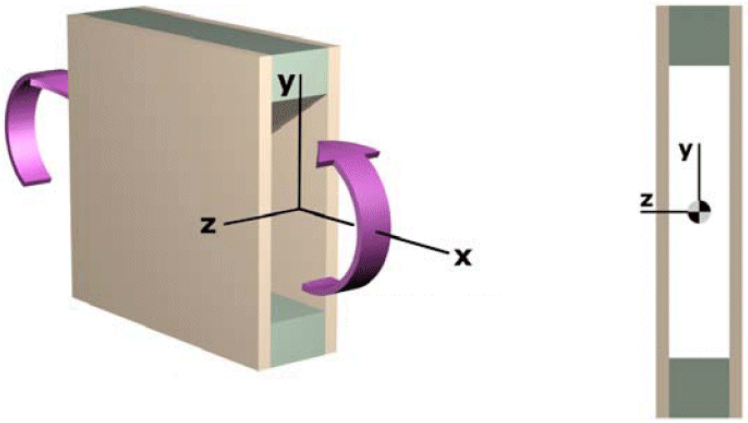
 Name: _____

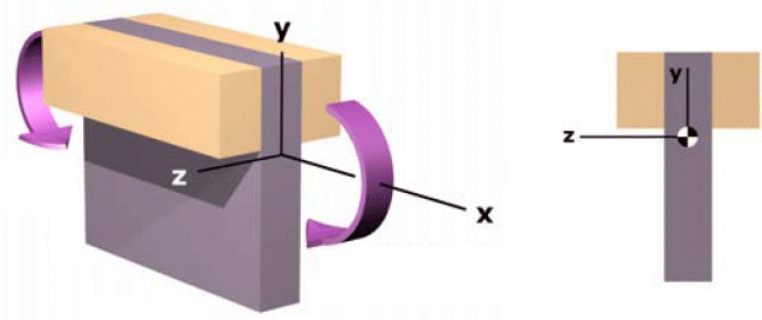
1. (3 points) Circle the following point on the beam's cross-section.

A. the location(s) where maximum shear stress $\tau = VQ/Ib$ occurs
B. the location(s) where zero shear stress $\tau = VQ/Ib$ occurs

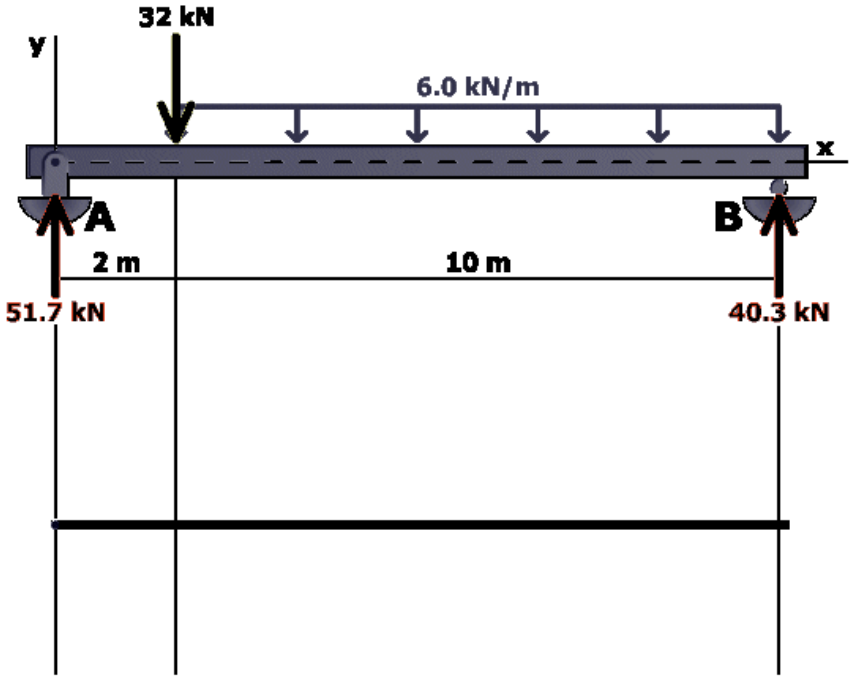


2. (3 points) Label the following points on the beam's cross-section.

