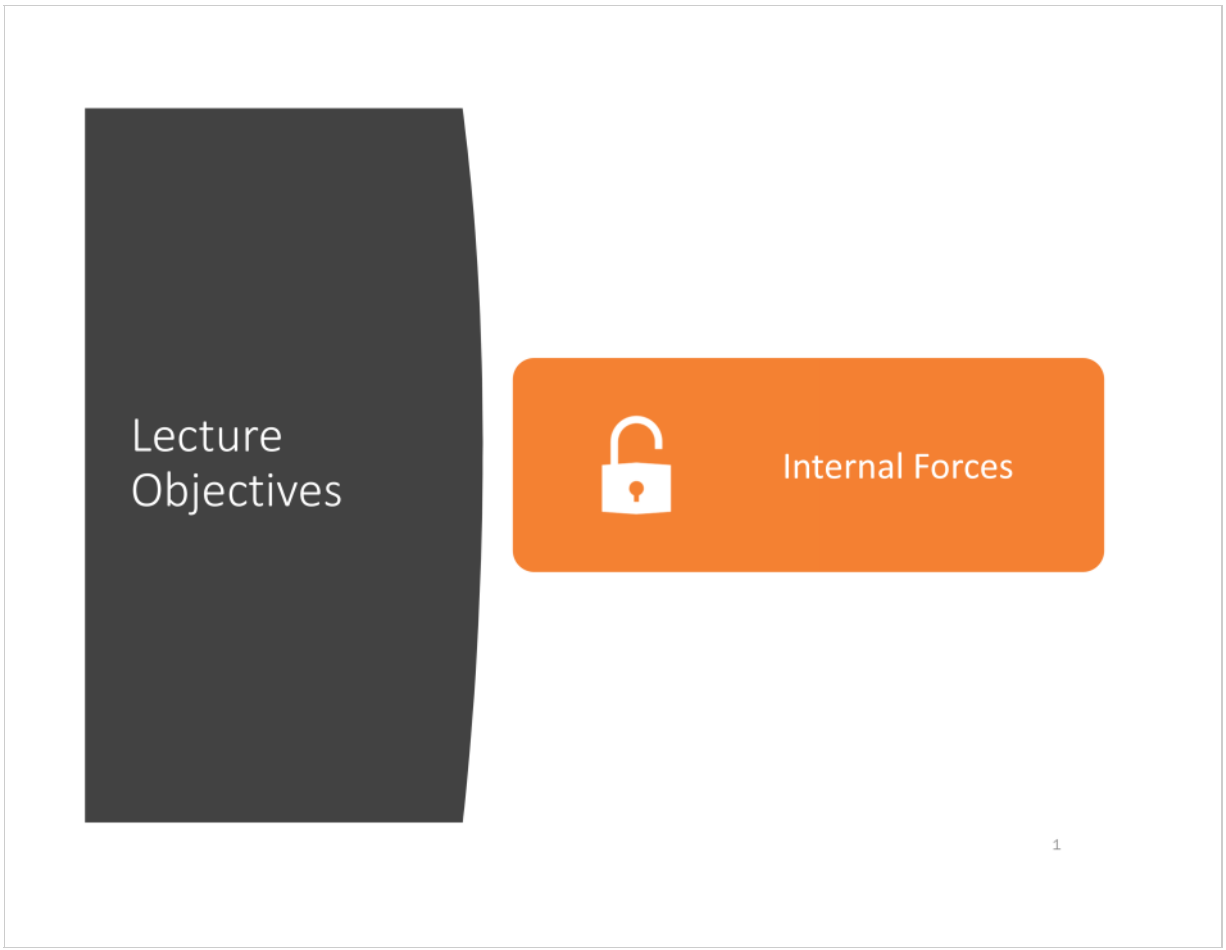
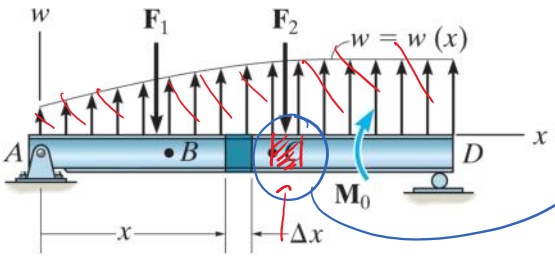
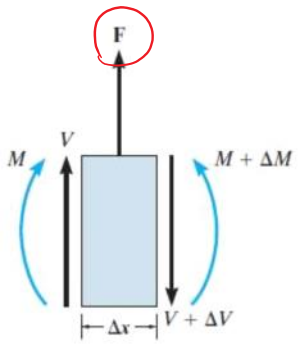
Lec23

