

# METHOD OF JOINTS

**Example:** Determine magnitude and nature of the forces in all the members of the truss loaded and supported as shown in the figure.

**Solution:** Determine reactions at the supports

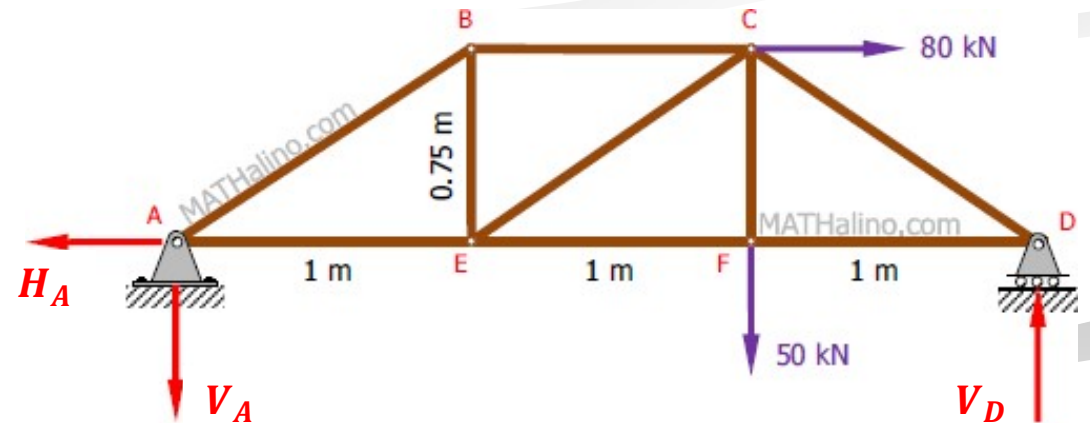
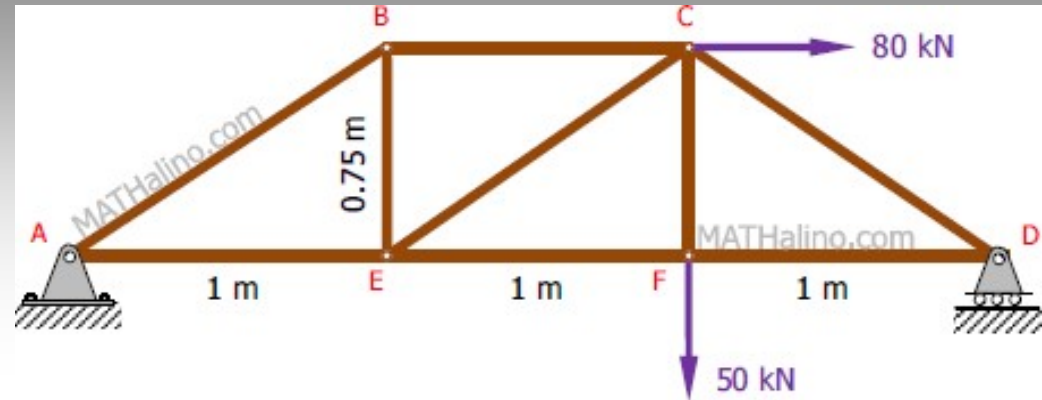
$$\Sigma M_D = 0$$

