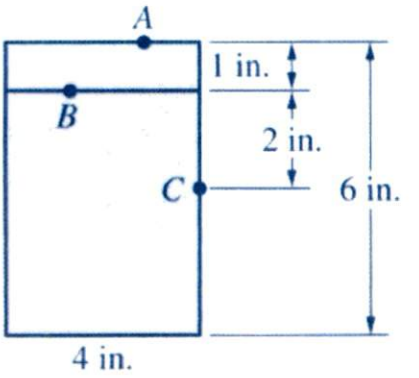
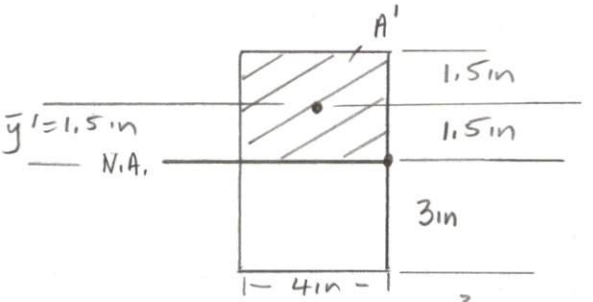
14-21

The beam of rectangular section in Fig. P14-21 is subjected to a maximum shear force of 1900 lb. Determine the shear stresses at points A, B, and C.



Solution

(a) Shear stress at point C (N.A.)



$V = 1900\ lb$

$$I_x = \frac{bh^3}{12} = \frac{4in(6in)^3}{12} = 72\ in^4$$

$$Q = A'\bar{y}' = 4in(3in)(1.5in) = 18\ in^3$$

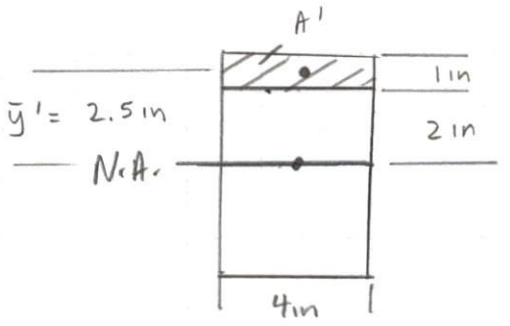
$$\tau_C = \tau_{MAX} = \frac{VQ}{It} = \frac{1900\ lb\ (18\ in^3)}{72\ in^4\ (4in)}$$

$$= 118.75\ psi$$

Check using (Rectangle)

$$\tau_{MAX} = 1.5\frac{V}{A} = \frac{1.5\ (1900\ lb)}{4in(6in)} = 118.75\ psi \quad \checkmark$$

(b) Shear stress at point B



$$Q = A'\bar{y}' = 4in(1in)(2.5in) = 10\ in^3$$

$$\tau_B = \frac{VQ}{It} = \frac{1900\ lb(10\ in^3)}{72\ in^4\ (4in)}$$

$$= 66\ psi$$

(c) Shear stress at point A

$$\tau_A = 0\ psi$$