1-106. The bar is held in equilibrium by the pin supports at A and B. Note that the support at A has a single leaf and therefore it involves single shear in the pin, and the support at B has a double leaf and therefore it involves double shear. The allowable shear stress for both pins is $\tau_{allow} = 150 \text{ MPa}$. If a uniform distributed load of $w = 8 \text{ kN/m}$ is placed on the bar, determine its minimum allowable position $x$ from B. Pins A and B each have a diameter of 8 mm. Neglect any axial force in the bar.

\[ \sum M_A = 0 \]
\[ F_B \cdot 2 - w(2-x) \left( \frac{2+x+(2-x)}{2} \right) = 0 \]
\[ 2F_B - 8(2-x)(3 + \frac{x}{2}) = 0 \]
\[ 2F_B - 48 + 16x + 4x^2 = 0 \]  
2 points (1)

\[ \sum M_B = 0 \]
\[ F_A \cdot 2 - w(2-x) \left( \frac{x}{2} + 1 \right) = 0 \]
\[ 2F_A - 8(2-x)(\frac{x}{2} + 1) = 0 \]
\[ 2F_A - 16 + 4x^2 = 0 \]  
2 points (2)

Pin A nun kırıldığı varsayalım

\[ \tau_{allow} = \frac{F_A}{A} \Rightarrow 150(10^6) = \frac{F_A}{\pi \left( \frac{0.008}{2} \right)^2} \]

\[ F_A = 7539.8 \text{ N} = 7.5398 \text{ kN} \]  
2 points
Pin B nin kırıldığı varsayalım

\[ \text{Tallow} = \frac{F_B}{2} \Rightarrow 150(10^6) = \frac{F_B}{2 \cdot \frac{\pi}{4} (0.008)^2} \]

\[ F_B = 15079.6 \text{ N} = 15.0796 \text{ kN} \]  

\[ \text{2 point} \]

\[ F_A = 7.5398 \text{ kN} \] (2) denklemde yerine koyarsak

\[ 4x^2 - 16 + 2F_A = 0 \]
\[ 4x^2 - 16 + 2(7.5398) = 0 \]
\[ 4x^2 - 16 + 15.0796 = 0 \]
\[ 4x^2 - 0.9204 = 0 \]
\[ \Rightarrow x = 0.4796 \]  

\[ \text{1 point} \]

\[ F_B = 15.0796 \text{ kN} \] (1) denklemde yerine koyarsak

\[ 2F_B - 48 + 16x + 4x^2 = 0 \]
\[ 4x^2 + 16x - 48 + 2(15.0796) = 0 \]

\[ ax^2 + bx + c = 0 \]
\[ x_{1,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \]
\[ a = 4 \]
\[ b = 16 \]
\[ c = -17.8408 \]

\[ x_1 = \frac{-16 + 23.27}{8} \Rightarrow x_1 = 0.9086 \]
\[ x_2 = \frac{-16 - 23.27}{8} \Rightarrow x_2 = -4.90875 \]

Minimum allowable position of \( x \)

\[ x = 0.9086 \text{ m} \]  

\[ \text{1 point}. \]