Thursday, November 12, 2020 9:58 AM



Relations Among Load, Shear and Bending Moments





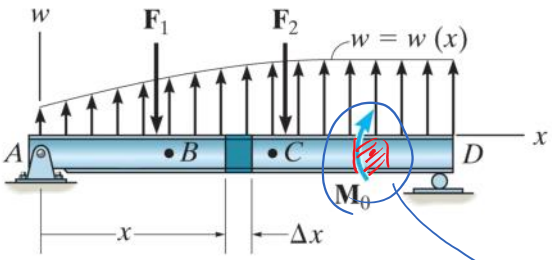
$\Sigma F_y = V + F - (V + \delta V) = 0$

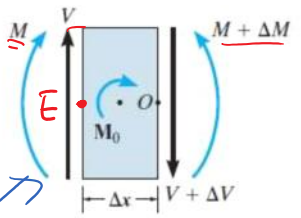
$\delta V = F$

Wherever there is an external concentrated force, there will be a change (jump) in internal shear force.

2

Relations Among Load, Shear and Bending Moments





$\Sigma M_E = -M - M_0 + M + \delta M - (V + \delta V)\cdot \delta x = 0$

$\delta M = M_0 + (V + \delta V)\delta x \qquad \delta x \to 0$

$\delta M = M_0$

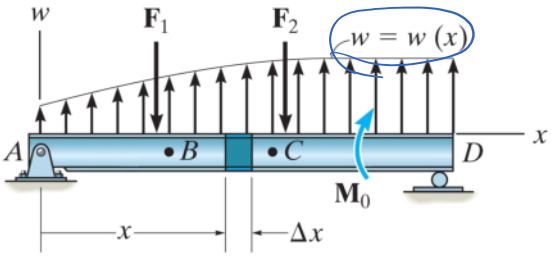
Wherever there is an external couple moment, there will be a change (jump) in internal bending moment.

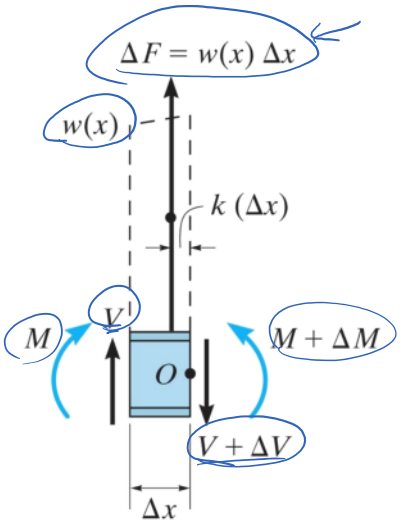
clockwise couple moment ↑

anticlockwise couple moment ↓

3

Relations Among Load, Shear and Bending Moments





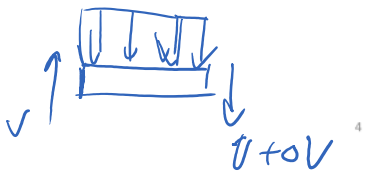
Relationship between load and shear:

$$\sum F_y = 0: \quad V - (V + \Delta V) + w\Delta x = 0$$

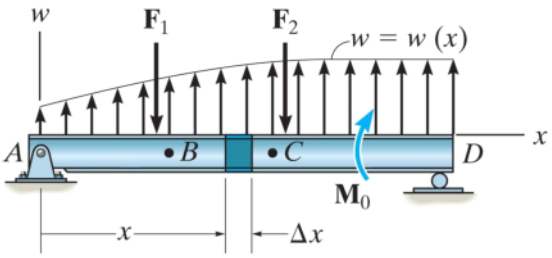
$$\Delta V = w\Delta x$$

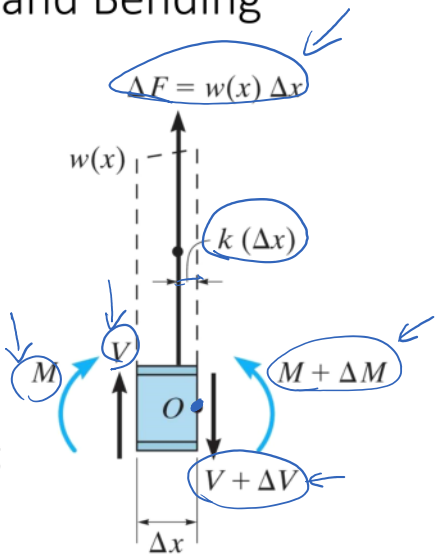
Dividing by Δx and letting $\Delta x \to 0$, we get:

