Example 2.10

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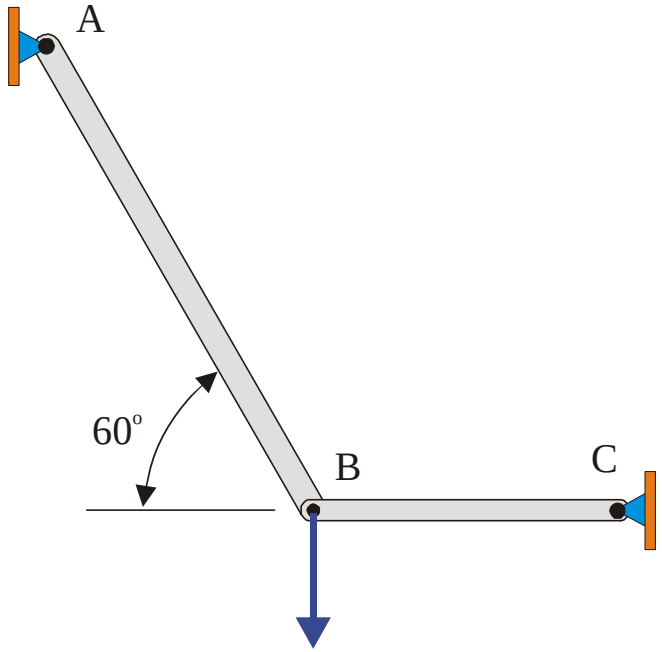
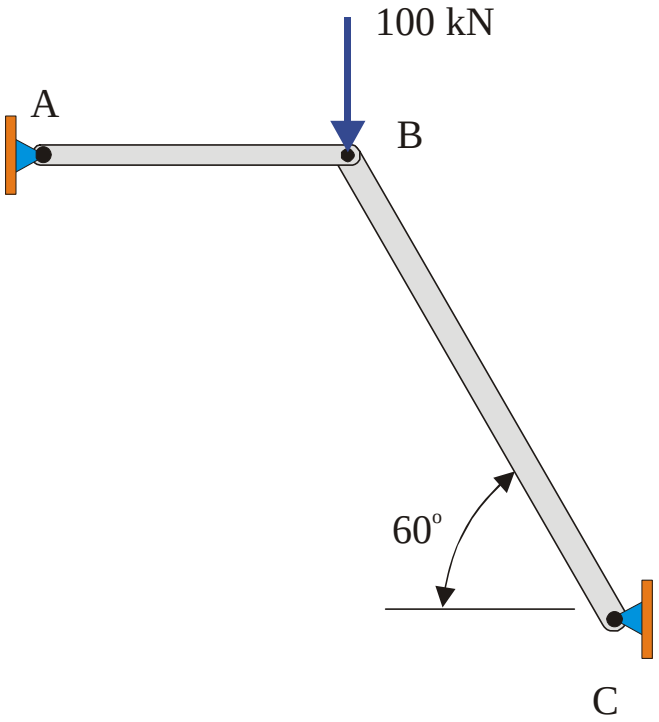
Example 2.10:

Two links are connected by a pin at B as shown in Figures (a) and (b). In each case, a 100 kN concentrated load is applied to the pin at B. Draw a free-body diagram of point B for both examples, determine the force in links BA and BC and state whether the links are in compression or tension.

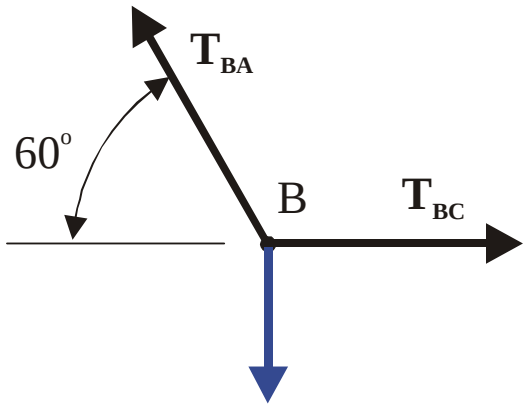


(a)



(b)

Part (a) – Draw the FBD



FBD (a)

IMPORTANT: In the **FBD** we assumed the senses of $\mathbf{T_{BA}}$ and $\mathbf{T_{BD}}$. Because $\mathbf{T_{BA}}$ and $\mathbf{T_{BD}}$ were both positive our assumption of the senses is **CORRECT**!!!

$$\sum F_x = 0 \rightarrow$$

$$T_{BC} - T_{BA}\cos 60^o = 0 \qquad (1)$$

$$\sum F_y = 0 \uparrow$$

$$T_{BA}\sin 60^o - 100 = 0 \qquad (2)$$

From (2)