$$-3V_A - 50(1) + 80(0.75) = 0$$

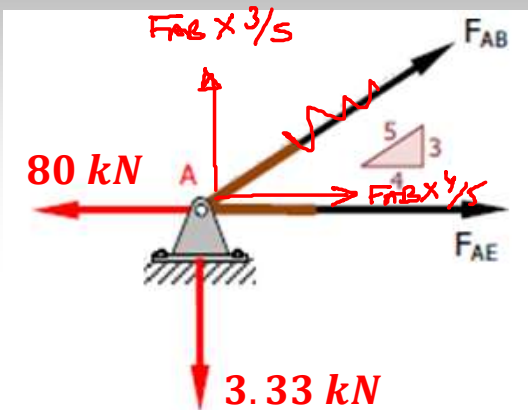
$$V_A = 3.33 \text{ kN}$$

$$\Sigma F_Y = 0; V_D = 50 + 3.33 = 53.33 \text{ kN}$$

$$\Sigma F_H = 0; H_A = 80 \text{ kN}$$



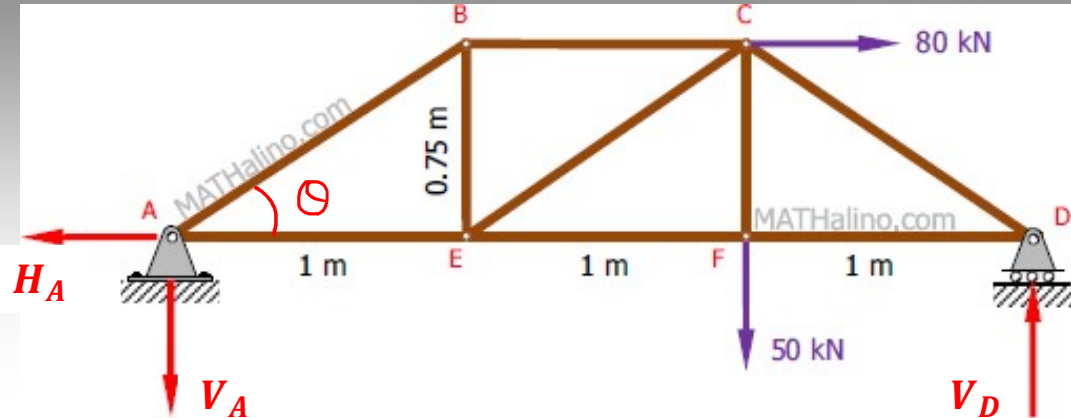
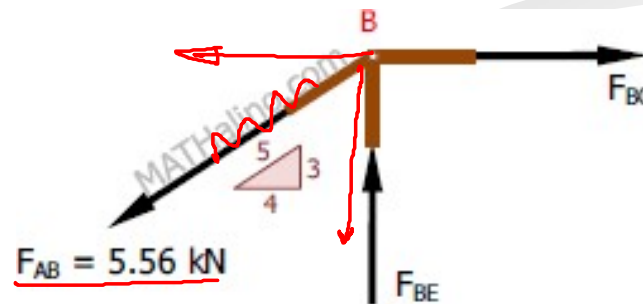
# METHOD OF JOINTS



FBD of Joint A

$$\begin{aligned}\sin \theta &= \frac{3}{5} \\ \cos \theta &= \frac{4}{5} \\ \sum F_y &= 0 \\ \frac{3}{5} F_{AB} &= 3.33 \\ F_{AB} &= \frac{3.33 \times 5}{3} \\ \boxed{F_{AB} &= 5.55 \text{ kN (T)}} \\ \sum F_x &= 0 \\ F_{AE} + 5.55 \times \frac{4}{5} &= 80 \\ \boxed{F_{AE} &= 75.56 \text{ kN (T)}}\end{aligned}$$

