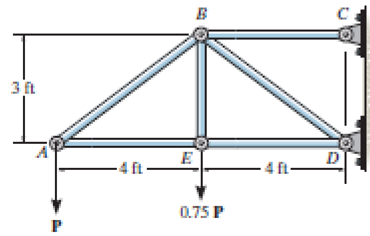
***1–36.** The bars of the truss each have a cross-sectional area of 1.25 in^2. If the maximum average normal stress in any bar is not to exceed 20 ksi, determine the maximum magnitude P of the loads that can be applied to the truss.



Joint A:

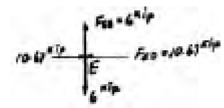
$$+\uparrow \Sigma F_y = 0; \quad -P + \left(\frac{3}{5}\right)F_{AB} = 0$$

$$F_{AB} = (1.667)P$$

$$\xrightarrow{+} \Sigma F_x = 0; \quad -F_{AE} + (1.667)P\left(\frac{4}{5}\right) = 0$$

$$F_{AE} = (1.333)P$$

Joint E:



$$+\uparrow \Sigma F_y = 0; \quad F_{EB} - (0.75)P = 0$$

$$F_{EB} = (0.75)P$$

$$\xrightarrow{+} \Sigma F_x = 0; \quad (1.333)P - F_{ED} = 0$$

$$F_{ED} = (1.333)P$$

Joint B:

$$+\uparrow \Sigma F_y = 0; \quad \left(\frac{3}{5}\right)F_{BD} - (0.75)P - (1.667)P\left(\frac{3}{5}\right) = 0$$

$$F_{BD} = (2.9167)P$$

$$\xrightarrow{+} \Sigma F_x = 0; \quad F_{BC} - (2.9167)P\left(\frac{4}{5}\right) - (1.667)P\left(\frac{4}{5}\right) = 0$$

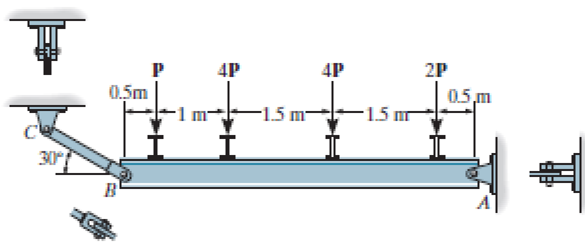
$$F_{BC} = (3.67)P$$

The highest stressed member is BC:

$$\sigma_{BC} = \frac{(3.67)P}{1.25} = 20$$

$P = 6.82$ kip **Ans.**

***1–48.** The beam is supported by a pin at A and a short link BC. If $P = 15$ kN, determine the average shear stress developed in the pins at A, B, and C. All pins are in double shear as shown, and each has a diameter of 18 mm.



For pins B and C:

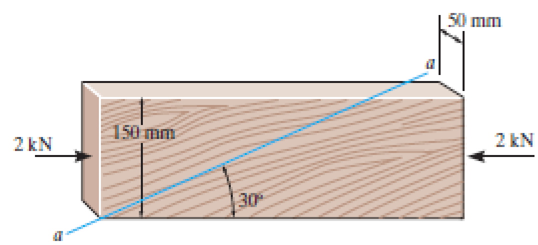
$$\tau_B = \tau_C = \frac{V}{A} = \frac{82.5\,(10^3)}{\frac{\pi}{4}\left(\frac{18}{1000}\right)^2} = 324 \text{ MPa}$$ **Ans.**

For pin A:

$$F_A = \sqrt{(82.5)^2 + (142.9)^2} = 165 \text{ kN}$$

$$\tau_A = \frac{V}{A} = \frac{82.5\,(10^3)}{\frac{\pi}{4}\left(\frac{18}{1000}\right)^2} = 324 \text{ MPa}$$ **Ans.**

1–50. The block is subjected to a compressive force of 2 kN. Determine the average normal and average shear stress developed in the wood fibers that are oriented along section a–a at 30° with the axis of the block.



Force equilibrium equations written perpendicular and parallel to section a–a gives

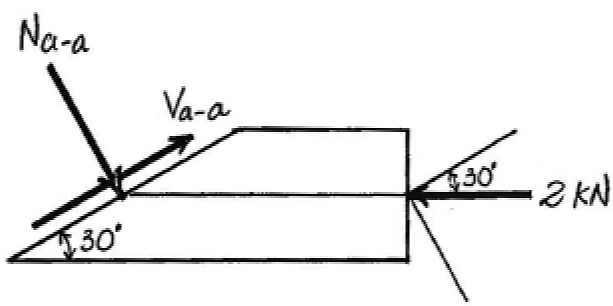
$+\nearrow \Sigma F_{x'} = 0;\quad V_{a-a} - 2\cos 30^\circ = 0 \quad V_{a-a} = 1.732 \text{ kN}$

$+\nwarrow \Sigma F_{y'} = 0;\quad 2\sin 30^\circ - N_{a-a} = 0 \quad N_{a-a} = 1.00 \text{ kN}$

The cross sectional area of section a–a is $A = \left(\frac{0.15}{\sin 30^\circ}\right)(0.05) = 0.015 \text{ m}^2$. Thus

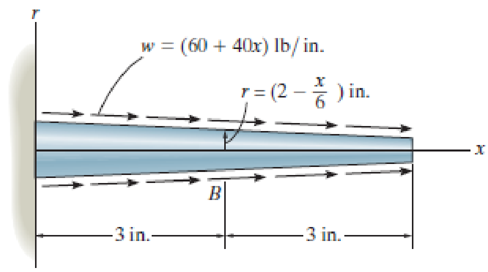
$$(\sigma_{a-a})_{avg} = \frac{N_{a-a}}{A} = \frac{1.00(10^3)}{0.015} = 66.67(10^3)\text{Pa} = 66.7 \text{ kPa}$$ **Ans.**

$$(\tau_{a-a})_{avg} = \frac{V_{a-a}}{A} = \frac{1.732(10^3)}{0.015} = 115.47(10^3)\text{Pa} = 115 \text{ kPa}$$ **Ans.**



(a)

•1–69. The tapered rod has a radius of $r = (2 - x/6)$ in. and is subjected to the distributed loading of $w = (60 + 40x)$ lb/in. Determine the average normal stress at the center of the rod, B.



$$A = \pi\left(2 - \frac{3}{6}\right)^2 = 7.069 \text{ in}^2$$

$$\Sigma F_x = 0; \qquad N - \int_3^6 (60 + 40x)\,dx = 0; \qquad N = 720 \text{ lb}$$

$$\sigma = \frac{720}{7.069} = 102 \text{ psi}$$

Ans.