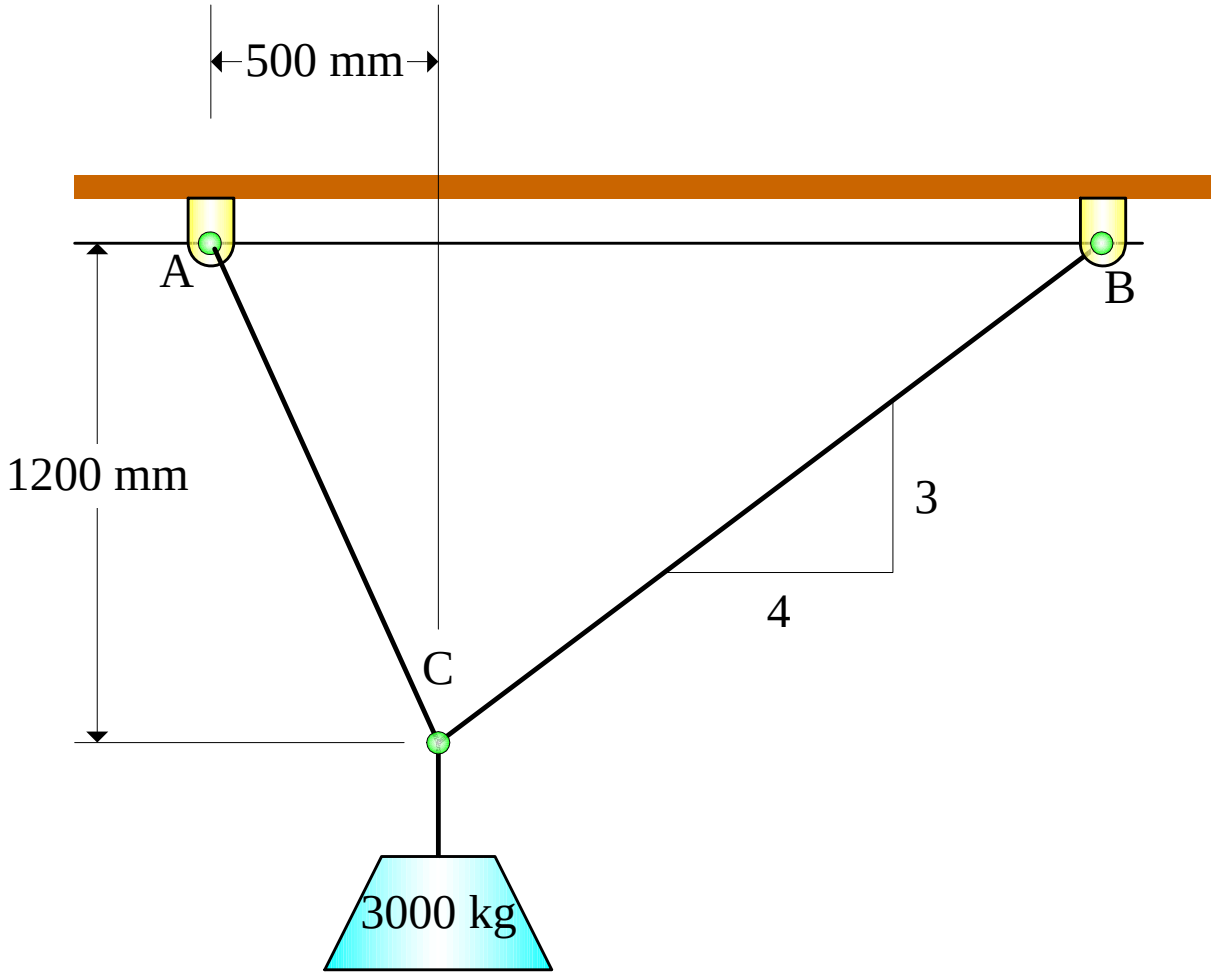
Example 2.11

J. Frye

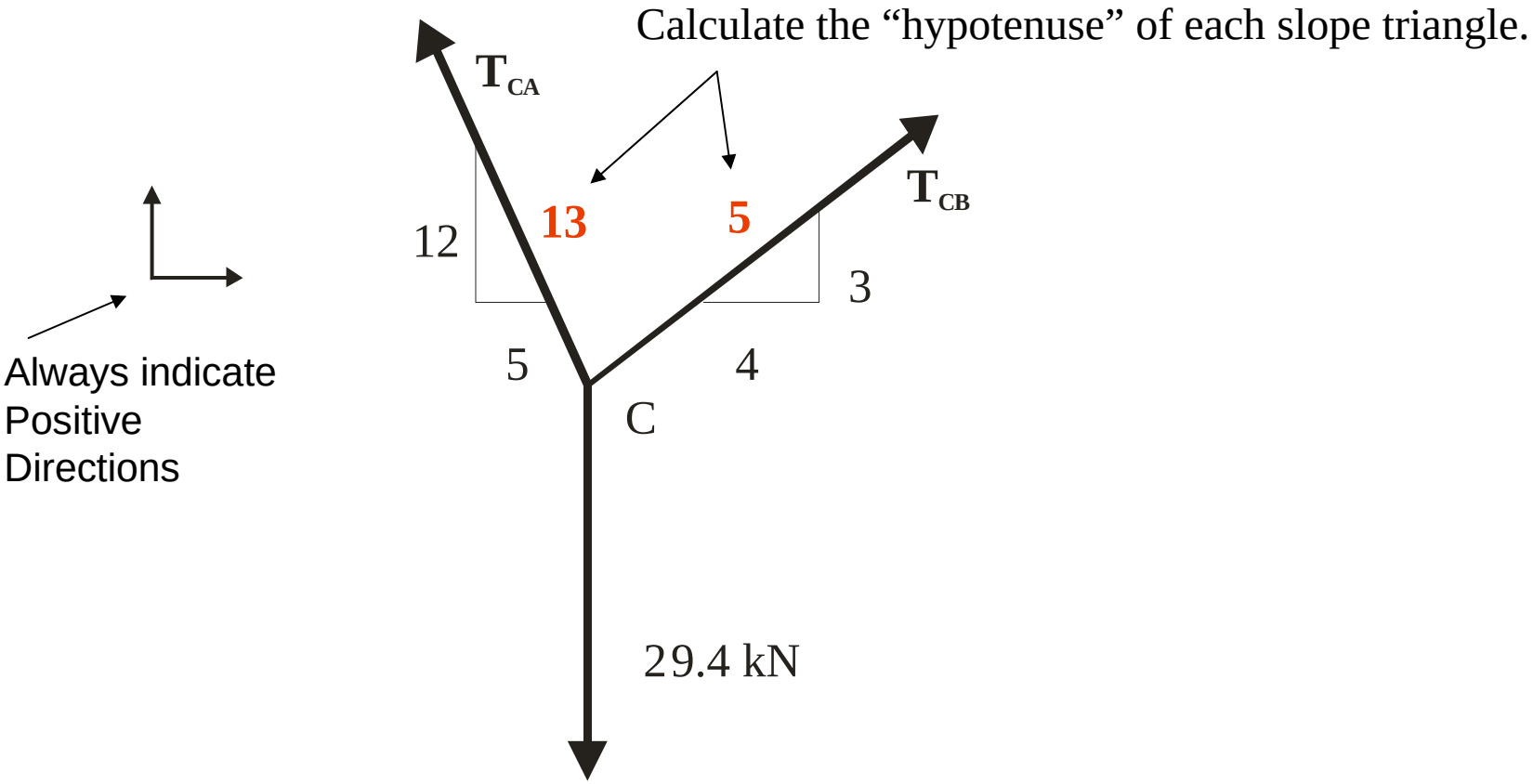
Example 2.11:

Two cables are joined at C and loaded as shown. Determine the tension in AC and BC.