Draw FBD of joint B



# METHOD OF JOINTS

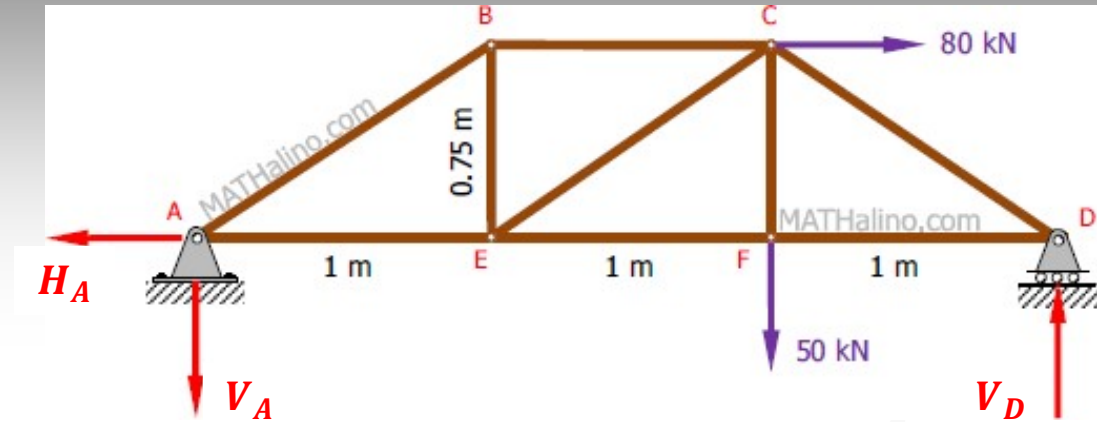
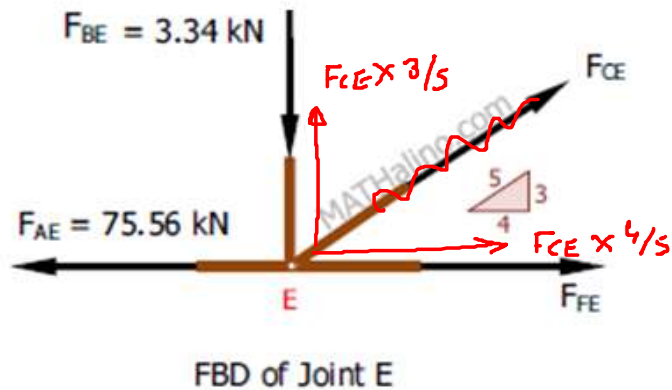
$$F_{AB} = 5.56 \text{ kN (Tensile)}$$

