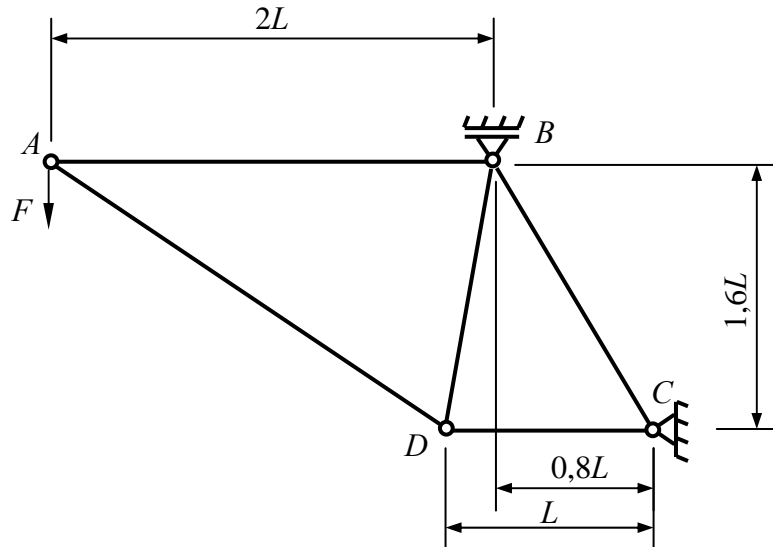


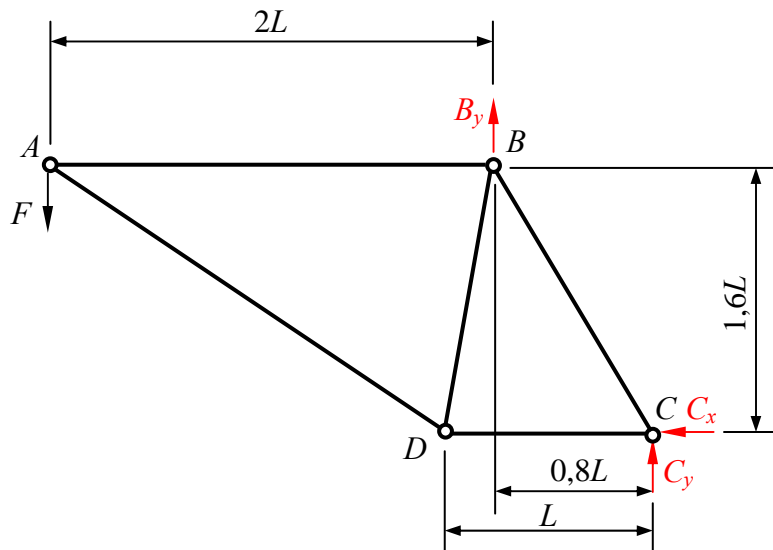
For the given construction determine:

1. The support reactions;
2. The internal forces in all elements.

The members AB , BC , CD , BD and AD are trusses and points A , B , C and D are joints.
 $F = 20 \text{ kN}$, $L = 1 \text{ m}$.



1. Free Body Diagram (FBD)



2. Determining of the support reactions

$$\sum F_x = 0 \Rightarrow \boxed{C_x = 0};$$

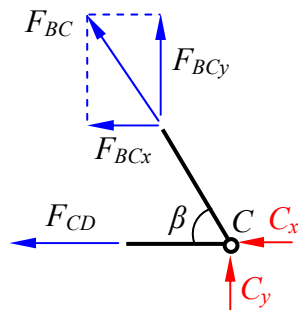
$$\sum F_y = 0 \Rightarrow B_y + C_y - F = 0.$$

$$\sum M_{z_C} = 0 \Rightarrow B_y \cdot 0,8L - F \cdot 2,8L = 0$$

$$\Rightarrow B_y = \frac{F \cdot 2,8}{0,8} = \frac{56}{0,8} \Rightarrow \boxed{B_y = 70 \text{ kN}}$$

$$\Rightarrow C_y = F - B_y = 20 - 70 \Rightarrow \boxed{C_y = -50 \text{ kN}}$$

Joint C



$$\sum F_x = 0 \Rightarrow F_{CD} + F_{BCx} + C_x = 0;$$

$$\sum F_y = 0 \Rightarrow F_{BCy} + C_y = 0 \Rightarrow F_{BCy} = -C_y \Rightarrow F_{BCy} = -(-50) \Rightarrow F_{BCy} = 50 \text{ kN}.$$

