Georgia Institute of Technology

Applications in Engineering Mechanics

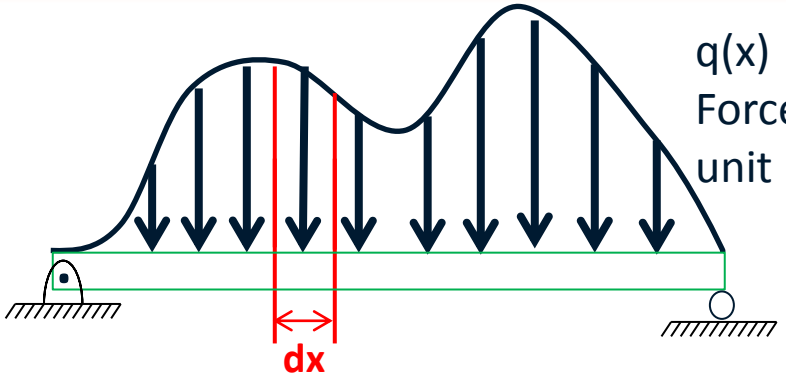
Dr. Wayne Whiteman
Director of the Office of Student Services
and Senior Academic Professional
School of Mechanical Engineering

This course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering systems and problem solving.

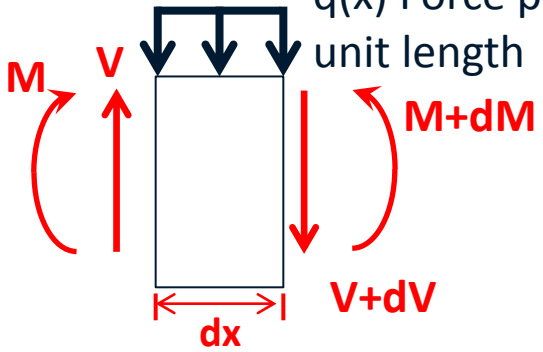
School of Mechanical Engineering

Module 15 Learning Outcomes

- Determine Internal Shear Forces and Bending Moments in multiforce members.
- Sketch a Shear Force Diagram for a multiforce member



q(x)
Force per
unit length



q(x) Force per
unit length

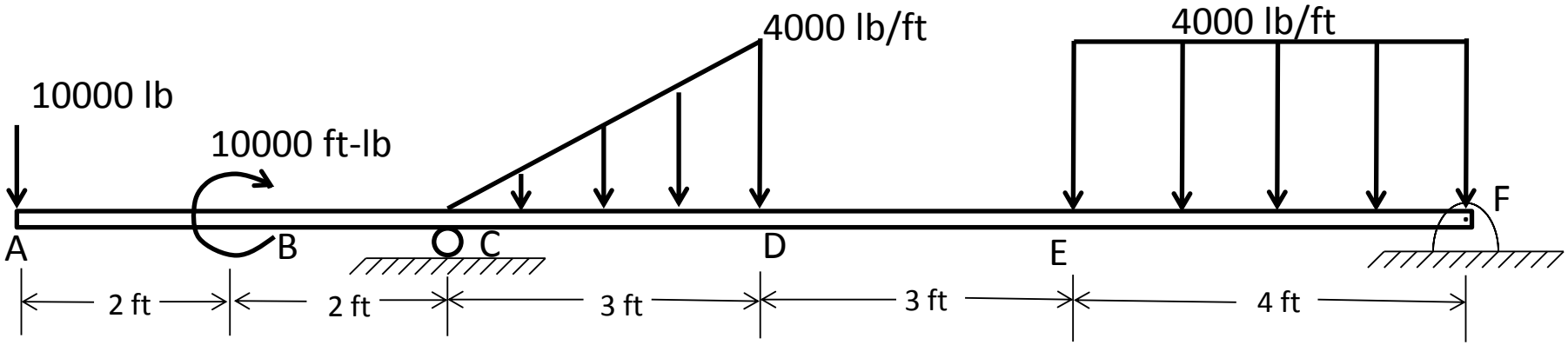
$$-q = \frac{dV}{dx}$$

The negative value of the load at a point equals the slope (rate of change) of shear diagram