$$T_{BA} = \frac{100}{\sin 60^o} = +115.47\text{kN}$$

$$\therefore \mathbf{T_{BA}} = 115.47\text{kN}$$ 

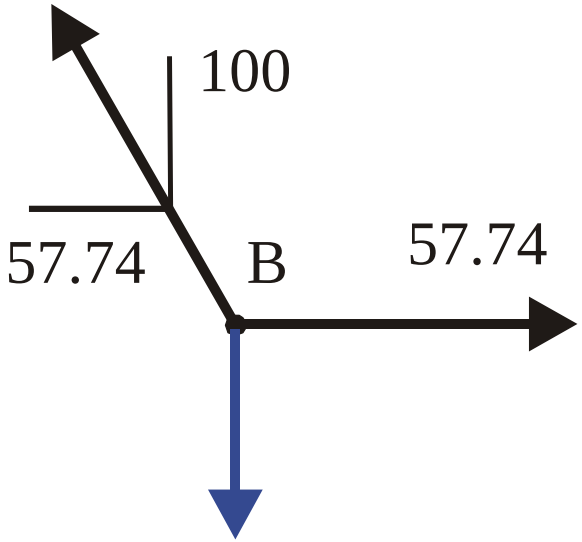
Substitute in (1):

$$T_{BC} - (115.47)\cos 60^o = 0$$

$$T_{BC} = +57.74\text{kN}$$

$$\therefore \mathbf{T_{BC}} = 57.74\text{kN} \rightarrow$$

As a check of our work, we redraw the FBD and resolve any sloping forces into their rectangular components and place them on the PLACEHOLDERS. We can easily apply the equilibrium equations as a check!!!



FBD (a)

$$\sum F_x = 0 \rightarrow$$

$$-57.74 + 57.74 = 0$$

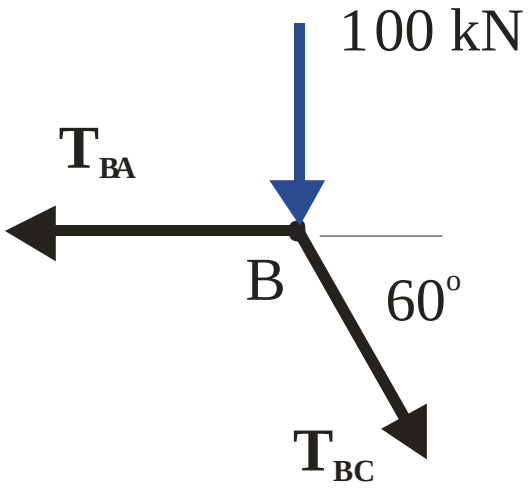
$$0 = 0$$

$$\sum F_y = 0 \uparrow$$

$$100 - 100 = 0$$

$$0 = 0$$

Part (b) – Draw the FBD



FBD (a)

IMPORTANT: In the **FBD** we assumed the senses of $\mathbf{T_{BA}}$ and $\mathbf{T_{BD}}$. Because $\mathbf{T_{BA}}$ and $\mathbf{T_{BD}}$ were both negative our assumption of the senses was **INCORRECT**!!!

$$\sum F_x = 0 \rightarrow$$

$$-T_{BA} + T_{BC}\cos 60^o = 0 \qquad (1)$$

$$\sum F_y = 0 \uparrow$$

$$-T_{BC}\sin 60^o - 100 = 0 \qquad (2)$$

From (2)

$$T_{BC} = -\frac{100}{\sin 60^o} = -115.47\text{kN}$$

$$\therefore \mathbf{T_{BC}} = 115.47\text{kN}$$

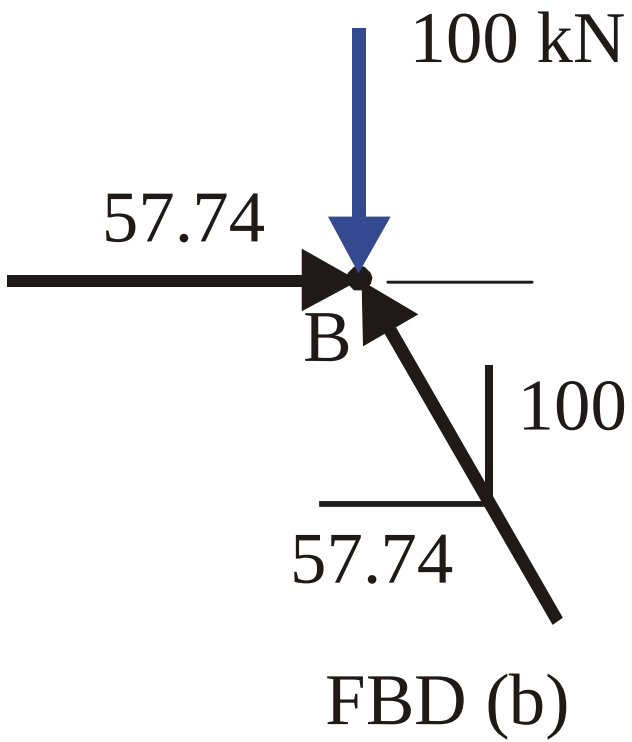
Substitute in (1):

$$-T_{BA} + (-115.47)\cos 60^o = 0$$

$$T_{BA} = -57.74\text{kN}$$

$$\therefore \mathbf{T_{BA}} = 57.74\text{kN} \rightarrow$$

As a check of our work, we redraw the FBD (SHOW ALL FORCES WITH THEIR **CORRECT DIRECTIONS**) and resolve any sloping forces into their rectangular components and place them on the PLACEHOLDERS. We can easily apply the equilibrium equations as a check!!!



FBD (b)

$$\sum F_x = 0 \rightarrow$$

$$-57.74 + 57.74 = 0$$

$$0 = 0$$

$$\sum F_y = 0 \uparrow$$

$$100 - 100 = 0$$

$$0 = 0$$