Two-Force and Three-Force Member Example

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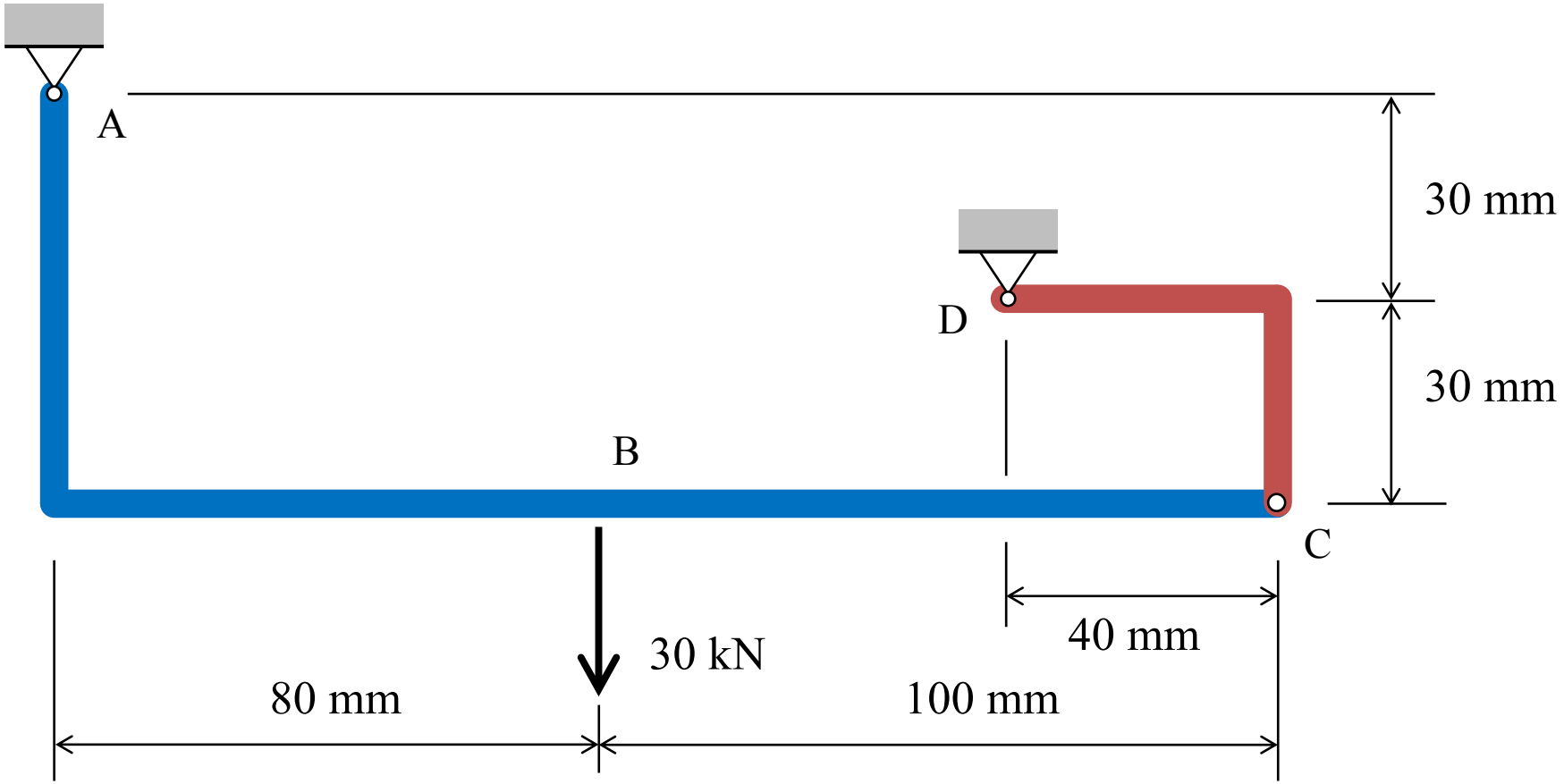
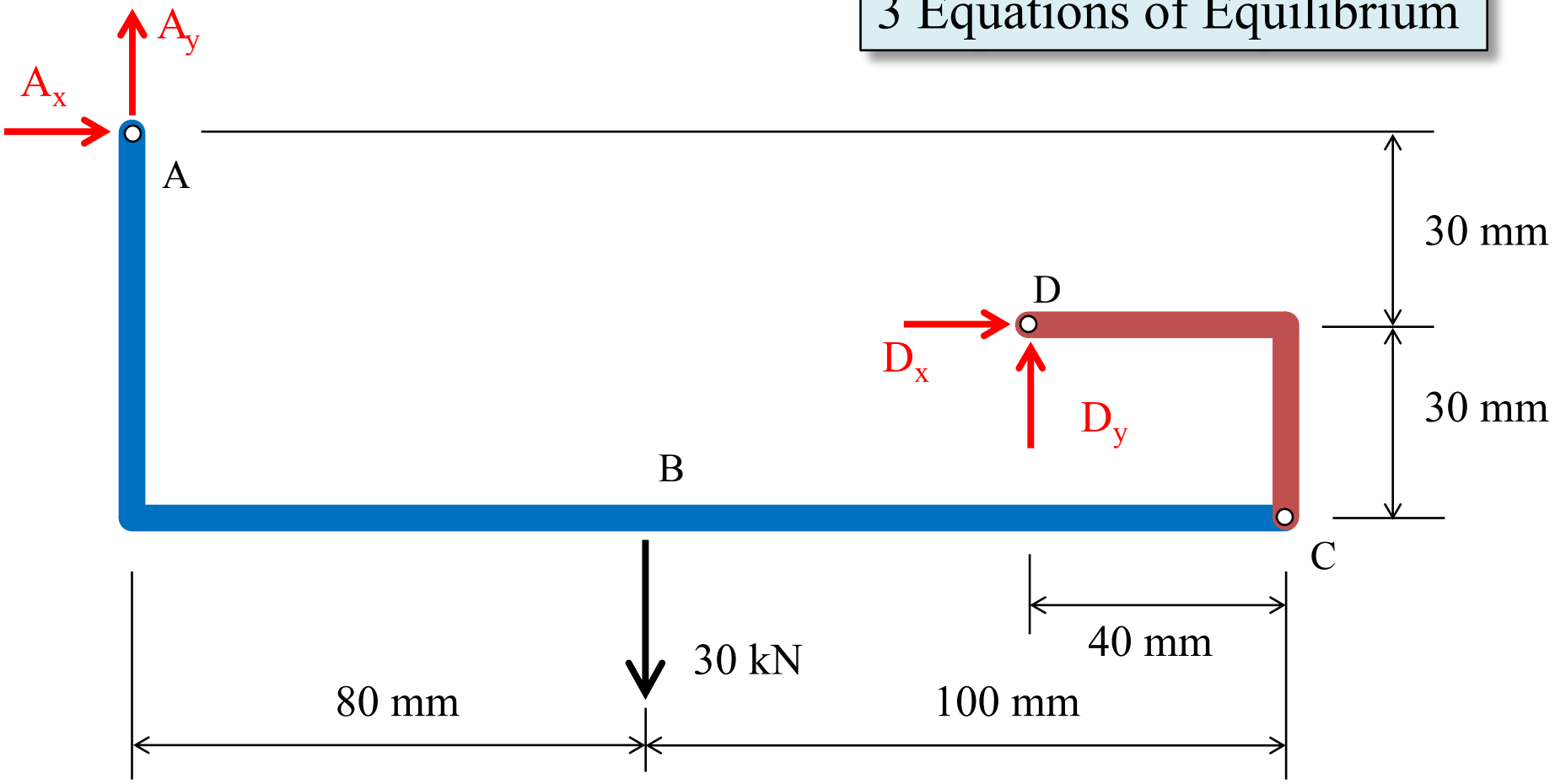
The structure shown is pin supported at points A and D. Members ABC and CD are connected by an internal hinge at point C. **For the loading shown, find the reaction forces at the pin supports at at points A and D.** The weight of the members is negligible.



