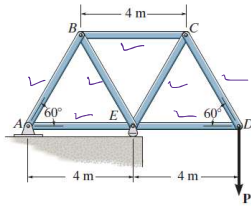
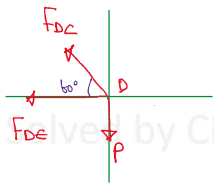


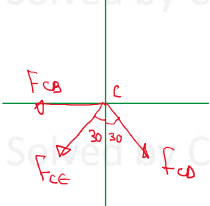
6-17. If the maximum force that any member can support is 8 kN in tension and 6 kN in compression, determine the maximum force P that can be supported at joint D .



Probs. 6-16/17

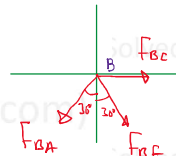


$$\begin{aligned} F_{DC} \sin 60^\circ - P &= 0 \\ \Rightarrow F_{DC} &= \frac{P}{\sin 60^\circ} \text{ (T)} \\ -F_{DE} - F_{DC} \cos 60^\circ &= 0 \\ F_{DE} &= -F_{DC} \cos 60^\circ = -\frac{P}{\sin 60^\circ} \cos 60^\circ \\ \Rightarrow F_{DE} &= -\frac{P}{\tan 60^\circ} \text{ (C)} \end{aligned}$$



$$\begin{aligned} -F_{CB} \cos 30^\circ - F_{CE} \cos 30^\circ &= 0 \\ F_{CE} &= -F_{CB} = -\frac{P}{\sin 60^\circ} \text{ (C)} \\ \therefore F_{DC} &= \frac{P}{\sin 60^\circ} \text{ (T)} \end{aligned}$$

$$\begin{aligned} -F_{CB} - F_{CE} \sin 30^\circ + F_{CD} \sin 30^\circ &= 0 \\ \Rightarrow F_{CB} &= F_{CE} \sin 30^\circ - F_{CD} \sin 30^\circ \\ \Rightarrow F_{CB} &= (F_{CE} - F_{CD}) \sin 30^\circ \\ &= \left(-\frac{P}{\sin 60^\circ} - \frac{P}{\sin 60^\circ} \right) \sin 30^\circ \\ \Rightarrow F_{CB} &= -2P \frac{\sin 30^\circ}{\sin 60^\circ} \end{aligned}$$



$$\begin{aligned} -F_{BE} \cos 30^\circ - F_{AB} \cos 30^\circ &= 0 \\ \Rightarrow F_{BE} &= -F_{AB} \end{aligned}$$

$$F_{BC} + F_{BE} \sin 30^\circ - F_{AB} \sin 30^\circ = 0$$

$$F_{BC} + F_{BE} \sin 30^\circ + F_{BE} \sin 30^\circ = 0$$

$$F_{BC} = -2 F_{BE} \sin 30^\circ$$

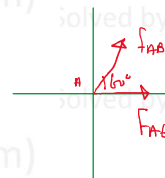
$$\Rightarrow F_{BE} = \frac{-F_{BC}}{2 \sin 30^\circ} = \frac{2P \sin 30^\circ / \sin 60^\circ}{2 \sin 30^\circ}$$

$$\therefore F_{BE} = -2P \frac{\sin 30^\circ}{\sin 60^\circ}$$

$$\Rightarrow F_{BE} = \frac{P}{\sin 60^\circ} \text{ (T)}$$

$$\Rightarrow F_{AB} = -\frac{P}{\sin 60^\circ} \text{ (C)}$$

$$\therefore F_{BE} = -F_{AB}$$



$$F_{AB} \cos 60^\circ + F_{AB} = 0$$

$$\Rightarrow F_{AB} = -F_{AB} \cos 60^\circ = \frac{P}{\sin 60^\circ} \text{ (T)}$$

$$\therefore F_{AB} = -\frac{P}{\sin 60^\circ} \text{ (C)}$$

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$$F_{DE} = \frac{P}{\sin 60^\circ} (T) = 1.1547 P (T) \quad F_{DB} = -2P \frac{\sin 30^\circ}{\sin 60^\circ} = 1.1547 P (C)$$
$$F_{DE} = -\frac{P}{\tan 60^\circ} (C) = 0.577 P (C) \quad F_{BE} = \frac{P}{\sin 60^\circ} (T) = 1.1547 P (T)$$

$$F_{CE} = -\frac{P}{\sin 60^\circ} (C) = 1.1547 P (C) \quad F_{CB} = -\frac{P}{\sin 60^\circ} (C) = 1.1547 P (C)$$

$$F_{AC} = \frac{P}{\sin 60^\circ} (T) = 1.1547 P (C)$$

Max internal force = 1.1547 P

For safety, Max internal force = Minimum Allowed force = 6 kN [provided]

$$\Rightarrow 1.1547 P = 6 \text{ kN}$$

$$\Rightarrow P = \frac{6}{1.1547} \text{ kN} = 5.196 \text{ kN} \text{ Ans.}$$

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