$$F_{AE} = 75.56 \text{ kN (Tensile)}$$

$$F_{BC} = 4.45 \text{ kN (Tensile)}$$

$$F_{BE} = 3.34 \text{ kN (Comp)}$$

Draw FBD of joint E



# METHOD OF JOINTS

$$F_{AB} = 5.56 \text{ kN (Tensile)}$$

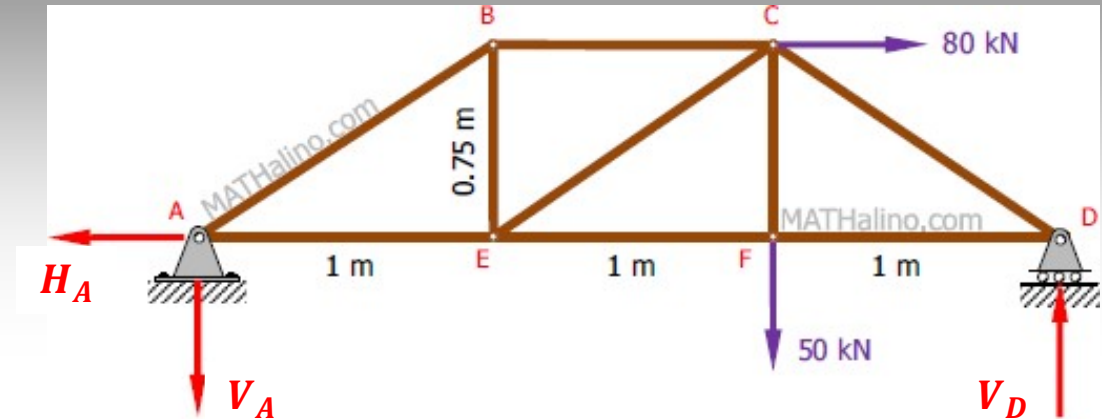
$$F_{AE} = 75.56 \text{ kN (Tensile)}$$

$$F_{BC} = 4.45 \text{ kN (Tensile)}$$

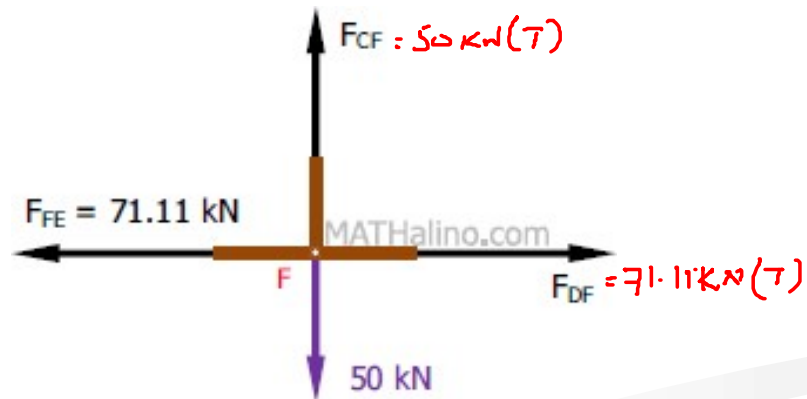
$$F_{BE} = 3.34 \text{ kN (Comp)}$$

$$F_{CE} = 5.56 \text{ kN (Tensile)}$$

$$F_{FE} = 71.11 \text{ kN (Tensile)}$$

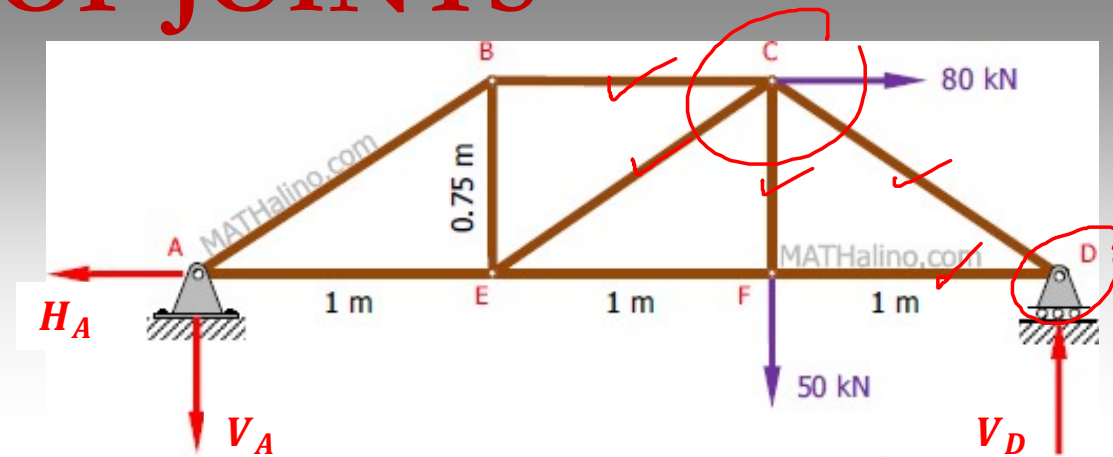


Draw FBD of joint F

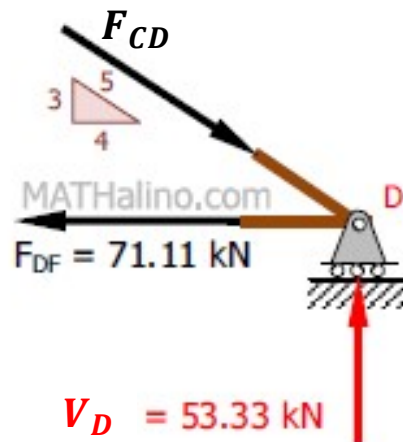


# METHOD OF JOINTS

$$\begin{aligned}
 F_{AB} &= 5.56 \text{ kN (Tensile)} \\
 F_{AE} &= 75.56 \text{ kN (Tensile)} \\
 F_{BC} &= 4.45 \text{ kN (Tensile)} \\
 F_{BE} &= 3.34 \text{ kN (Comp)} \\
 F_{CE} &= 5.56 \text{ kN (Tensile)} \\
 F_{FE} &= 71.11 \text{ kN (Tensile)} \\
 F_{CF} &= 50 \text{ kN (Tensile)} \\
 F_{DF} &= 71.11 \text{ kN (Tensile)}
 \end{aligned}$$



