

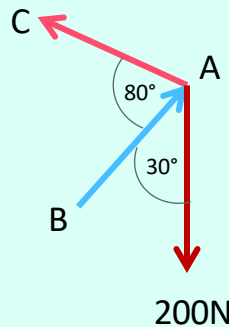
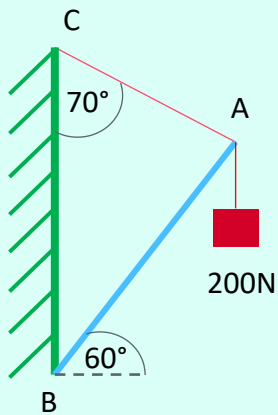
Pin Jointed Frames Examples

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EG1101 – Mechanical Engineering – Mechanics of Materials

Example 1

- A rigid rod is hinged to a vertical support and held at 60° to the horizontal by means of a cable when a weight of 200N is suspended as shown in the figure.



Associated Free
Body Diagram

Example 1

Balance of forces in x-direction: \rightarrow +

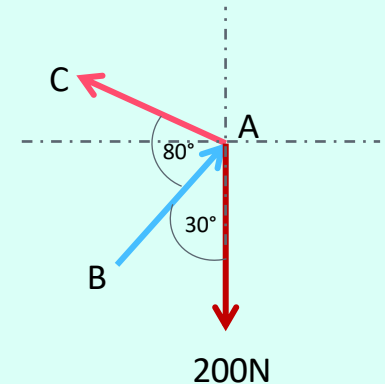
$$-F_{AC} \cdot \cos 20^\circ + F_{AB} \cdot \cos 60^\circ = 0 \quad (1)$$

$$F_{AB} = 1.88F_{AC} \quad (2)$$

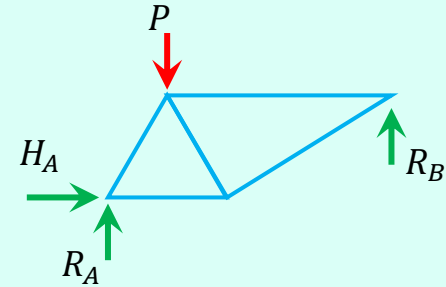
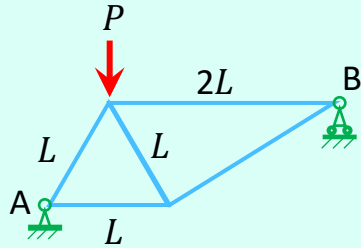
Balance of forces in y-direction: \uparrow +

$$F_{AB} \sin 60^\circ + F_{AC} \sin 20^\circ - 200 = 0 \quad (3)$$

By substitute (2) into (3), we have: $F_{AC} = 102 \text{ N}$ and $F_{AB} = 192 \text{ N}$



Example 2



Balance of forces vertically, we have: $\uparrow +$

$$R_A + R_B = P \quad (1)$$

Taking a moment about B, $\curvearrowright +$

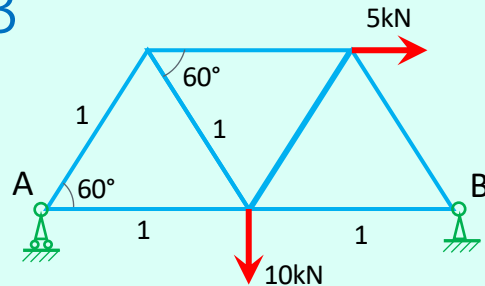
$$R_A \cdot \left(\frac{1}{2}L + 2L \right) - P \cdot 2L = 0 \quad (2)$$

$$R_A \cdot \left(\frac{5}{2}L \right) = P \cdot 2L \Rightarrow R_A = \frac{4P}{5} \quad (3)$$

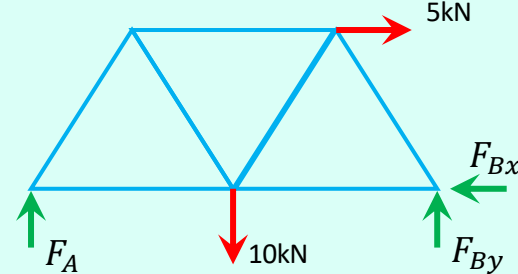
By either substitute (3) into (1), or taking a moment about A, we obtain:

$$R_B = \frac{1}{5} \cdot P$$

Example 3



Free Body Diagram



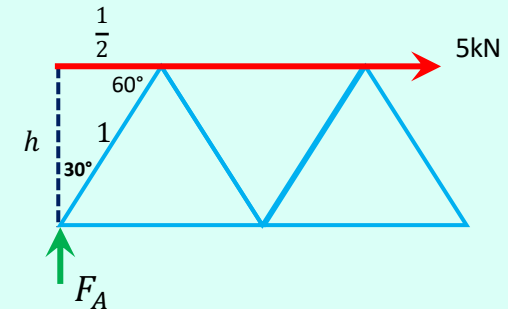
Balance of forces horizontally, we have: $F_{Bx} = 5 \text{ kN}$

Balance of forces vertically, we have: $\uparrow +$

$$F_A + F_{By} = 10 \text{ kN} \quad (1)$$

Taking moment about A, $\curvearrowright +$

$$F_{By} \cdot 2 - 10 \times 1 - \frac{\sqrt{3}}{2} \times 5 = 0 \quad \Rightarrow \quad F_{By} = 7.17 \text{ kN} \quad (2)$$



By substitute (2) into (1), we obtain: $F_A = 2.83 \text{ kN}$