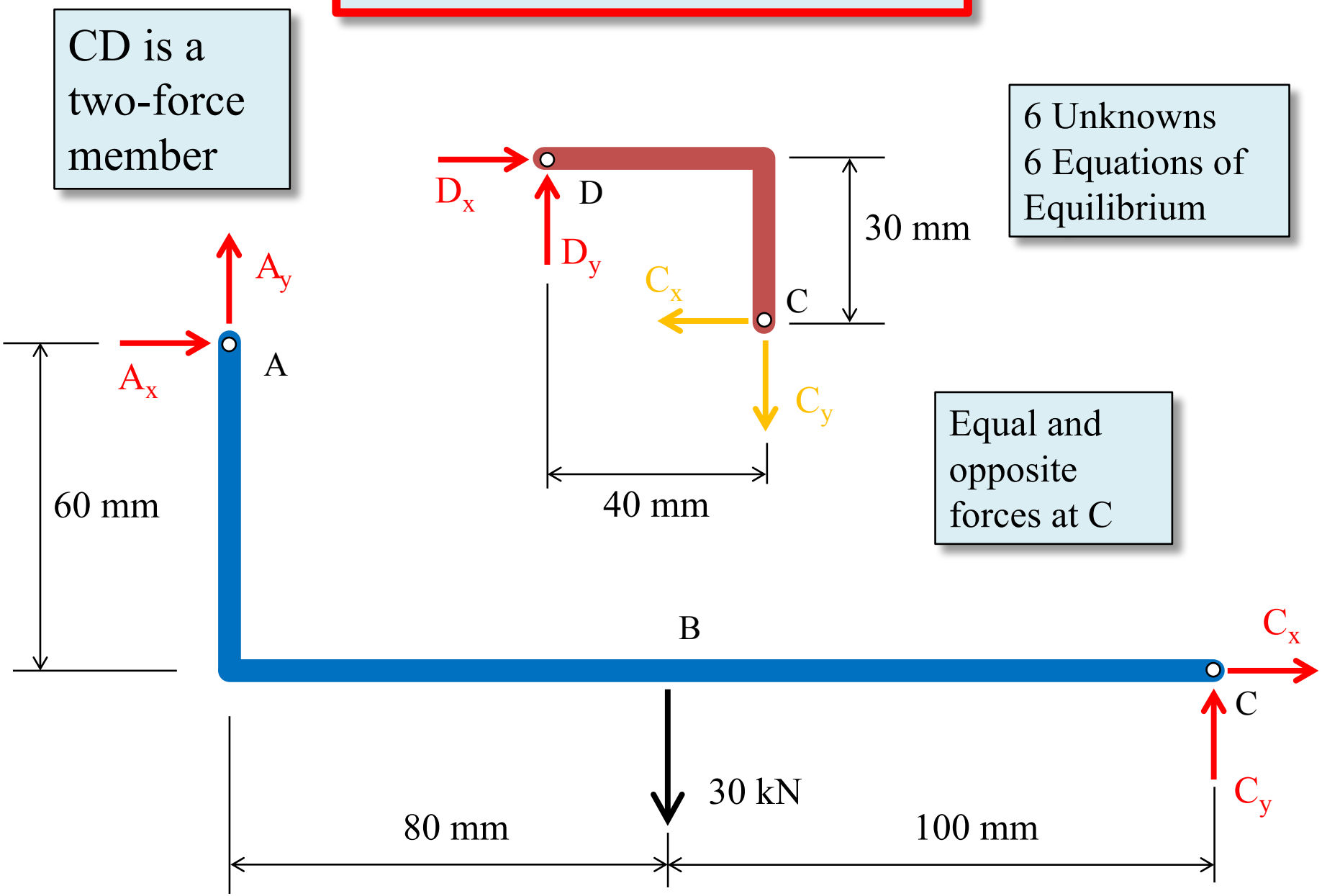
FBD of Entire Structure

4 Unknowns
3 Equations of Equilibrium



FBDs of ABC and CD

