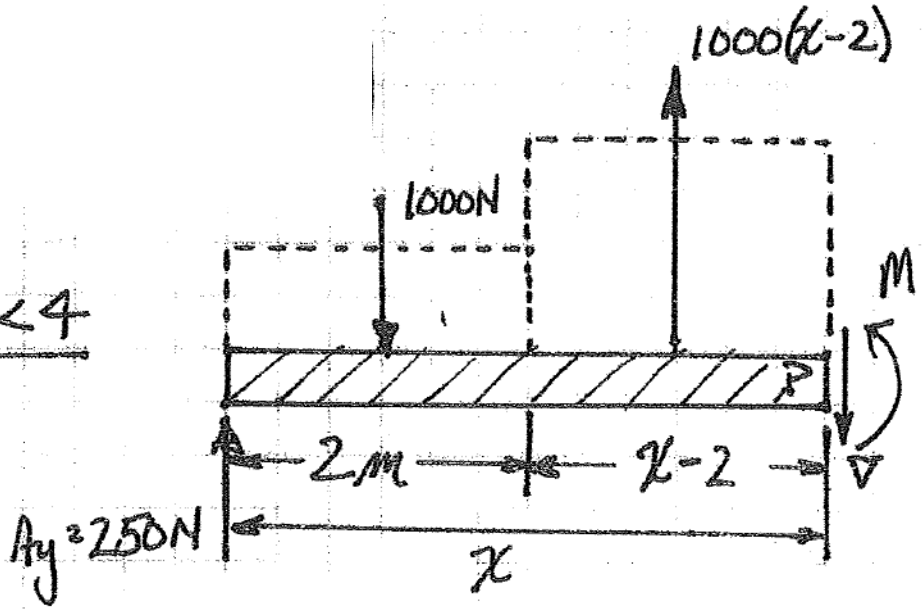
b) Sketch the shear-force and bending-moment diagram for beam AB.