Draw FBD of joint D

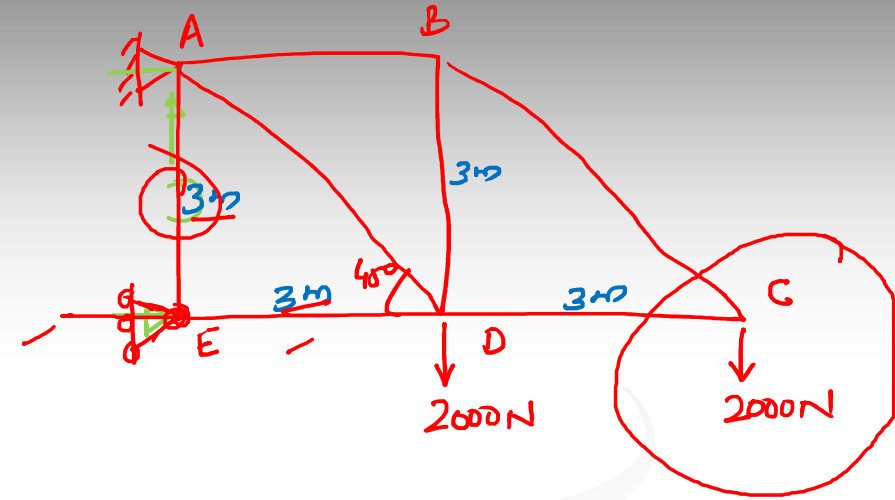


$$F_{CD} \times \frac{4}{5} = 71.11$$

$$F_{CD} = 71.11 \times \frac{5}{4} = 88.89 \text{ kN}$$

$$F_{CD} = 88.89 \text{ kN (Compressive)}$$

# METHOD OF JOINTS



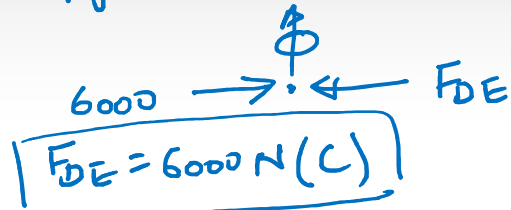
# METHOD OF JOINTS

$$\sum F_y = 0, V_A = 4000 \text{ N}, \sum F_x = 0, H_A = H_E$$

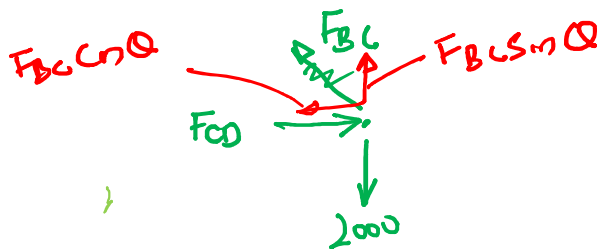
$$\sum M_A = 0; 2000 \times 3 + 2000 \times 6 - 3 H_E = 0$$

$$H_E = 6000 \text{ N}$$

FBD of joint E



FBD of joint 'C'



