

Note: Please write your answers clearly in the bluebook provided, make sure to show all your work. Thank you!

1. For the simply supported beam shown, determine the reaction at the supports A and B.

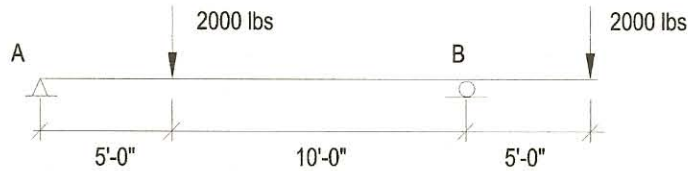


Figure-1

2. For the simply supported beam shown below: a) Find the reactions b) Determine the magnitude and location of maximum shear and bending moment. c) Draw the diagrams.

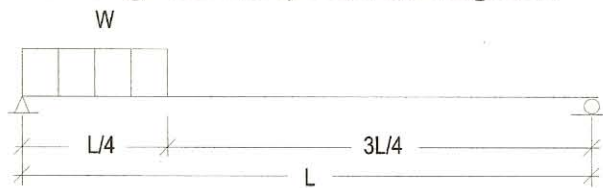


Figure-2

3. Given a square member 10"x10" with length  $L = 20'-0''$  loaded in tension with 200,000 lbs, determine:  
 a) The Tensile stress in the member.  
 b) Determine the strain and extension.

Given: A36 Steel with  $F_y = 36000$  psi  
 Modulus of Elasticity  $E = 29000000$  psi  
 Following formulas given for information and use:

$$\sigma = F/A$$

$$\epsilon = \Delta L/L$$

$$\sigma = E \cdot \epsilon$$

$$\Delta L = PL/AE$$

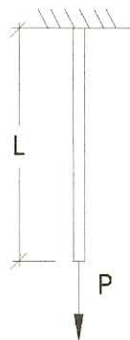
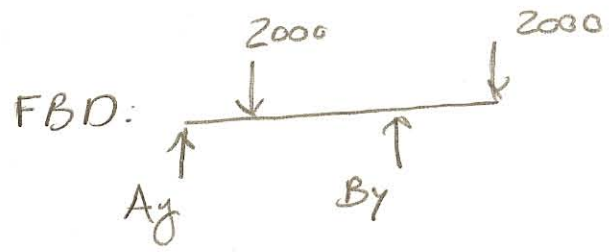
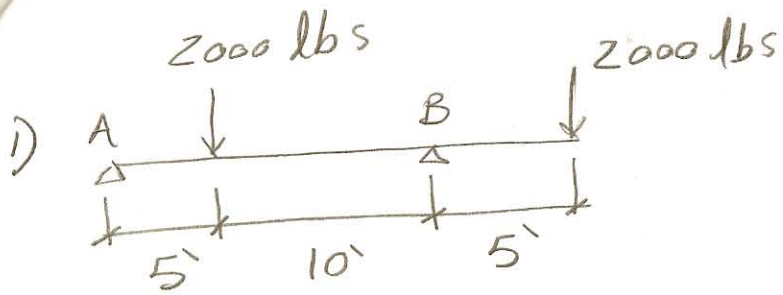


Figure-3

# AC EXAM #1 FALL 2005 SOLUTION:



$$\sum F_x = 0$$

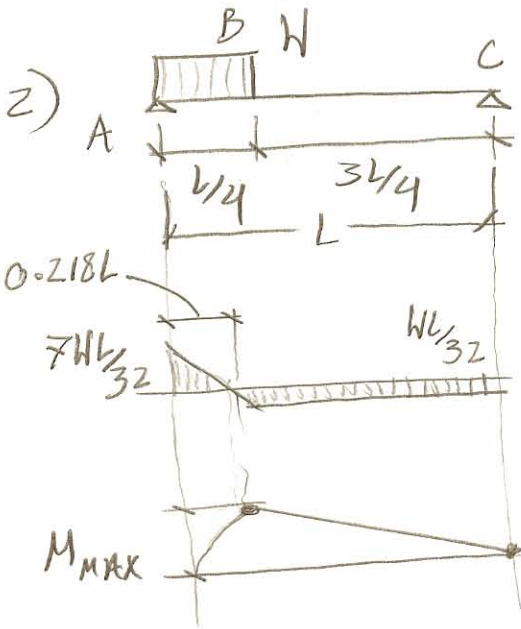
$$\sum F_y = 0 \Rightarrow Ay + By - 4000 = 0 \quad (1)$$

$$\sum M_A = 0 \Rightarrow -2000(5') + By(15') - 2000(20') = 0 \quad (2)$$

$$\Rightarrow -10000 \text{ lbft} + By(15') - 40000 \text{ lbs.ft} = 0$$

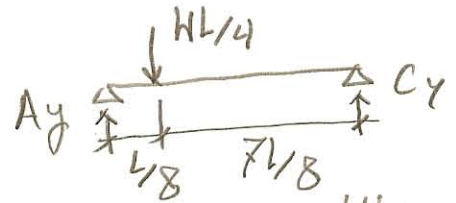
$$\Rightarrow By(15') = -50000 \Rightarrow By = 3333.33 \text{ lbs} \uparrow$$

$$(1) \Rightarrow Ay + 3333.33 - 4000 = 0 \Rightarrow Ay = 666.67 \text{ lbs} \uparrow$$



$$\sum F_x = 0$$

$$\sum F_y = 0$$



$$\Rightarrow Ay + Cy - WL/4 = 0 \Rightarrow Ay + Cy = WL/4 \quad (1)$$

$$\sum M_A = 0 \Rightarrow WL/4 \left(\frac{L}{8}\right) + CyL = 0 \Rightarrow$$

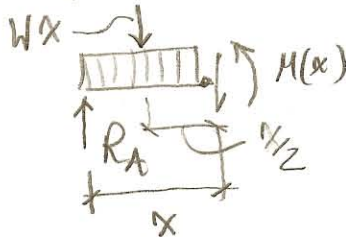
$$Cy = WL/32$$

$$(1) \Rightarrow Ay = WL/4 - WL/32 = 8WL/32 - WL/32 = 7WL/32$$

$$V(x) = R_A - Wx = Ay - Wx$$

$$V(x) = 7WL/32 - Wx \quad \text{SET } = 0$$

$$V(x) = 0 \text{ @ } x = \frac{7L}{32} = 0.218L$$



$$M(x) = R_A x - Wx^2/2$$

$$M(x) = Ay \cdot x - Wx^2/2$$

$$M(x) = 7WL/32 \cdot x - \frac{Wx^2}{2} \Rightarrow M_{\text{max}} \text{ @ } V=0 \Rightarrow M_{\text{max}} = M\left(\frac{7L}{32}\right)$$

$$M_{\text{max}} = 7WL/32 \cdot 7L/32 - \frac{W}{2} \left(\frac{7L}{32}\right)^2 = \frac{49WL^2}{1024} - \frac{49WL^2}{2048} = \frac{49WL^2}{2048}$$

$$a) A = 10'' \times 10'' = 100 \text{ in}^2, P = 200000 \text{ lbs}$$

$$\sigma_T = \frac{P}{A} = \frac{200000}{100} = \underline{2000 \text{ Psi}}$$

$$b) \text{ STRAIN } \epsilon = \frac{\sigma}{E} = \frac{2000}{29 \times 10^6} = 0.000069 \text{ in/in}$$

$$\text{EXTENSION } \frac{\Delta L}{L} = \epsilon \Rightarrow \Delta L = 0.000069 \times (20' \times 12 \text{ in/ft}) = \underline{0.1656 \text{ in}}$$