

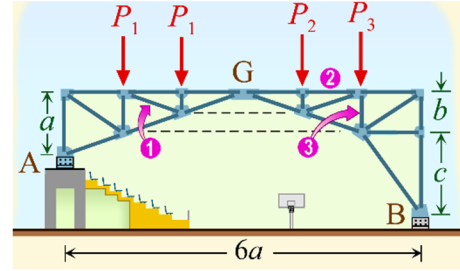
STATICS

Structural Analysis

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Question : The compound roof truss of the indoor sports hall is given in Figure. $P_1 = 22\text{ kN}$, $P_2 = 47.5\text{ kN}$, $P_3 = 19\text{ kN}$, $a = 6\text{ m}$, $b = 4\text{ m}$, $c = 8\text{ m}$.

- a) Determine the support reactions of the truss,
- b) Determine the force in members 1, 2 and 3.



Solution :

Since there are four unknowns as support reactions, they are obtained separating the truss from the joint G.

- Segment AG;

$$\sum M_G = 0;$$

$$22(6 + 12) + 6A_x - 18A_y = 0$$

$$66 + A_x - 3A_y = 0$$

- Entire Truss;

$$\sum M_B = 0;$$

$$22(24 + 30) + 47.5 \times 12 + 19 \times 6 - 6A_x - 36A_y = 0$$

$$312 - A_x - 6A_y = 0$$

The support reactions at the joint A is obtained using the above equations as $A_y = 42\text{ kN} \uparrow$, $A_x = 60\text{ kN} \rightarrow$.

The equilibrium equations are used in order to obtain B_x and B_y ,

$$\sum F_x = 0; \quad A_x - B_x = 0 \quad \Rightarrow \quad B_x = 60\text{ kN} \leftarrow$$

$$\sum F_y = 0; \quad B_y + A_y - 110.5 = 0 \quad \Rightarrow \quad B_y = 68.5\text{ kN} \uparrow$$

- b) The force in members $\alpha = \tan^{-1}(1/3) = 18.43^\circ$,

- Segment AG,

$$\sum M_G = 0;$$

$$60 \times 6 - 42 \times 18 + 22 \times 12 + (S_1 \sin \alpha)12 = 0 \quad \Rightarrow \quad S_1 = 34.79\text{ kN}$$

- Segment GB,

$$\sum M_C = 0;$$

$$19 \times 6 + 60 \times 10 - 68.5 \times 12 - 2S_2 = 0 \quad \Rightarrow \quad S_2 = -54\text{ kN}$$

$$\sum M_G = 0;$$

$$60 \times 12 - 68.5 \times 18 - 12S_3 = 0 \quad \Rightarrow \quad S_3 = -42.75\text{ kN}$$