$$\frac{dV}{dx} = w \qquad \Delta V = \int w\, dx$$



Relations Among Load, Shear and Bending Moments





Relationship between shear and bending moment:

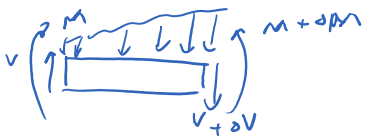
$$\sum M_O = 0: \quad (M + \Delta M) - M - V\,\Delta x - w\,\Delta x\,(k\,\Delta x) = 0$$

$$\Delta M = V\,\Delta x + w k (\Delta x)^2$$

Dividing by Δx and letting $\Delta x \to 0$, we get:

$$\frac{dM}{dx} = V \qquad \Delta M = \int V\,dx$$

$wk(\Delta x)^2 << V\Delta x$



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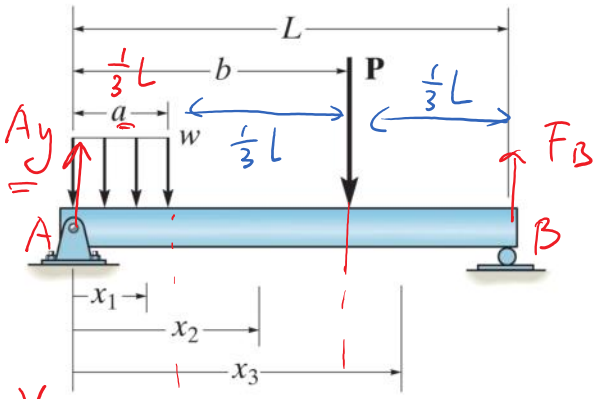
Relationships between w, V, M

Draw the shear and moment diagrams for the beam.



$a = \frac{1}{2}b = \frac{1}{3}L$

$\Sigma F_y = A_y + F_B - P - w \cdot \frac{1}{3}L$

$\Sigma M_A = -\frac{1}{3}L \cdot w \cdot \frac{1}{6}L - P \cdot \frac{2}{3}L + F_B \cdot L = 0$

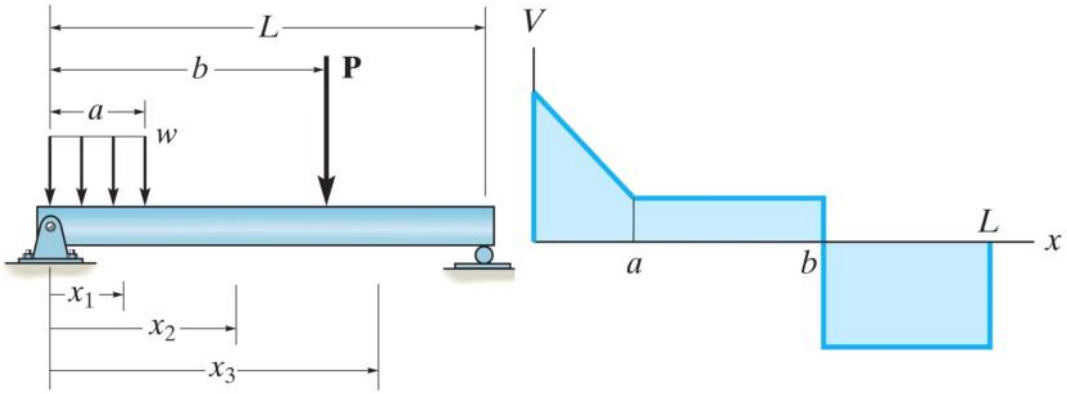
$F_B = \frac{2}{3}P + \frac{1}{18}w \cdot L$

