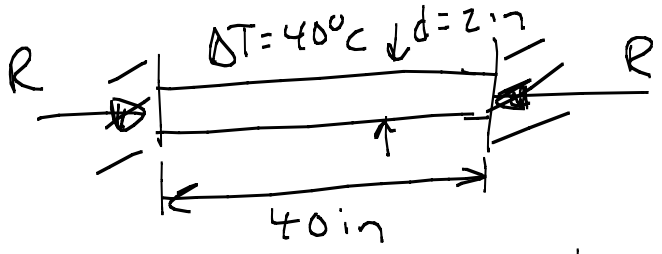
Problem 4

$\alpha = 12 \times 10^{-6}\ 1/^{\circ}C$

$E = 30{,}000\ ksi$



Determine: The axial stress due to the temperature change

$$\delta_T = \varepsilon_T L = \alpha(\Delta T) L = (12 \times 10^{-6}\ 1/^{\circ}C)(40^{\circ}C)(40\ in)$$

$$\delta_T = 1.92 \times 10^{-3}\ in = \delta_R$$

$$\delta_R = \frac{RL}{EA} = \left(\frac{L}{E}\right)\underbrace{\left(\frac{R}{A}\right)}_{\sigma}$$

$$\delta_R = \frac{L}{E}\sigma \qquad \sigma = \frac{E\delta_R}{L}$$

$$\sigma = \frac{(30{,}000\ ksi)(1.92 \times 10^{-3}\ in)}{40\ in}$$

$$\boxed{\sigma = 1.44\ ksi}$$