$$\sum F_y = 0$$

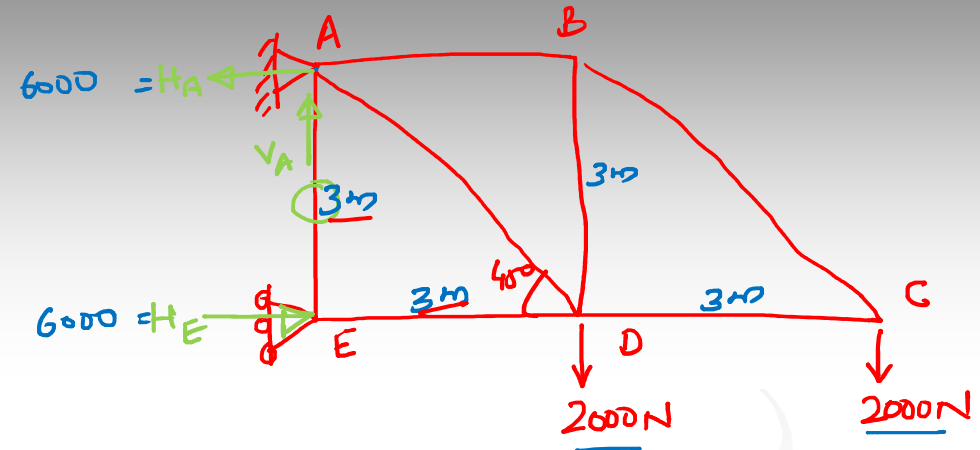
$$F_{BC} \sin 45 = 2000$$

$$F_{BC} = 2828.43 \text{ N (T)}$$

$$\sum F_x = 0$$

$$F_{CD} = F_{BC} \cos 45$$

$$= 2828.43 \times \cos 45 = 2000 \text{ N (C)}$$



$$DE = 6000 \text{ N (C)}$$

$$AB = 2000 \text{ N (T)}$$

$$BC = 2828.43 \text{ N (T)}$$

$$CD = 2000 \text{ N (C)}$$

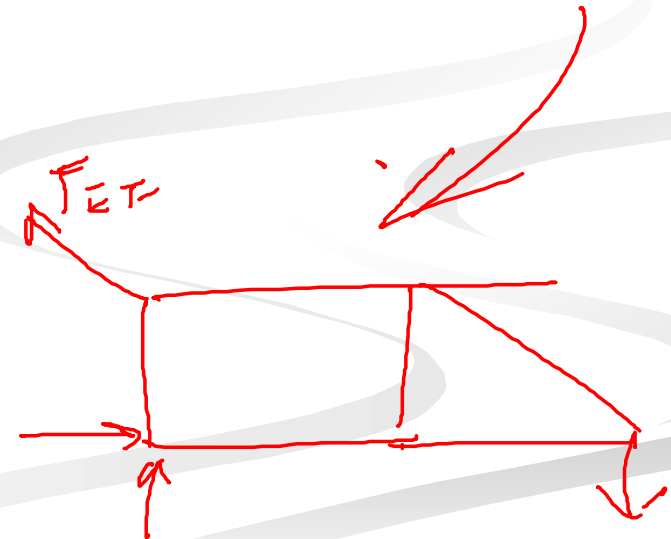
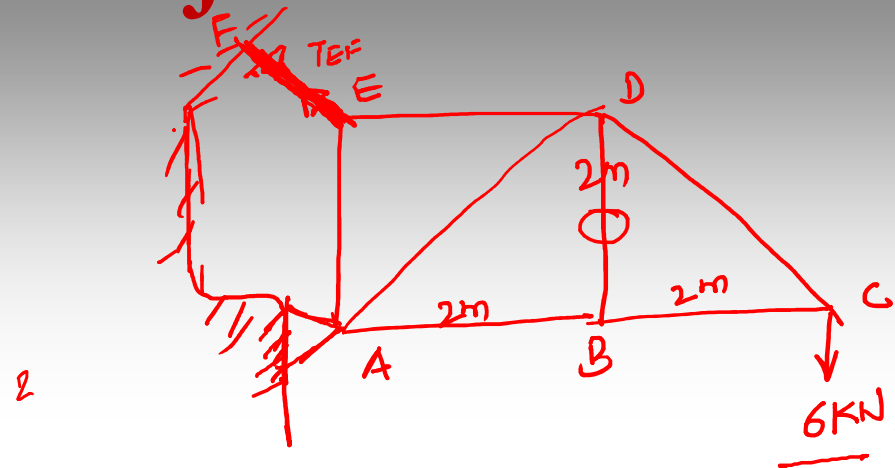
$$EA = 0$$

$$AD = 5656.8 \text{ N (T)}$$

$$BD = 2000 \text{ N (C)}$$

# METHOD OF JOINTS

$$\begin{aligned} F_{CD} &= 8.48 \text{ kN (T)} \\ F_{BC} &= 6 \text{ kN (C)} \\ F_{AD} &= 8.48 \text{ kN (C)} \\ F_{DE} &= 12 \text{ kN (T)} \\ F_{EF} &= 16.97 \text{ kN} \end{aligned}$$