$$\Delta V = -\int_{x_1}^{x_2} q\ dx$$

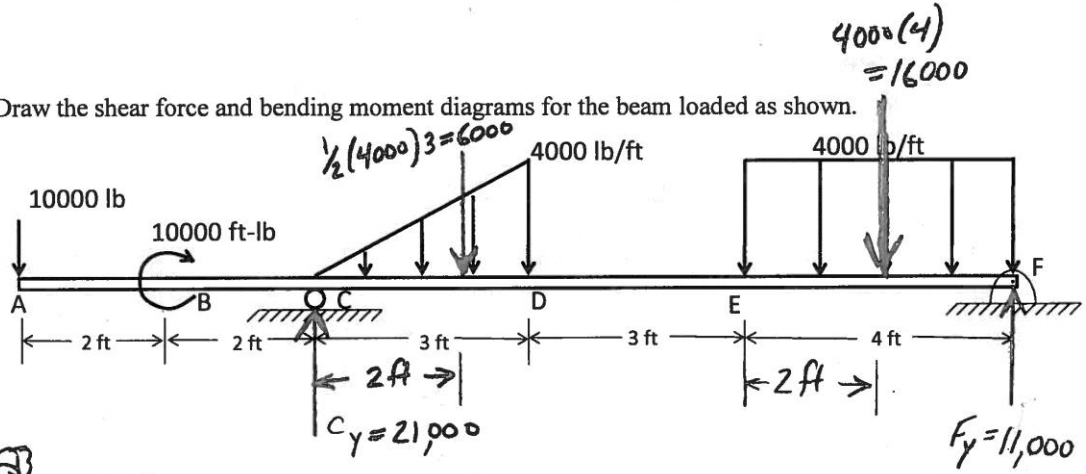
The change in shear between two points equals negative the area under the load curve

Draw the shear force diagram for the beam loaded as shown.



Start by determining the external reactions at points C and F as an exercise on your own.

Draw the shear force and bending moment diagrams for the beam loaded as shown.



(+) $\Sigma M_C = 0$

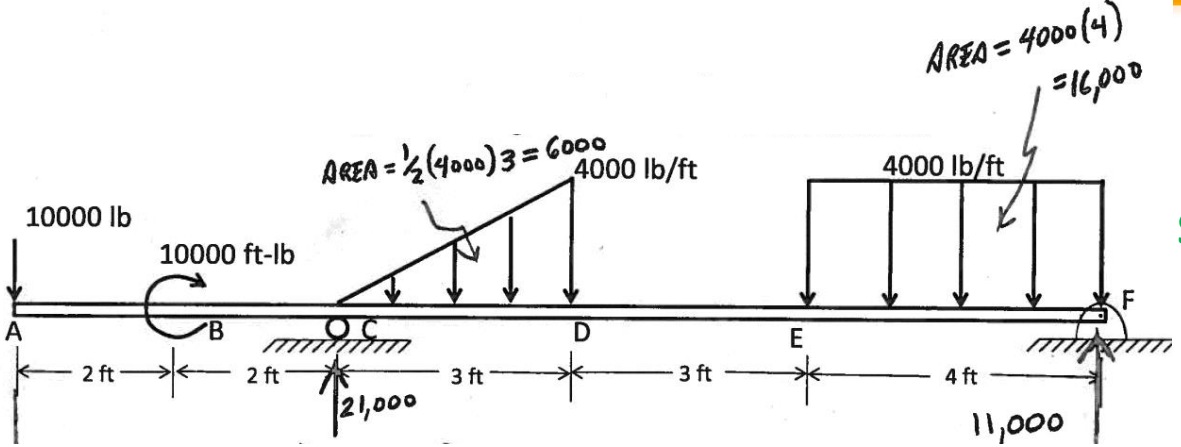
$-10000(4) + 10000 + 6000(2) + 16000(8) - F_y(10) = 0$

$F_y = 11,000\ lb \uparrow$

(+↑) $\Sigma F_y = 0$

$-10000 + C_y - 6000 - 16000 + F_y = 0$ (F_y = 11000)