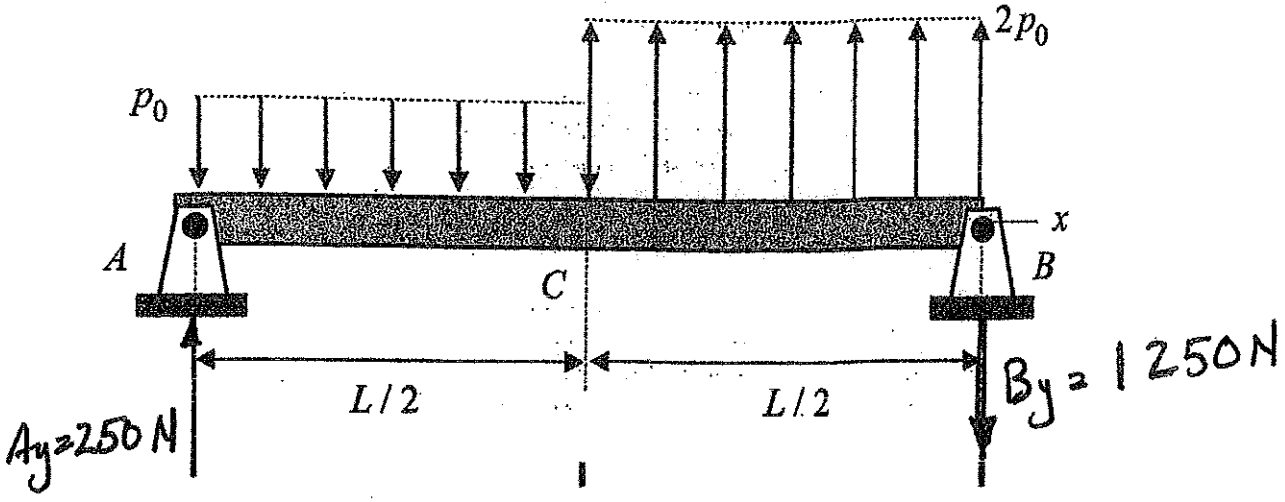


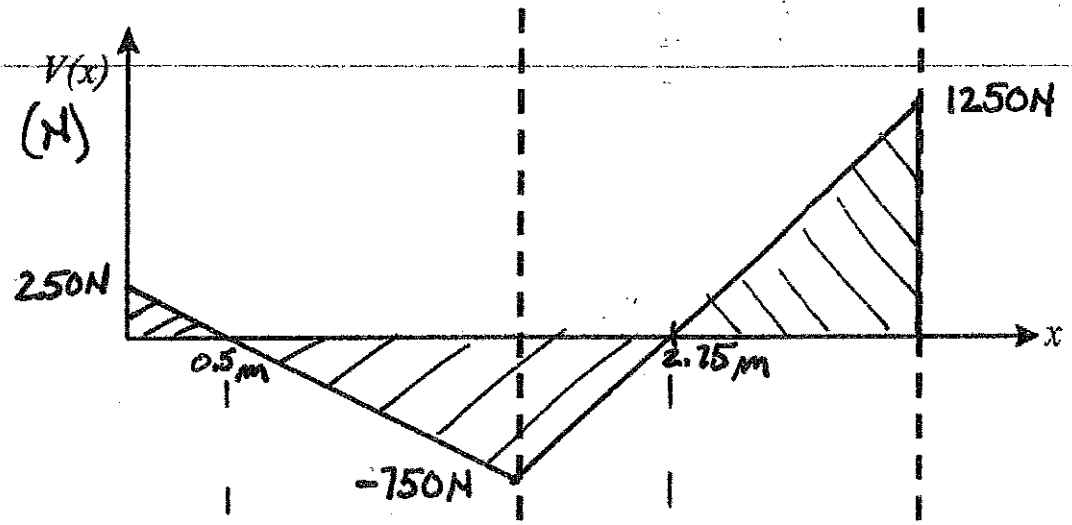
Segment 1: $0 < x < 2$

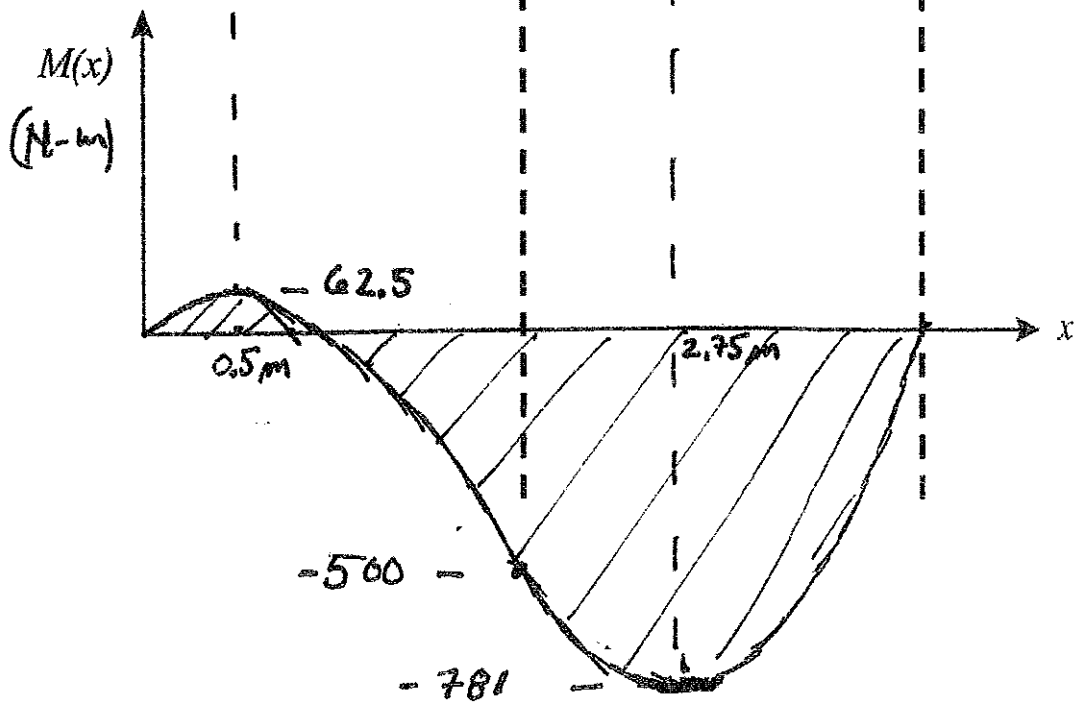


Segment 2: $2 < x < 4$




$2p_0$
p_0
A
C
B
x
L/2
L/2
Ay=250 N
By = 1250N


V(x)
(N)
1250N
250N
x
0.5m
2.75m
-750N


M(x)
(N-m)
-62.5
x
0.5m
2.75m
-500