$A_y = P + \frac{1}{3}wL - F_B = \frac{1}{3}P + \frac{5}{18}wL$

$-\frac{2}{3}P - \frac{wL}{18}$ —

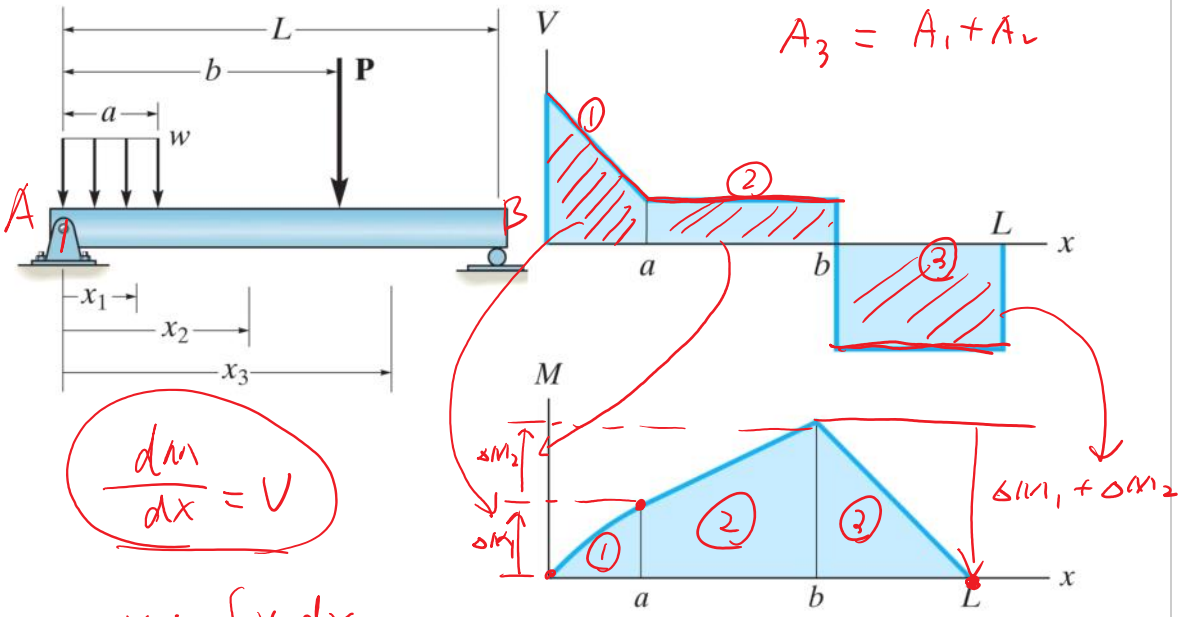
Relationships between w, V, M

Draw the shear and moment diagrams for the beam.



Relationships between w, V, M

Draw the shear and moment diagrams for the beam.



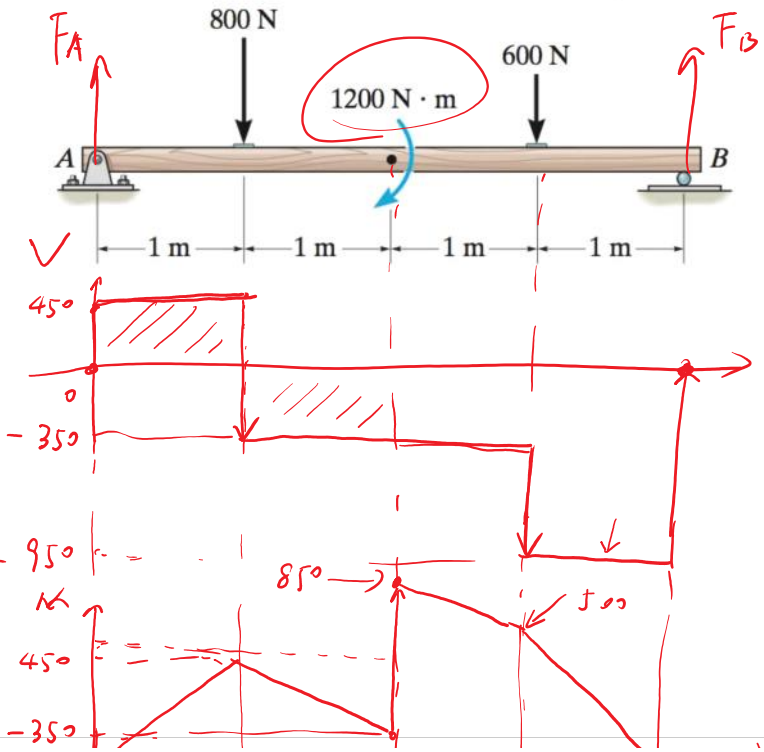
$A_3 = A_1 + A_2$

$\frac{dM}{dx} = V$

$\Delta M = \int V \cdot dx$

Example

Draw the shear and moment diagrams for the beam.