A. the location(s) where maximum shear stress $\tau = VQ/Ib$ occurs
B. the location(s) where zero shear stress $\tau = VQ/Ib$ occurs

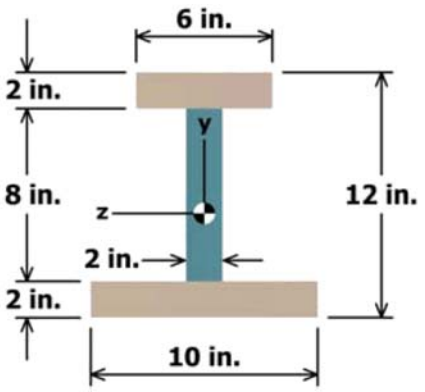


3. (5 points) Determine the maximum shear force V.



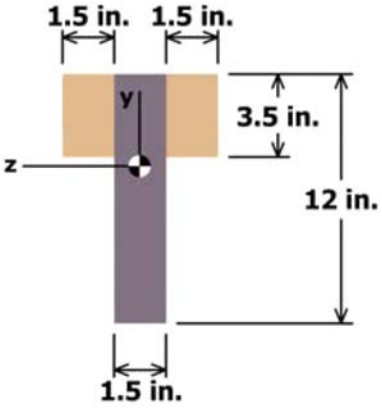
V_{max} = _____ kN

4. (5 points) Determine the centroid location measured from the bottom of the cross-section.



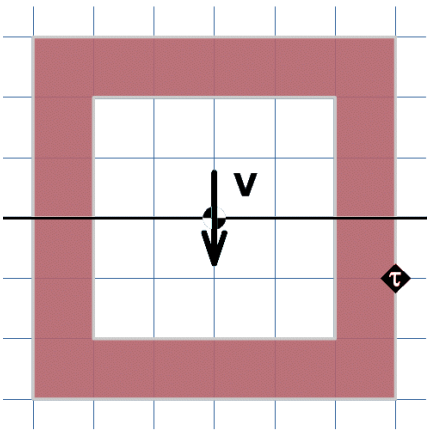
y = _____ in.

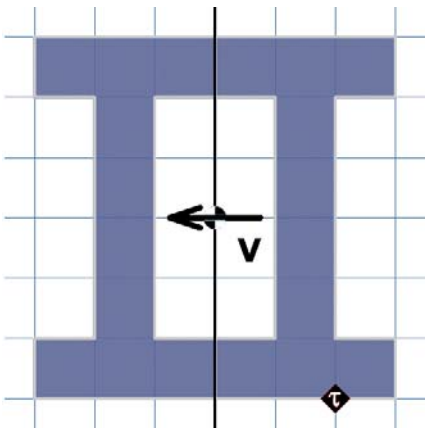
5. (6 points) Determine the moment of inertia about the z-axis if the centroid is y = 7.5658 inches from the bottom of the cross-section.

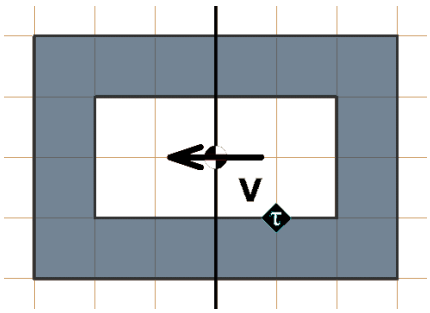


$I_{z\text{-axis}}$ = _____ $in.^4$

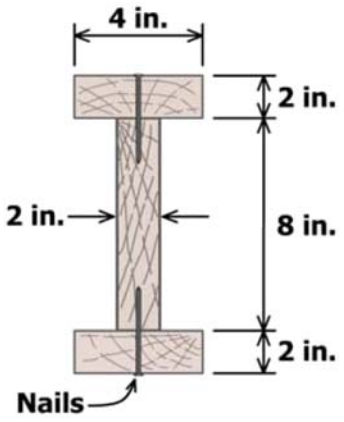
6. (6 points) Shear stress τ due to the indicated shear force V is to be calculated at the point indicated. Shade the area needed to calculate Q for each cross-section.







7. (7 points) Determine the following values used for finding the maximum horizontal shear stress $\tau = VQ/Ib$.