-781

ME 270 – Basic Mechanics I – Group Quiz

Your Name: _____ Group Members: 1) _____

Date: _____ Period: _____ 2) _____

3) _____

4) _____

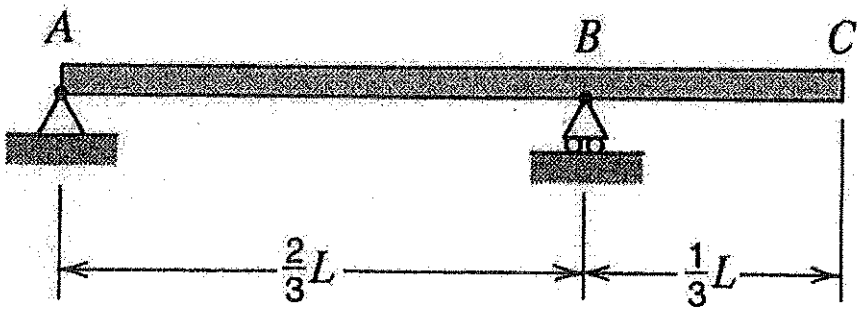
Given: Overhanging beam ABC has a constant weight per unit length (w).

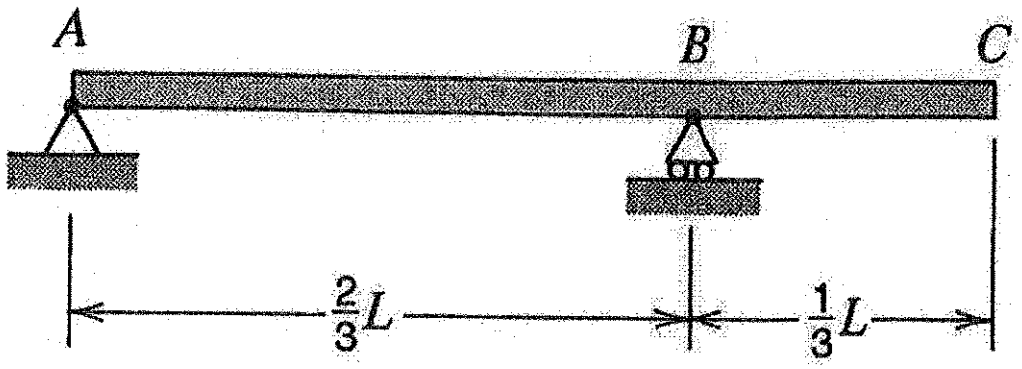
Find:

