

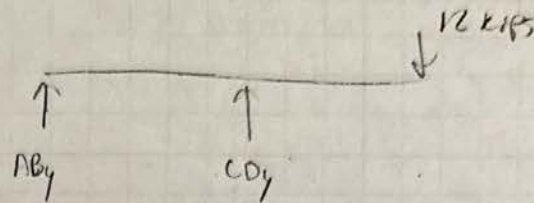
$$1. \sum F_y: AB_y + CD_y - 12 \text{ kips} = 0$$

$$\sum M_A: CD_y(8) - 12(48) = 0$$

$$CD_y = 16 \text{ kips}$$

$$AB_y = -4 \text{ kips}$$

$$\sigma_{AB} = \frac{-4 \text{ kips}}{.2 \text{ in}^2} = -20 \text{ ksi}$$



$$2. \sigma_{CD} = \frac{16 \text{ kips}}{.5 \text{ in}^2} = 32 \text{ ksi}$$

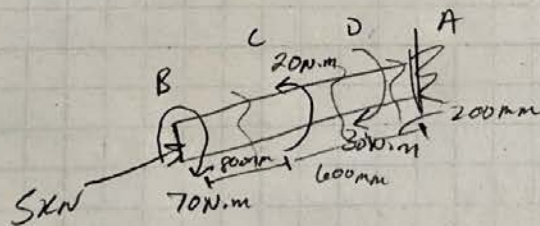
$$3. F.S. = \frac{36 \text{ ksi}}{-32 \text{ ksi}} = 1.125$$

$$4. \Delta L_x = \frac{-32 \text{ ksi} \cdot 24''}{29000 \text{ ksi}} = -.0265 \text{ in}$$

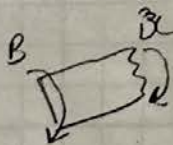
$$5. \epsilon_{DL} = \frac{-32 \text{ ksi}}{29000 \text{ ksi}} = -.001103$$

$$6. \delta_{A/B} = \frac{(20 \text{ ksi})(24'')}{(29000 \text{ ksi})} + (6.6 \times 10^{-6}/^\circ\text{F})(50^\circ\text{F})(24'') = .0245 \text{ in}$$

7.



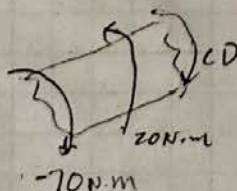
FBD B to C



$$\sum M: -70 \text{ N.m} - BC = 0$$

$$BC = -70$$

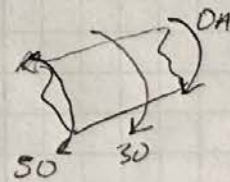
FBD C to D



$$-70 + 20 - CD = 0$$

$$CD = -50$$

FBD D to A



$$-50 - 30 - DA = 0$$

$$DA = -80 \text{ N.m}$$

8. $CD = -50 \text{ N}\cdot\text{m}$

$$\tau = \frac{-50 \text{ N}\cdot\text{m} (1.025 \text{ m})}{\frac{\pi}{2} (1.025 \text{ m})^4} = 4074366.54 \text{ N/m}^2$$

4074 kPa

9. $BC = -70 \text{ N}\cdot\text{m}$

$CD = -50 \text{ N}\cdot\text{m}$

$DA = -80 \text{ N}\cdot\text{m}$

$$\theta_{B/D} = \frac{(-70 \text{ N}\cdot\text{m})(1.8 \text{ m})}{(75 \times 10^9 \text{ N/m}^2)(\frac{\pi}{2} (1.025 \text{ m})^4)} + \frac{(-50 \text{ N}\cdot\text{m})(1.6 \text{ m})}{(75 \times 10^9 \text{ N/m}^2)(\frac{\pi}{2} (1.025 \text{ m})^4)} + \frac{(-80 \text{ N}\cdot\text{m})(1.2 \text{ m})}{(75 \times 10^9 \text{ N/m}^2)(\frac{\pi}{2} (1.025 \text{ m})^4)} = -0.00223 \text{ rad}$$

10. $\sigma = \frac{5000 \text{ N}}{\frac{\pi}{4} (1.005 \text{ m})^2} = 2546479.089 \text{ N/m}^2 \cdot \frac{1 \text{ MPa}}{1 \times 10^6 \text{ Pa}} = 2.546 \text{ MPa}$

