1. A rigid plate is pivoted at point C. After the load P is applied the temperature of bar B is observed to decrease by 50°F. Determine the axial stress in bar A and the deformation of bar B. The area of cross-section of both bars is 2 in$^2$.

<table>
<thead>
<tr>
<th></th>
<th>Modulus of Elasticity</th>
<th>Coefficient of Thermal Expansion</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bar A</td>
<td>10,000 ksi</td>
<td>16 $(10^{-6})/°F$</td>
<td>10 inches</td>
</tr>
<tr>
<td>Bar B</td>
<td>30,000 ksi</td>
<td>10 $(10^{-6})/°F$</td>
<td>18 inches</td>
</tr>
</tbody>
</table>

2. A beam of elastic-perfectly plastic material has a yield stress of 50 ksi and a cross-section shown. Determine the location of the neutral axis when point A is at yield stress.

(b) the depth of plastic zone in BC.

(c) the maximum torsional shear \textit{strain} in AB.
(c) A force $F$ is applied to the roller that slides inside a slot. Both bars have an area of cross-section of $A = 100 \text{ mm}^2$, Modulus of Elasticity $E = 200 \text{ GPa}$, and a yield stress of $250 \text{ MPa}$. Bar AP and BP have lengths of $L_{AP} = 200 \text{ mm}$ and $L_{BP} = 250 \text{ mm}$ respectively. Determine the collapse load

In parts (d) and (e) below use the composite cross-section shown in which $E_1 = 30,000 \text{ ksi}$ and $E_2 = 10,000 \text{ ksi}$. Point a is at the bottom of the cross-section and points B and C are at the top of the cross-section.

(d) The AXIAL normal stress at A is 12 ksi (T). What are the axial stresses at points B and C?

(e) The BENDING normal stress at A is 12 ksi (T). What are the bending normal stresses at B and C?

ANSWERS
1. $\sigma_A = 5 \text{ ksi (C)}$  \hspace{1cm} $\delta_B = 0.015 \text{ in}$
2. $a = 2.7 \text{ in}$
3a $\gamma_{max} = 4500 \mu$
3b $P_{\text{collapse}} = 32,216 \text{ N}$
3d $\sigma_B = 12 \text{ ksi (T)}$ \hspace{1cm} $\sigma_C = 36 \text{ ksi (T)}$
3e $\sigma_B = 12 \text{ ksi (C)}$ \hspace{1cm} $\sigma_C = 36 \text{ ksi (C)}$