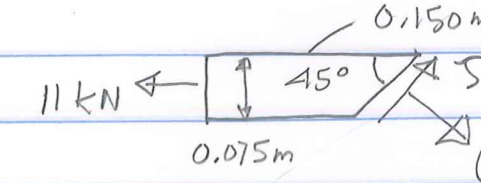
HW #1 Solution

1.31

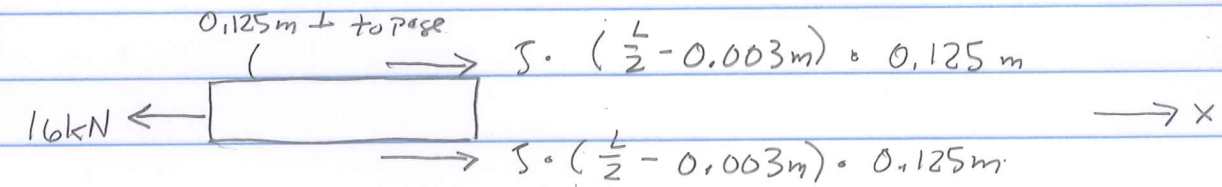


$\Sigma F_x = 0 = -11\,kN + \tau \cdot 0.075m \cdot \sqrt{2} \cdot 0.150m \frac{1}{\sqrt{2}} + \sigma \cdot 0.075m \cdot \sqrt{2} \cdot 0.150m \frac{1}{\sqrt{2}}$

$\Sigma F_y = 0 = \tau \cdot 0.075m \cdot \sqrt{2} \cdot 0.150m \frac{1}{\sqrt{2}} - \sigma \cdot 0.075m \cdot \sqrt{2} \cdot 0.150m \frac{1}{\sqrt{2}}$

Solve: $\boxed{\sigma = \tau = 489\,kN/m^2 = 489\,kPa}$

1.43

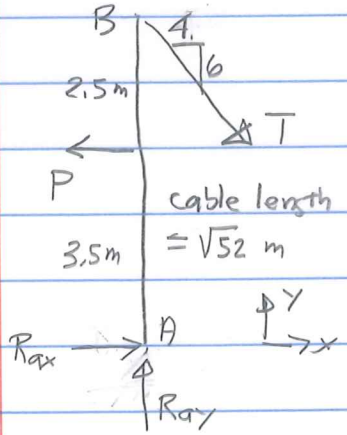


$\Sigma F_x = 0 = -16\,kN + 2 \cdot \tau \cdot (\frac{L}{2} - 0.003m) \cdot 0.125m$

$\tau = 2.5\,MPa / 2.75$

Solve for L: $\boxed{L = 0.147\,m}$

2.14



$\Sigma M_A = 0 = P \cdot 3.5m - T \frac{4}{\sqrt{52}} \cdot 6.0m$

$P = 0.9509\,T \quad (1)$

σ_{max} A

$T \le 190\,MPa \cdot \pi (0.002m)^2 \quad (2)$

$T \le 2.3876\,kN$

T σ $\frac{1}{E}$ L

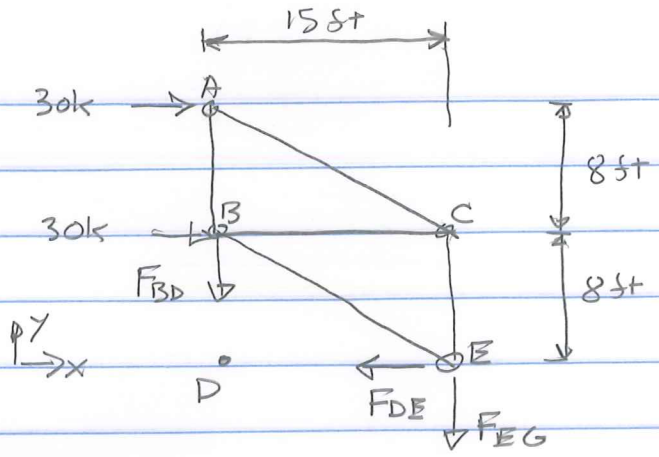
$0.006m \ge \frac{T}{\pi (0.002m)^2} \frac{1}{200\,GPa} \cdot \sqrt{52}\,m$

$T \le 2.0912\,kN \leftarrow$ controls (3)

From (1) and (3)

$P \le \boxed{1.989\,kN = P_{max}}$

2.22



$\Sigma M_E = 0 = F_{BD} \cdot 15' - 30k \cdot 8' - 30k \cdot 16'$

$F_{BD} = 48k$

$\Sigma F_x = 0 = 60k - F_{DE}$

$F_{DE} = 60k$

σ $\frac{1}{E}$ L

$$\Delta L_{BD} = \frac{48k}{2in^2} \cdot \frac{1}{29 \times 10^6 psi} \cdot 96in = 0.0794 in$$

$$\Delta L_{DE} = \frac{60k}{3in^2} \cdot \frac{1}{29 \times 10^6 psi} \cdot 180in = 0.1241 in$$