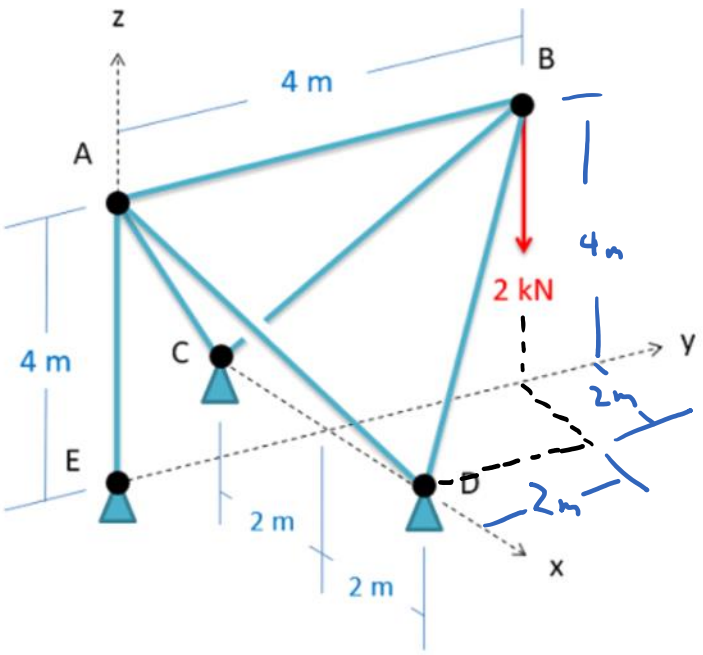
Question 5:

Use the method of joints to find the forces in all members of the truss shown to the right. Remember to specify tension or compression.

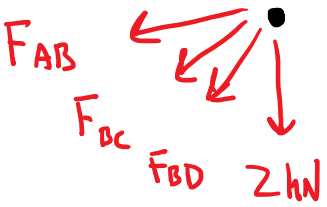


$L_{BD} = \sqrt{2^2 + 2^2 + 4^2}$

$L_{BD} = \sqrt{24}$

$\sqrt{24} = L_{BC} = L_{AC} = L_{AD}$

Start at B



$$\sum F_x = \frac{2}{\sqrt{24}} L_{BD} - \frac{2}{\sqrt{24}} L_{BC} = 0$$

$$L_{BC} = L_{BD}$$

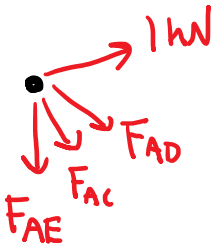
$$\sum F_y = -F_{AB} - \frac{2}{\sqrt{24}} L_{BD} - \frac{2}{\sqrt{24}} L_{BC} = 0$$

$$\sum F_z = -\frac{4}{\sqrt{24}} F_{BC} - \frac{4}{\sqrt{24}} F_{BD} - 2 = 0$$

$$F_{BC} = F_{BD} = \frac{2}{-\frac{8}{\sqrt{24}}} = -1.22\,kN \text{ comp}$$

$$F_{AB} = -\frac{2}{\sqrt{24}}(-1.22) - \frac{2}{\sqrt{24}}(-1.22) = 1\,kN \text{ tens}$$

point A



$$\Sigma F_x = \frac{2}{\sqrt{24}} F_{AD} - \frac{2}{\sqrt{24}} F_{AC} = 0$$

$$F_{AD} = F_{AC}$$

$$\Sigma F_y = 1 + \frac{2}{\sqrt{24}} F_{AC} + \frac{2}{\sqrt{24}} F_{AD} = 0$$

$$\Sigma F_z = -F_{AE} - \frac{4}{\sqrt{24}} F_{AC} - \frac{4}{\sqrt{24}} F_{AD} = 0$$

$$F_{AC} = F_{AD} = \frac{-1}{\left(\frac{4}{\sqrt{24}}\right)} = -1.22\,kN \leftarrow \text{comp}$$

$$F_{AE} = -\frac{4}{\sqrt{24}}(-1.22) - \frac{4}{\sqrt{24}}(-1.22)$$

$$F_{AE} = 2\,kN \leftarrow \text{tens}$$

Solution

$F_{AE} = 2\,kN\ T$

$F_{AB} = 1\,kN\ T$

$F_{AC} = F_{AD} = F_{BC} = F_{BD} = 1.22\,kN\ C$