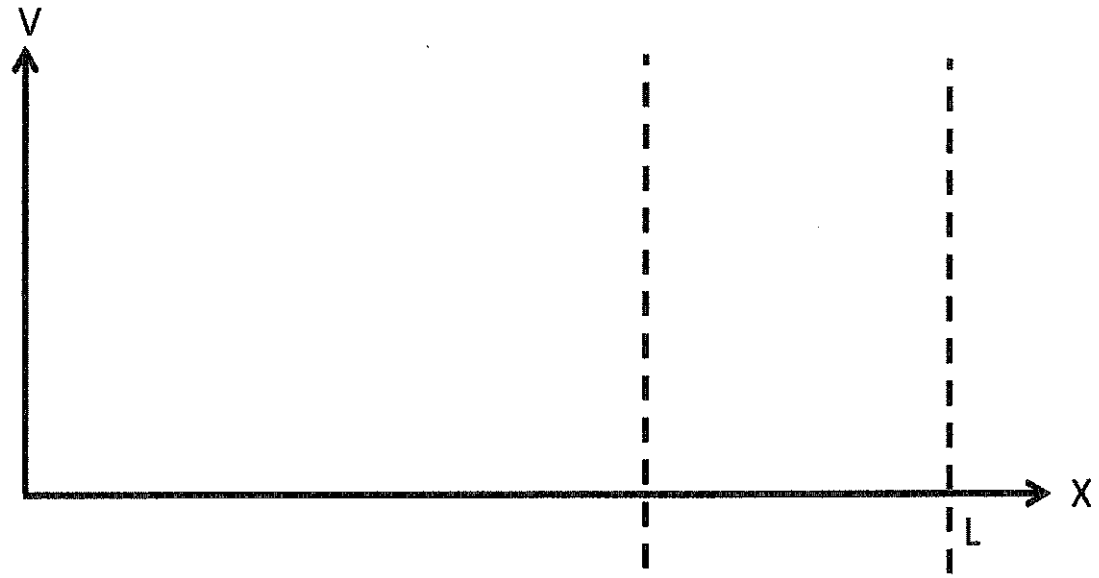
a) Determine the expressions for the shear force (V) and the bending moment (M) along the beam in terms on w and L.

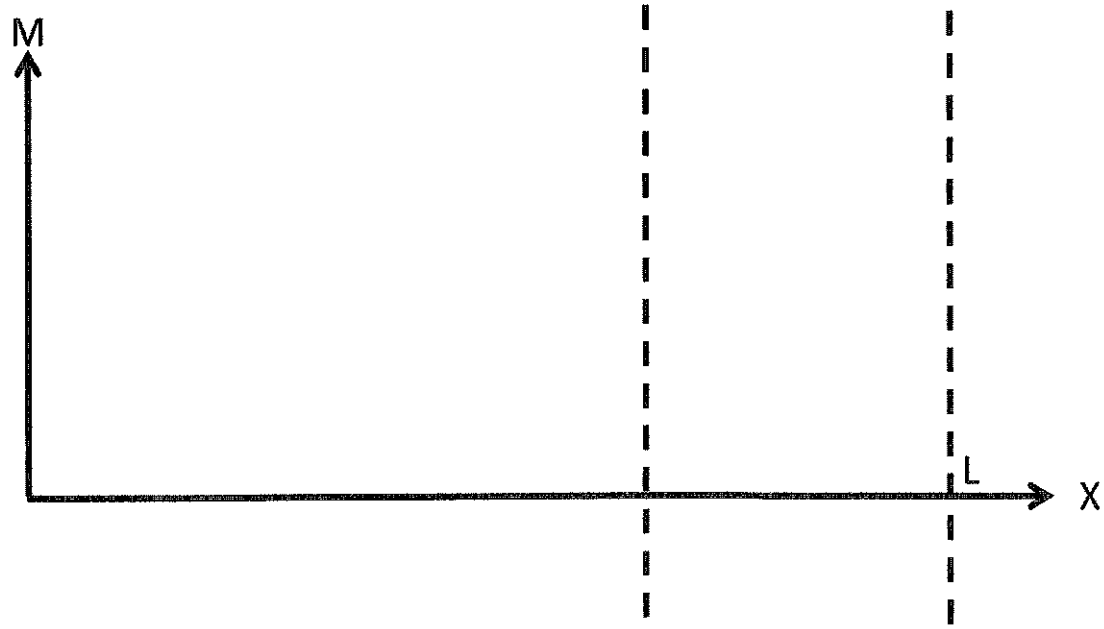
b) Sketch the shear-force and bending-moment diagrams for beam shown.

Solution:




A
B
C
$\frac{2}{3}L$
$\frac{1}{3}L$


V
X
L


M
L
X