Exam 4-2

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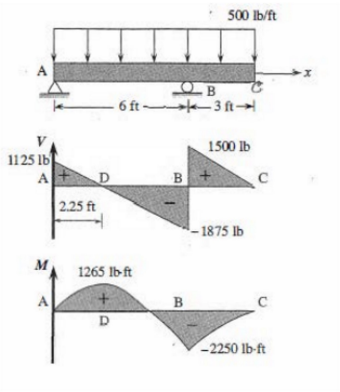
Problem 2: (10 Points =2 + 5 +3)

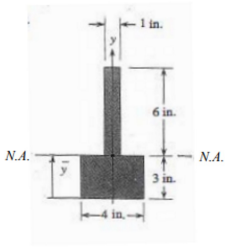
A beam is loaded as shown, and the V and M diagrams are given. The cross-section is an inverted Tee-section, and the neutral axis is shown.

a. Show that $I_{N.A.} = 108\ in^4$

b. Find the Maximum Tensile and Compressive Stresses in the beam, due to Bending Moment. **Clearly state where these maximum stresses occur**.

c. Find the Maximum Shear Stress in the beam, due to Shear Force. **Clearly state where this maximum stress occurs.**





A.) $I = \frac{1}{12}(4)(3)^3 + (12)(1.5)^2 + \frac{1}{12}(6)^3(1) + (6)(3)^2$

$I = 36 + 72$

$I = 108\ in.^4$

B.)

Tension:

D: $1265(-3)(12) = 45540$

C: $-2250(6)(12) = 162000$

Compression:

D: $1265(6)(12) = 91080$

C: $-2250(-3)(12) = 81000$

$\sigma_{tension(max)} = \frac{-(-162000)}{108} = 1500\ psi\ @C$

$\sigma_{compression(max)} = \frac{-(91080)}{108} = -843.33\ psi\ @D$

C.) $\tau = \frac{VQ}{It}$

Max shear stress occurs at N.A.

$t_{NA} = 1\ in.$

$I = 108\ in.^4$

$Q_{max} = A'y'$;

$y = 1.5$

$3(4)(1.5) = 18\ in.^3$

$V_{max} = -1875$

$\tau = \frac{-(1875)(18)}{(108)(1)} = -312.5\ psi$