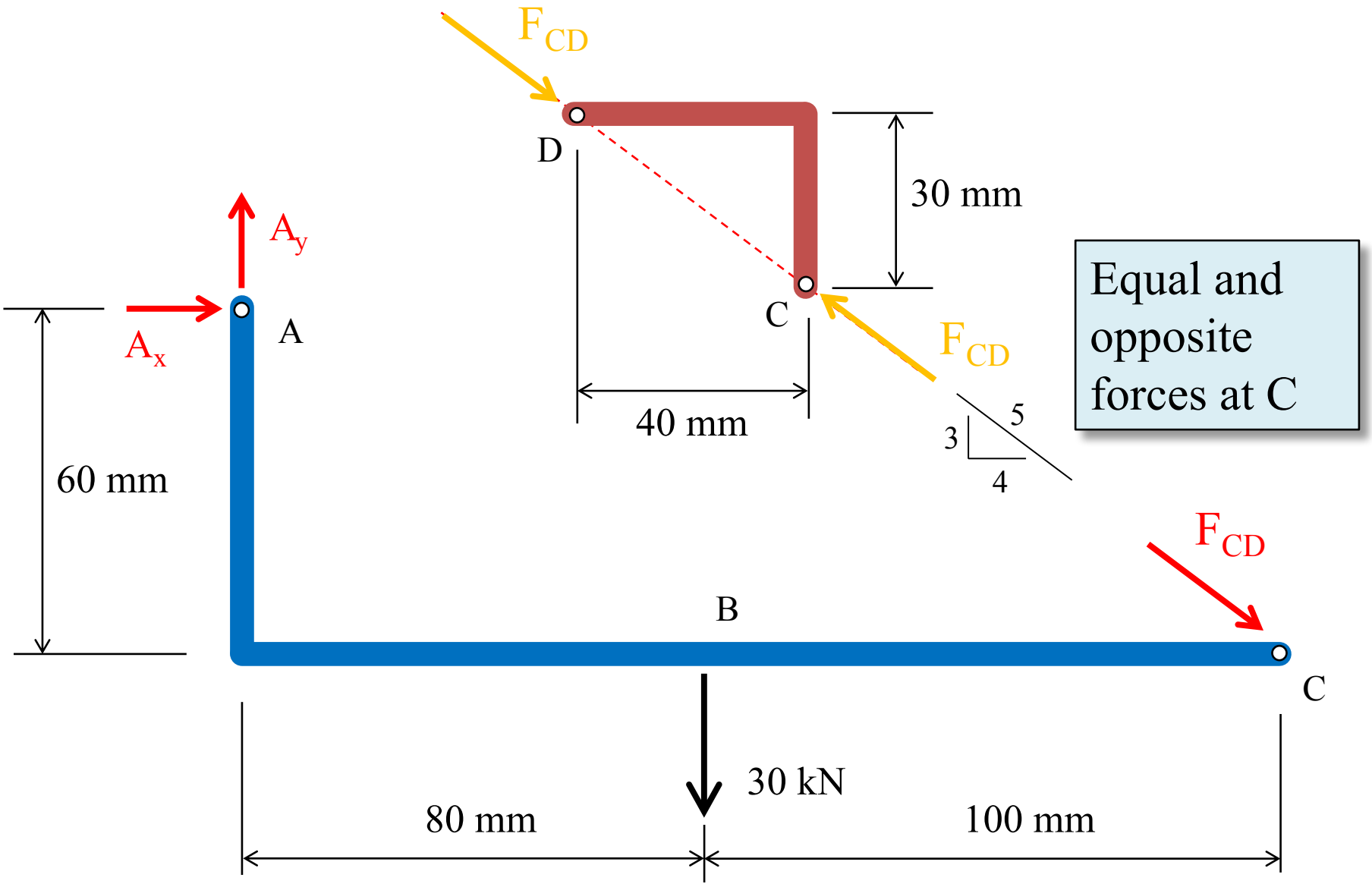
CD is a two-force member



6 Unknowns
6 Equations of Equilibrium