Knowing F_{BCy} we can find F_{BC} :

$$F_{BCy} = F_{BC} \cdot \sin(\beta) \Rightarrow F_{BC} = \frac{F_{BCy}}{\sin(63,4^\circ)} \Rightarrow F_{BC} = \frac{50}{0,894} \Rightarrow \boxed{F_{BC} = 55,9 \text{ kN}}.$$

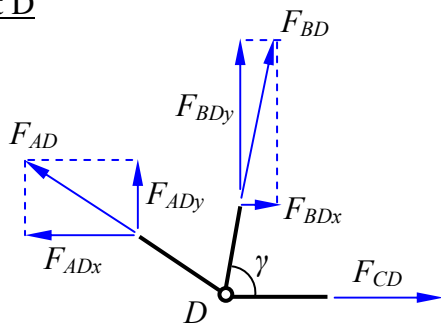
Knowing F_{BC} we can find F_{BCx}

$$F_{BCx} = F_{BC} \cdot \cos(\beta) \Rightarrow F_{BCx} = (55,9) \cdot 0,448 \Rightarrow F_{BCx} = 25 \text{ kN}$$

which value can be used for determination of F_{CD}

$$F_{CD} = -F_{BCx} - C_x \Rightarrow F_{CD} = -25 - 0 \Rightarrow \boxed{F_{CD} = -25 \text{ kN}}$$

Joint D



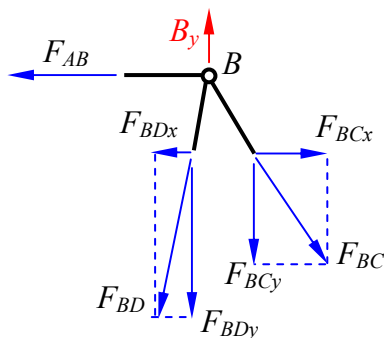
$$\sum F_x = 0 \Rightarrow F_{CD} + F_{BDx} - F_{ADx} = 0 \Rightarrow F_{BDx} = F_{ADx} - F_{CD} = -22,5 - (-25) \Rightarrow F_{BDx} = 2,5 \text{ kN};$$

$$\sum F_y = 0 \Rightarrow F_{ADy} + F_{BDy} = 0 \Rightarrow F_{BDy} = -F_{ADy} \Rightarrow F_{BDy} = -(-20) \Rightarrow F_{BDy} = 20 \text{ kN}.$$

Knowing F_{BDy} we can find F_{BD} :

$$F_{BDy} = F_{BD} \cdot \sin(\gamma) \Rightarrow F_{BD} = \frac{F_{BDy}}{\sin(82,9^\circ)} \Rightarrow F_{BD} = \frac{20}{0,992} \Rightarrow \boxed{F_{BD} = 20,2 \text{ kN}}$$

CHECK



Joint B

$$\begin{aligned} \sum F_x = 0 &\Rightarrow F_{BCx} - F_{BDx} - F_{AB} = 0 \Rightarrow 25 - 2,5 - 22,5 = 0 \\ &\Rightarrow 25 - 25 = 0 \Rightarrow \boxed{0 = 0} \end{aligned}$$

$$\begin{aligned} \sum F_y = 0 &\Rightarrow F_{BDy} + F_{BCy} - B_y = 0 \Rightarrow 20 + 50 - 70 = 0 \\ &\Rightarrow 70 - 70 = 0 \Rightarrow \boxed{0 = 0} \end{aligned}$$