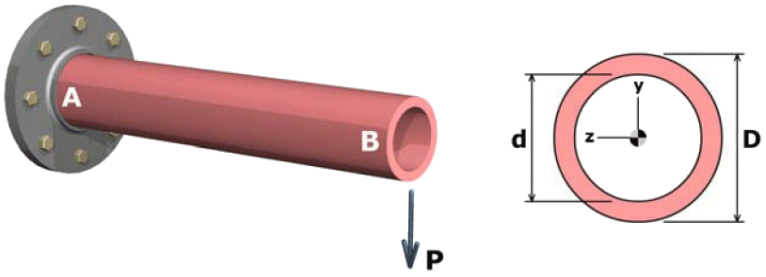
b = _____ in.

Q = _____ $in.^3$

8. (3 points) Using the image for problem 7, determine the value for Q used for finding the maximum nail spacing.

Q = _____ $in.^3$

9. (9 points) Determine the following values used finding the maximum horizontal shear stress $\tau = VQ/Ib$. Use D = 170 mm and d = 150 mm.



b = _____ mm

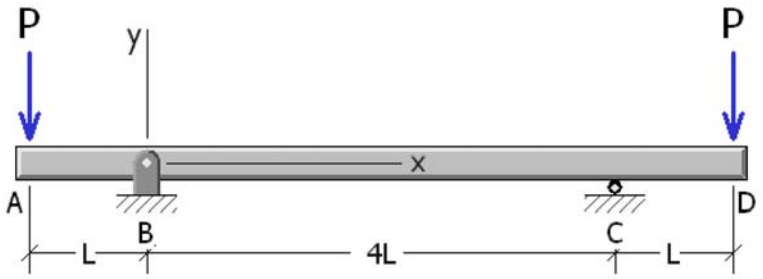
I = _____ mm^4

Q = _____ mm^3

10. (9 points) Describe the two deflection and/or slope boundary conditions for the following beams. Deflection boundary conditions should be formatted as y=? at x=?. Slope boundary conditions should be formatted as θ = ? at x = ?. Also state the distributed load equation w(x) for the given regions.

