Problem 3-7

The device shown is used to straighten the frames of wrecked autos. Determine the tensior of each segment of the chain,i.e., *AB* and *BC*, if the force which the hydraulic cylinder *DB* exerts on point *B* is F_{DB}, as shown.

Units Used:

$\mathbf{N} = 1\,\mathbf{kg}\cdot\frac{\mathbf{m}}{\mathbf{s}^2}$ $\quad 1\mathbf{kN} = 1\times 10^3\ \mathbf{N}$

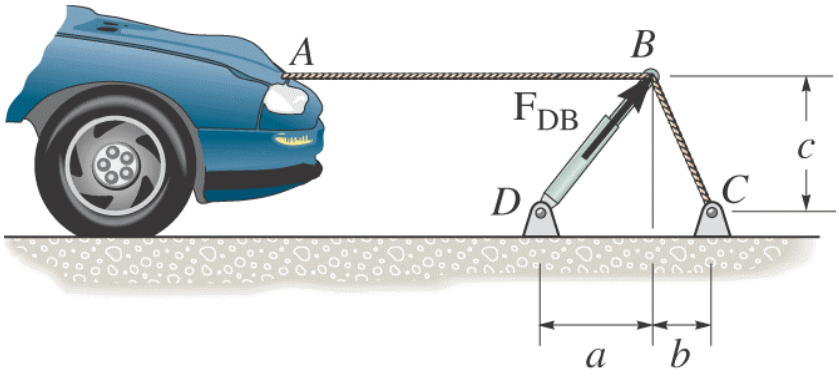
Given:

$\mathbf{F_{DB}} := 3.50\mathbf{kN}$

$\mathbf{a} := 400\mathbf{mm}$

$\mathbf{b} := 250\mathbf{mm}$

$\mathbf{c} := 450\mathbf{mm}$



Solution :

Equations of equilibrium: A direct solution for F_{BC} can be obtained by summing forces along the *y* axis.

$+\uparrow \Sigma F_y = 0;$ $\quad \mathbf{F_{BC}} := \mathbf{F_{DB}}\cdot\frac{\mathbf{c}}{\sqrt{\mathbf{c}^2+\mathbf{a}^2}}\cdot\frac{1}{\frac{\mathbf{c}}{\sqrt{\mathbf{c}^2+\mathbf{b}^2}}}$

$\mathbf{F_{BC}} = 2.99\,\mathbf{kN}$

Using the result $\mathbf{F_{BC}} = 2.99\,\mathbf{kN}$ and summing forces along *x* axis, we have

$\overset{+}{\rightarrow} \Sigma F_x = 0;$ $\quad \mathbf{F_{AB}} := \mathbf{F_{DB}}\cdot\frac{\mathbf{a}}{\sqrt{\mathbf{c}^2+\mathbf{a}^2}} + \mathbf{F_{BC}}\cdot\frac{\mathbf{b}}{\sqrt{\mathbf{c}^2+\mathbf{a}^2}}$

$\mathbf{F_{AB}} = 3.57\,\mathbf{kN}$