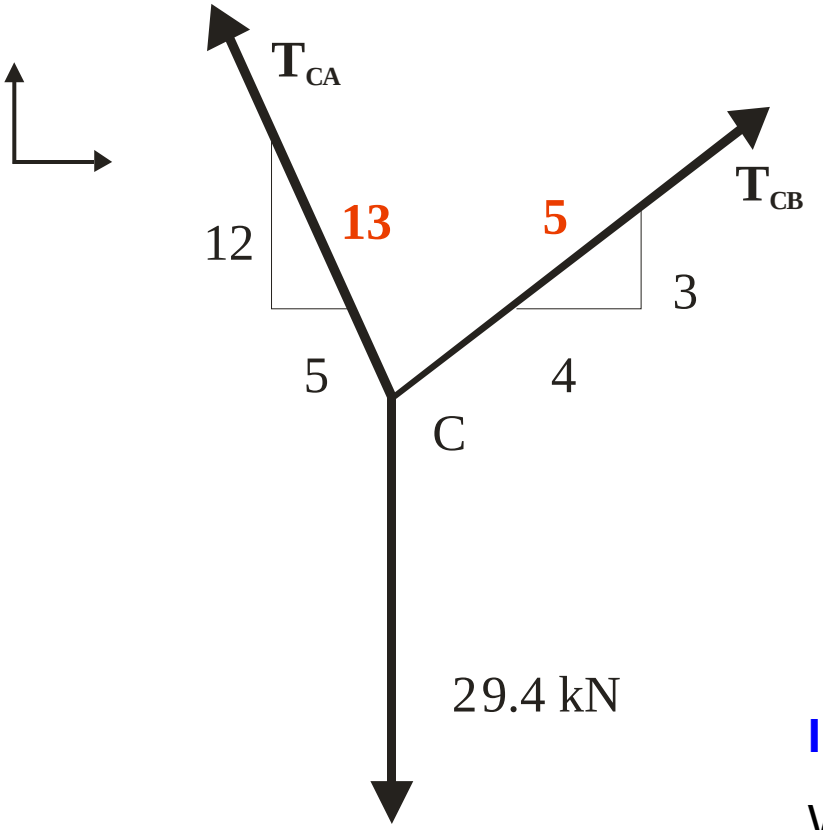


Draw the FBD at C:

We will work in kN and use the given slopes to resolve $\mathbf{T_{CA}}$ and $\mathbf{T_{CB}}$ into their rectangular components.



Write and Solve the Equilibrium Equations for the FBD



$$\sum F_x = 0 \rightarrow$$

$$\frac{4}{5}T_{CB} - \frac{5}{13}T_{CA} = 0 \quad (1)$$

$$\sum F_y = 0 \uparrow$$

$$\frac{3}{5}T_{CB} + \frac{12}{13}T_{CA} - 29.4 = 0 \quad (2)$$

IMPORTANT:

When writing the equilibrium equations for the FBD ALWAYS equate the left hand side of your equation to ZERO!!!!

Solve the equilibrium equations:

We will use elimination:

$$(-3)*(\text{Equation } 1) \Rightarrow \quad -\frac{12}{5}T_{CB}+\frac{15}{13}T_{CA}=0$$

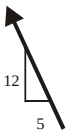
$$(4)*(\text{Equation } 2) \Rightarrow \quad \frac{12}{5}T_{CB}+\frac{48}{13}T_{CA}=117.6$$

Adding the two equations eliminates T_{CB} :

$$\therefore \frac{63}{13}T_{CA}=117.6$$

$$T_{CA}=\frac{13}{16}(117.6)=+24.27\text{kN}$$

$$\therefore \mathbf{T_{CA}}=24.27\text{kN}$$

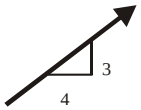


Back Substitute $T_{CA}=+24.27$ in Equation(1) :

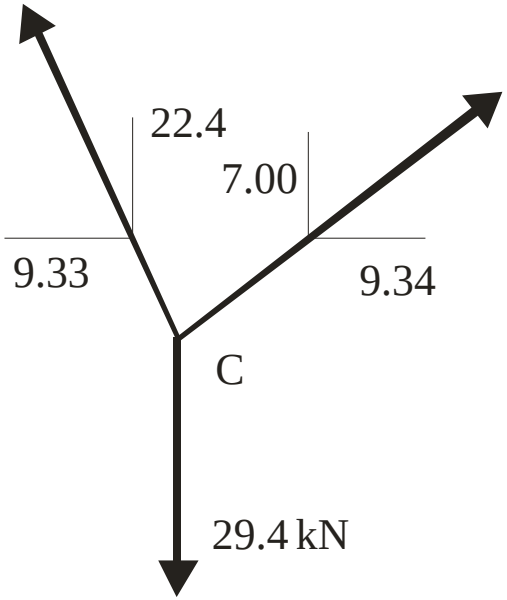
$$\frac{4}{5}T_{CB}-\frac{5}{13}(+24.27)=0$$

$$T_{CB}=+11.67\text{kN}$$

$$\mathbf{T_{CB}}=11.67\text{kN}$$



Check: Redraw the FBD and place the components of the sloping forces on the “Placeholder” and apply the equilibrium equations!!!



$$\sum F_x = 0 \rightarrow$$

$$9.34 - 9.33 \approx 0 \quad (1)$$

$$\sum F_y = 0 \uparrow$$

$$7 + 22.4 - 29.4 = 0 \quad (2)$$