BC 1: _____

BC 2: _____

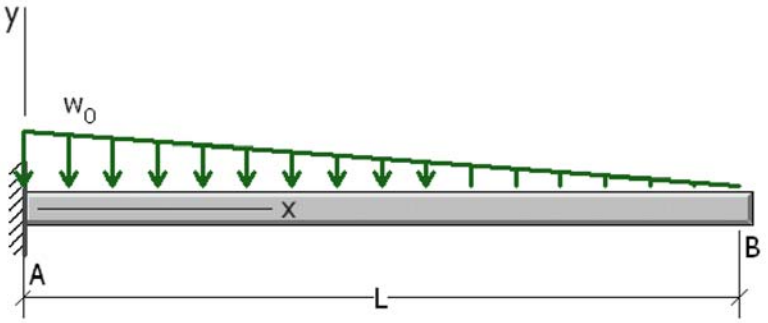


Between B and C,

w(x) = _____

BC 1: _____

BC 2: _____

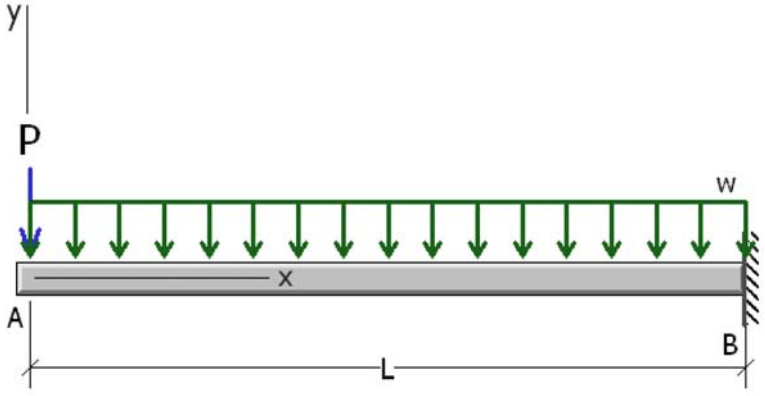


Between A and B,

w(x) = _____

BC 1: _____

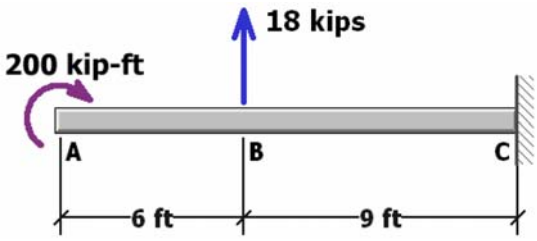
BC 2: _____



Between A and B,

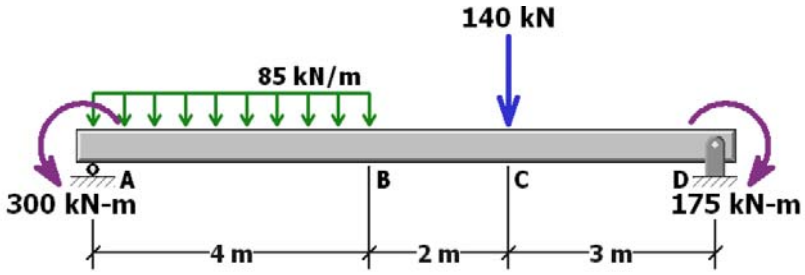
w(x) = _____

11. (6 points) Circle the two incorrect numbers in the following formula for the deflection at A. E = 29,000 ksi, I = 1710 in^4, and all of the numbers have been converted to inches and pounds.



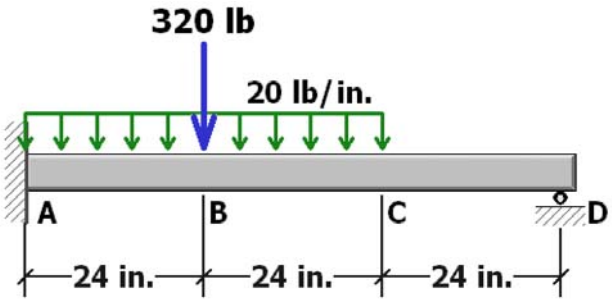
$$y_A = \frac{200{,}000(12)(180)^2}{2(29\times10^6)(1710)} + \frac{18{,}000(180)^3}{6(29\times10^6)(1710)} + 72\left[\frac{18{,}000(108)^2}{2(29\times10^6)(1710)}\right]$$

12. (8 points) Fill in the missing piece of the following formula for the deflection at B. Numbers should be in meters and Newtons. Do not simplify.



$$y_B = \frac{-140{,}000\,(3)(4)}{6(9)EI}\left[9^2-3^2-4^2\right] - \boxed{} + \frac{300{,}000\,(4)}{6(9)EI}\left[2(9)^2-3(9)(4)+4^2\right] + \frac{175{,}000\,(5)}{6(9)EI}\left[2(9)^2-3(9)(5)+5^2\right]$$

13. (8 points) Fill in the missing pieces of the following formula for the deflection at D. Numbers should be in inches and pounds.



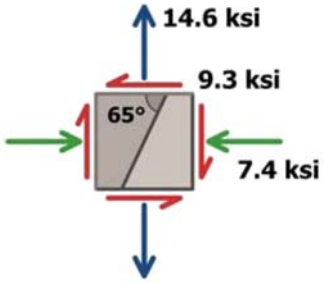
$$y_D = -\frac{320(24)^3}{3EI} - \boxed{} - \boxed{} - 24\left[\frac{20(48)^3}{6EI}\right] + \frac{D(72)^3}{3EI} = 0$$

14. (3 points) What are the following values.

σ_x = _____ ksi

σ_y = _____ ksi

τ_{xy} = _____ ksi



15. (4 points) Using the following values, determine the θ_p and θ_s.

σ_x = 82 MPa
σ_y = 48 MPa
τ_{xy} = -26 MPa

θ_p = _____ deg.

θ_s = _____ deg.

16. (6 points) Using the following values, determine σ_u, σ_v, and τ_{uv} and show these on an appropriate **sketch**.

σ_x = 18 MPa
σ_y = -42 MPa
τ_{xy} = 30 MPa
θ = -25 deg.

17. (9 points) Determine the following values from the Mohr's circle. Assume plane stress.

σ_x = _____ ksi

σ_y = _____ ksi

τ_{xy} = _____ ksi

θ_p = _____ deg.

σ_1 = _____ ksi

σ_2 = _____ ksi

$\sigma_{average}$ = _____ ksi

$\tau_{in\text{-}plane\ max}$ = _____ ksi

$\tau_{absolute\ max}$ = _____ ksi