Equal and opposite forces at C

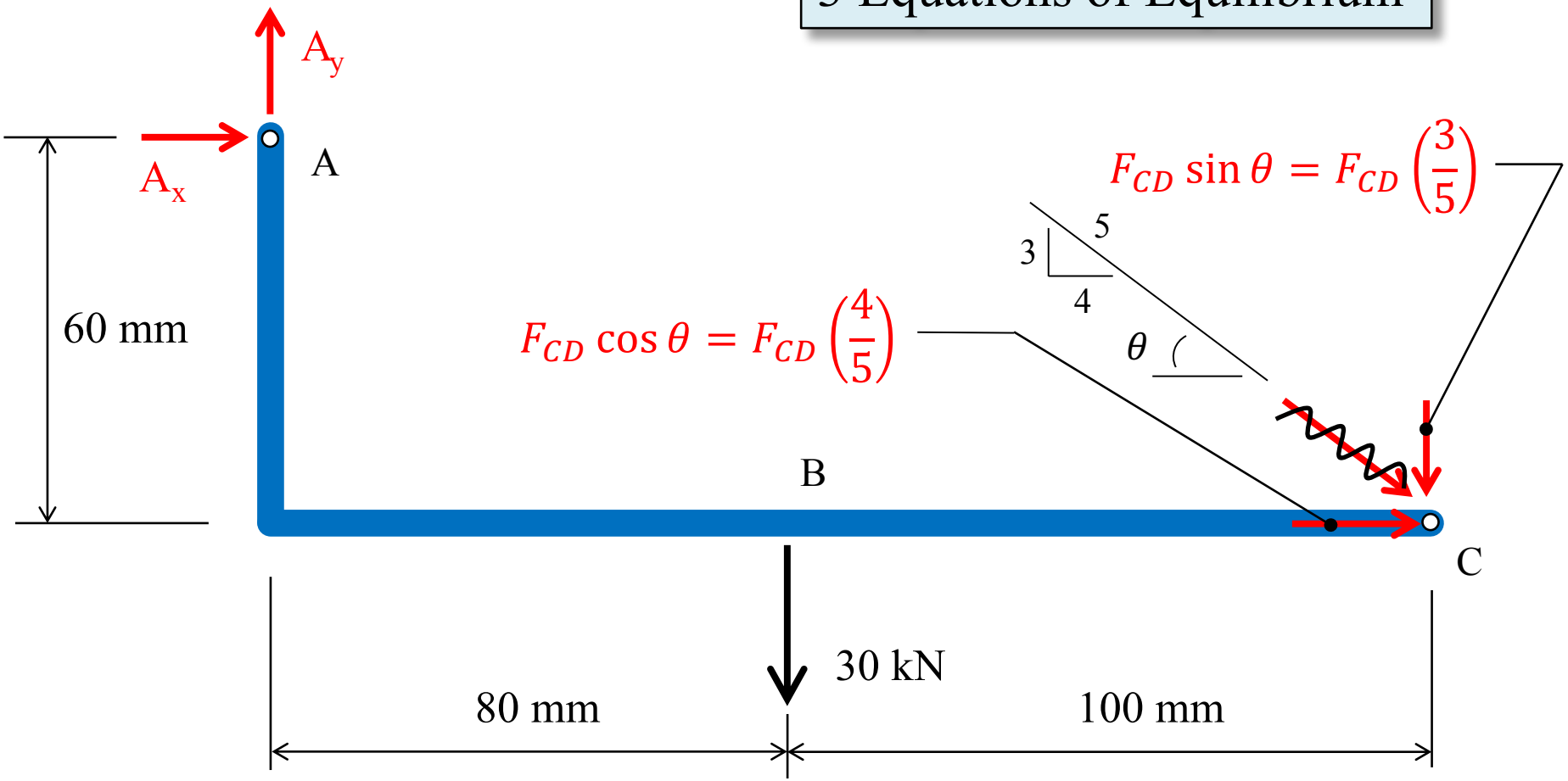
FBDs of ABC and CD recognizing that CD is a two-force member