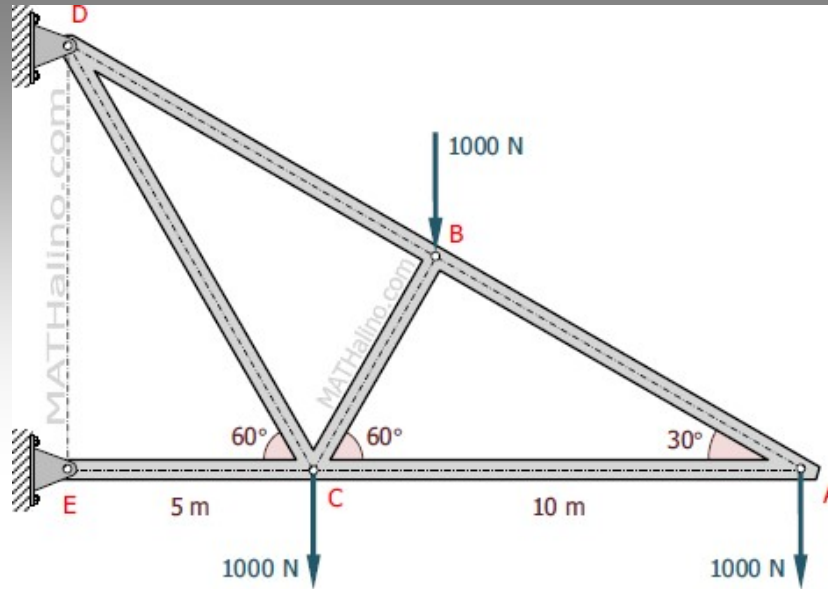
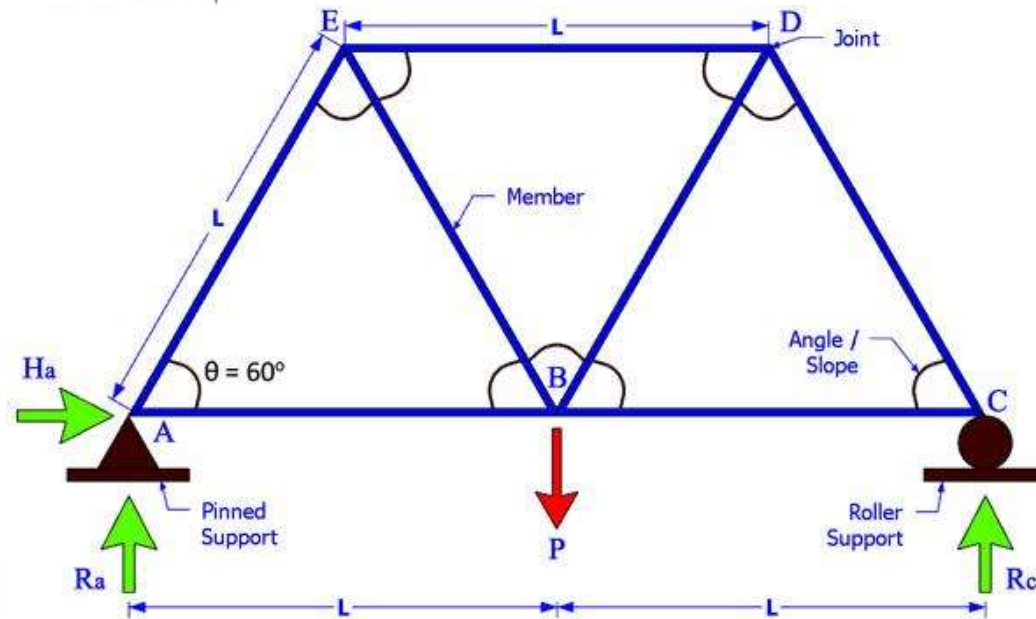


Figure P-406



# Thank You

Three thick, light gray wavy lines that originate from the bottom left and curve upwards and to the right, ending near the top right corner of the slide.