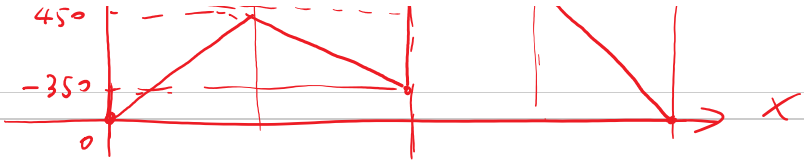


$F_A = 450\,N$

$F_B = 950\,N$

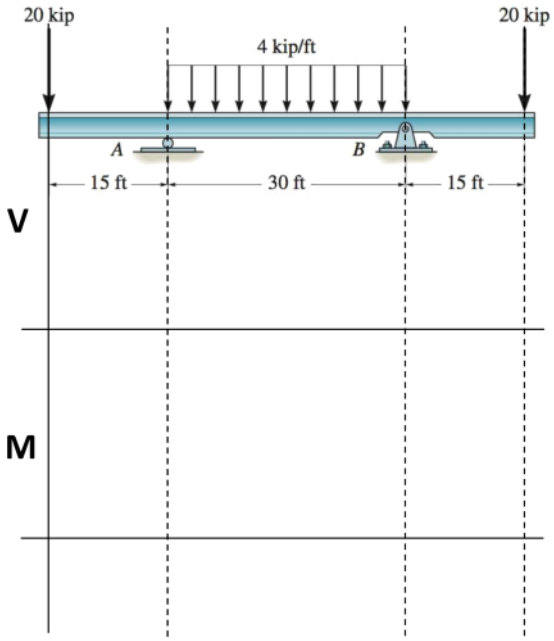
1200 − 350

850



Example

Draw the shear force and bending moment diagrams for the beam.



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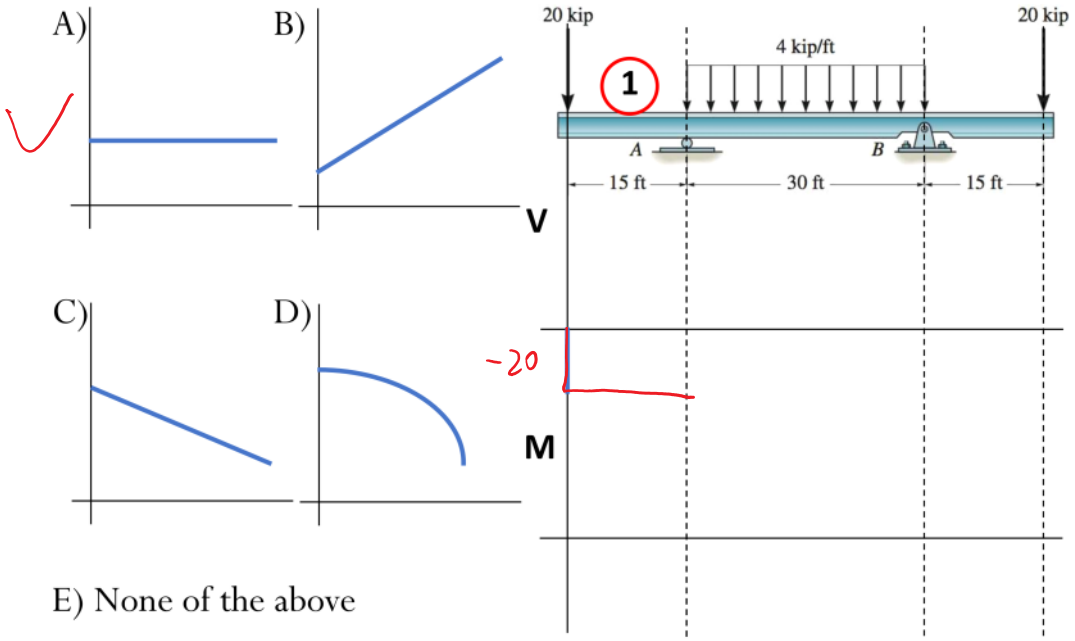
i-Clicker Time