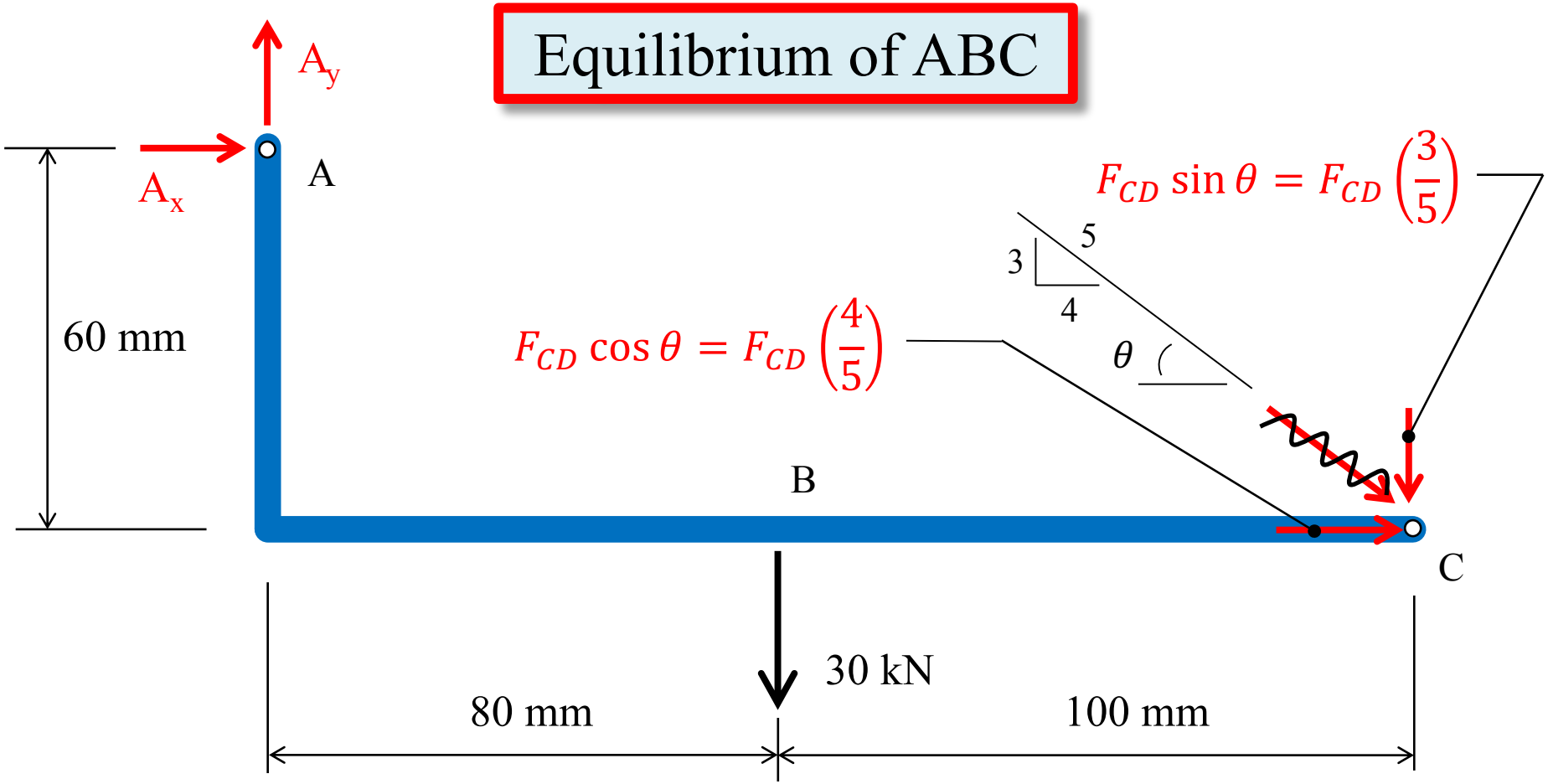
Equal and opposite forces at C

FBD of ABC

3 Unknowns
3 Equations of Equilibrium