11. $\sum F_x: A_x + 10 \text{ k} = 0 \quad A_x = -10 \text{ k}$

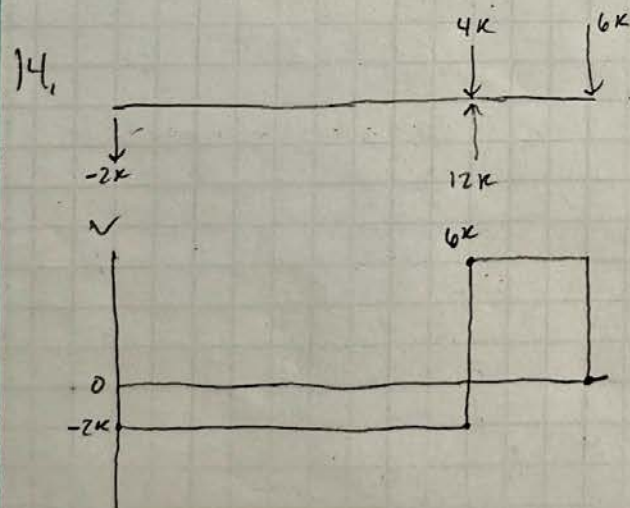
12. $\sum F_y: A_y + B_y - 4 \text{ k} - 6 \text{ k} = 0$

$\sum M_B: -A_y(18 \text{ ft}) - 6 \text{ k}(6 \text{ ft}) = 0$

$+ A_y = \frac{-36 \text{ k}\cdot\text{ft}}{18 \text{ ft}} = -2 \text{ k}$

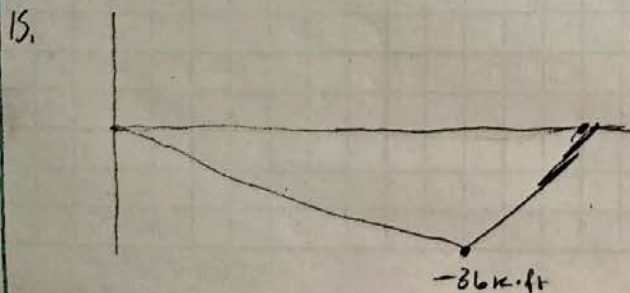
13. $\sum F_y: -2 \text{ k} + B_y - 4 \text{ k} - 6 \text{ k} = 0$

$B_y = 12 \text{ k}$



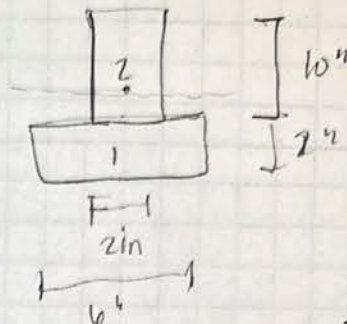
$M_{AB} = 0 + (-2)(18) = -36 \text{ k}\cdot\text{ft}$

$M_{BC} = -36 + (6)(6) = 0$
36



	A	y	AY	I_x	d_y
1	12 in^2	1 in	12 in^3	$\frac{12(2^3)}{12} = 4 \text{ in}^4$	-3.75 in
2	20 in^2	7 in	140 in^3	$\frac{2(10^3)}{12} = 166.67 \text{ in}^4$	2.25 in
	32 in^2		152 in^3		

$$\bar{y} = \frac{152 \text{ in}^3}{32 \text{ in}^2} = 4.75 \text{ in}$$



$$17. (4 \text{ in}^4 + 166.67 \text{ in}^4) + ((12 \text{ in}^2 \cdot (-3.75 \text{ in})^2) + (20 \text{ in}^2 \cdot (2.25 \text{ in})^2)) = 440.67 \text{ in}^4$$

$$18. M = -36 \text{ k} \cdot \text{ft} \quad \sigma_B = \frac{36 \text{ k} \cdot \text{ft} \cdot \frac{12 \text{ in}}{\text{ft}} \cdot (4.75 \text{ in})}{440.67 \text{ in}^4} = 4.657 \text{ ksi}$$

$$19. V = 6 \text{ k} \quad \tau_{\max} = \frac{6 \text{ k} \left((4.75 \cdot 2) \left(\frac{7.25}{2} \right) \right)}{(440.67)(2 \text{ in})} = 1.3578 \text{ ksi}$$

$$20. \sigma_{\text{comb}} = \frac{10 \text{ k}}{32 \text{ in}^2} + 4.657 \text{ ksi} = 4.969 \text{ ksi (+)}$$