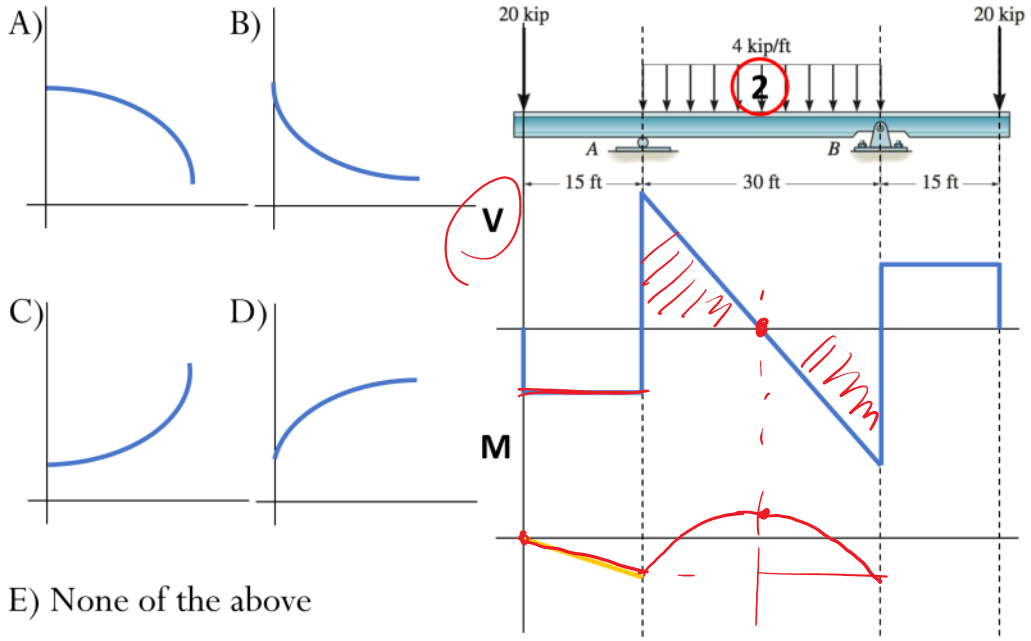
What is the shape of V(x) for region 1?



E) None of the above

i-Clicker Time

What is the shape of M(x) for region 2?



E) None of the above

i-Clicker Time

What is the value of M at *A*?

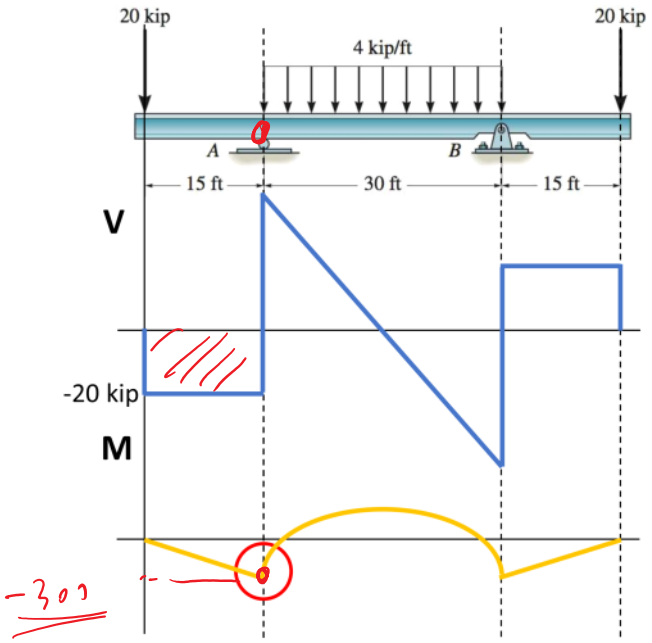
A) 200 kip-ft

B) 300 kip-ft

C) 400 kip-ft

D) 500 kip-ft

E) None of the above



Example

Draw the shear and moment diagrams for the beam.