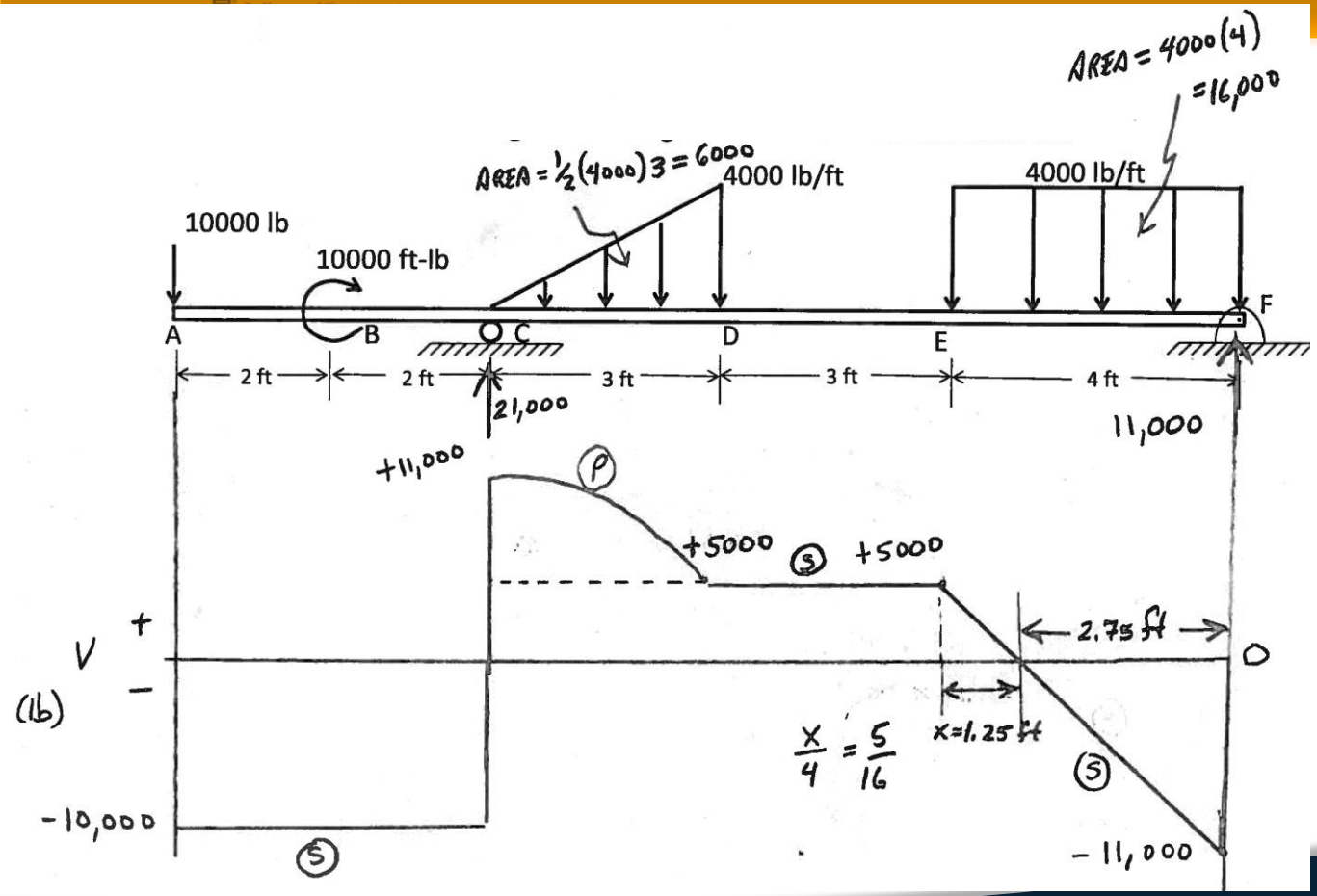
$C_y = 21000\ lb \uparrow$



$$-q = \frac{dV}{dx} \qquad \Delta V = -\int_{x_1}^{x_2} q\, dx$$

Shear-Positive(CW on Material)

Negative (CCW on Material)


AREA = 4000(4)
=16,000
AREA = ½(4000)3 = 6000
4000 lb/ft
4000 lb/ft
10000 lb
10000 ft-lb
A
B
C
D
E
F
2 ft
2 ft
3 ft
3 ft
4 ft
21,000
11,000
+11,000
+5000
+5000
2.75 ft
V
(lb)
+
−
-10,000
- 11,000
x=1.25 ft
x/4 = 5/16