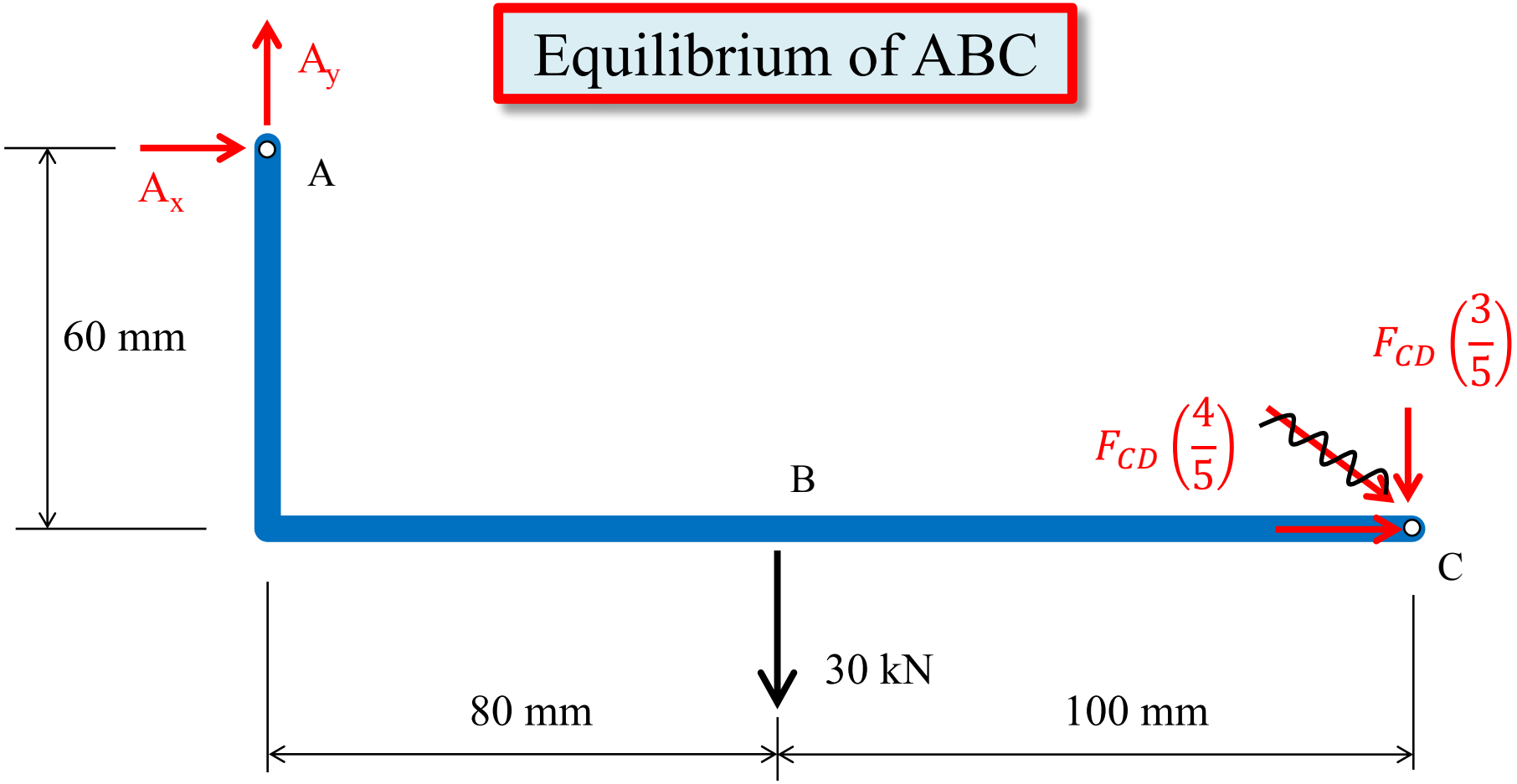
Equilibrium of ABC



$$\circlearrowleft + \sum M_A = 0$$

