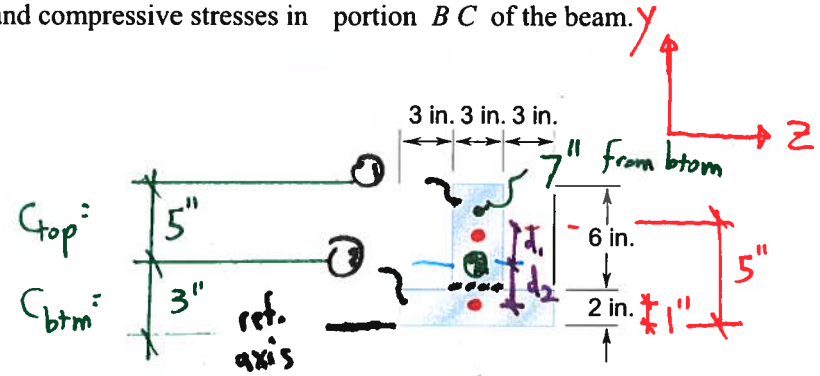
Do not round intermediate calculations. Give your final answer(s) to three significant figures.

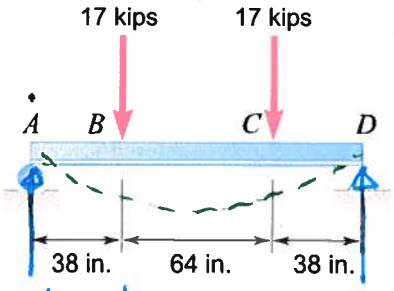
P2

Two vertical forces are applied to a beam of the cross section shown. Determine the maximum tensile and compressive stresses in portion BC of the beam.



Section	Area	$\bar{y}$	$A\bar{y}$
1	18	5"	90
2	18	1"	18
Σ	36		108

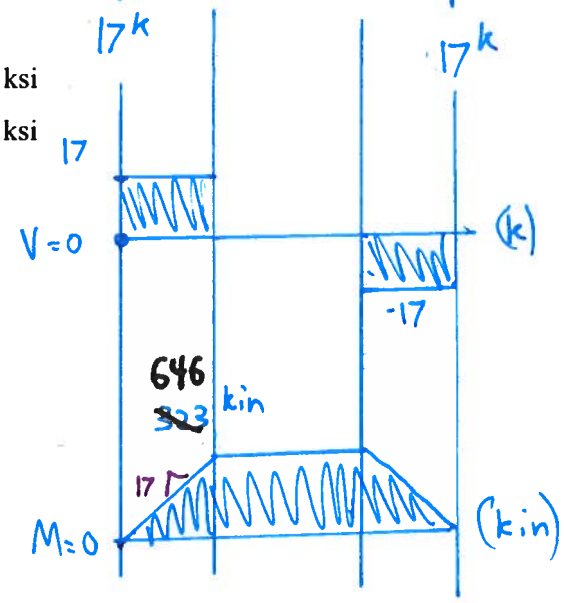
$$\bar{y} = \frac{\Sigma A\bar{y}}{\Sigma A} = 3"$$

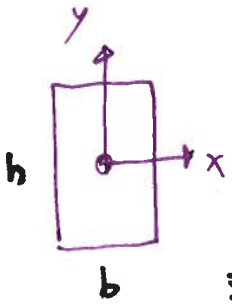


$$\bar{y} = \frac{(6)(3)(5) + (2)(9)(1)}{3(6) + 2(9)} = 3"$$

σ_{top} = ksi

σ_{bot} = ksi





$$I_x = \frac{1}{12}bh^3$$

$$I_y = \frac{1}{12}hb^3$$

$$J = I_x + I_y$$

$$M_{max} = 646 \text{ (323) kin}$$

$$\sigma_{max} = \frac{Mc}{I}$$

$$\sigma_{max,ten} = \frac{646 \text{ (323) kin}(3")}{204 \text{ in}^4} = 4.75 \text{ ksi}$$

$$I_{total} = \Sigma\left(\bar{I} + Ad^2\right) = 204 \text{ in}^4$$

SHAPE 1

$$\left[\underbrace{\frac{1}{12}(3")(6")^3}_{\bar{I}_1} + \underbrace{(3")(6")}_{A_1}\underbrace{(2")^2}_{d_1}\right]$$

$$+ \left[\underbrace{\frac{1}{12}(9")(2")^3}_{\bar{I}_2} + \underbrace{(9")(2")}_{A_2}\underbrace{(2")^2}_{d_2}\right]$$

$$\sigma_{max,comp} = \frac{646 \text{ (323) kin}(5")}{204 \text{ in}^4} \approx 8 \text{ ksi}$$

3rd Point: $\sigma = \frac{-My}{I} = \frac{-(323^{kin})(4")}{204\ in^4} = -6.33^{ksi}$ ← purely w/ sign

Intuitively

$\sigma = \frac{My}{I} = \frac{(323^{kin})(4")}{204\ in^4} = 6.33^{ksi}$ (comp)