F_{CD} = -40 kN

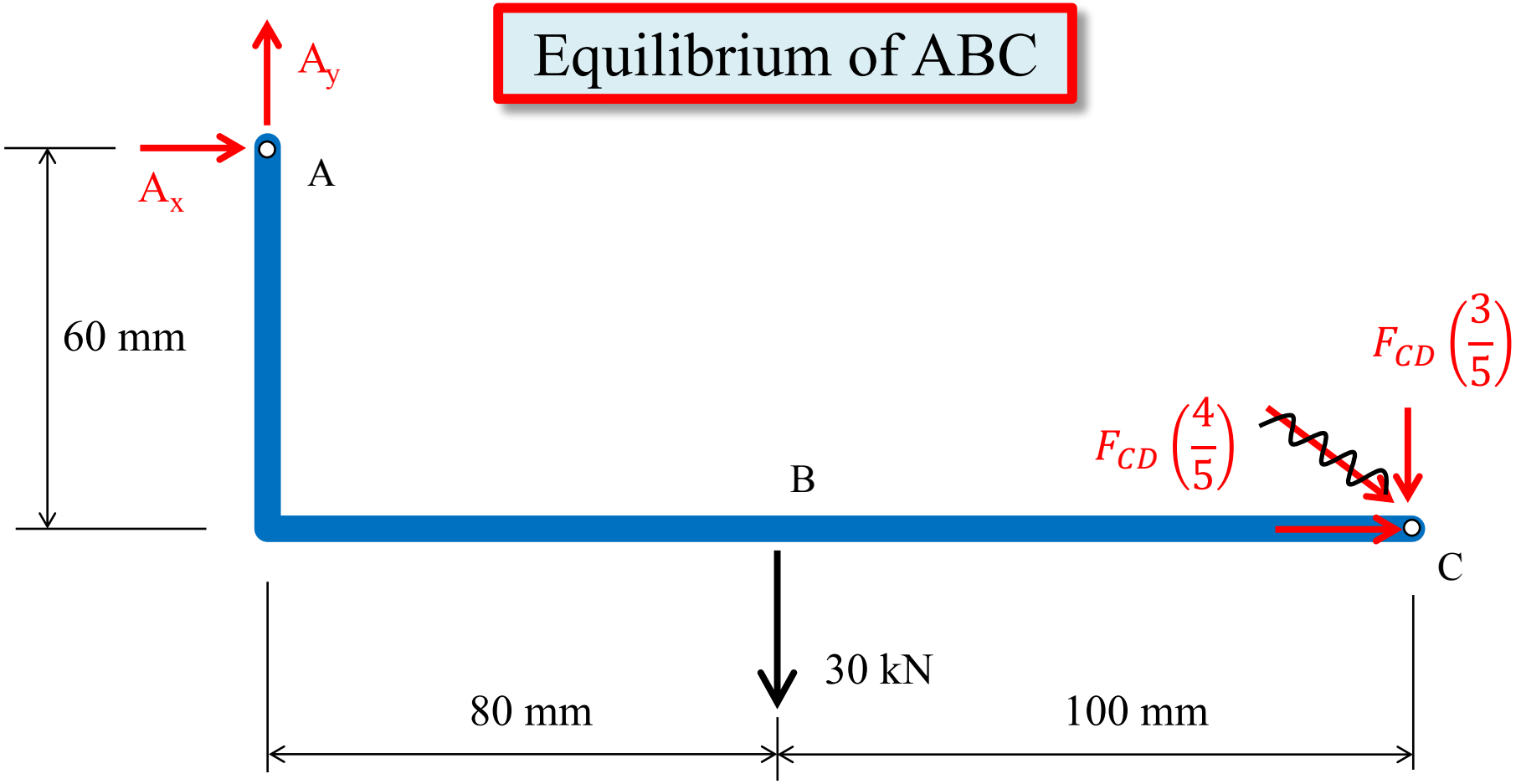
Equilibrium of ABC



$$+\uparrow \sum F_y = 0$$

$A_y = 6$ kN

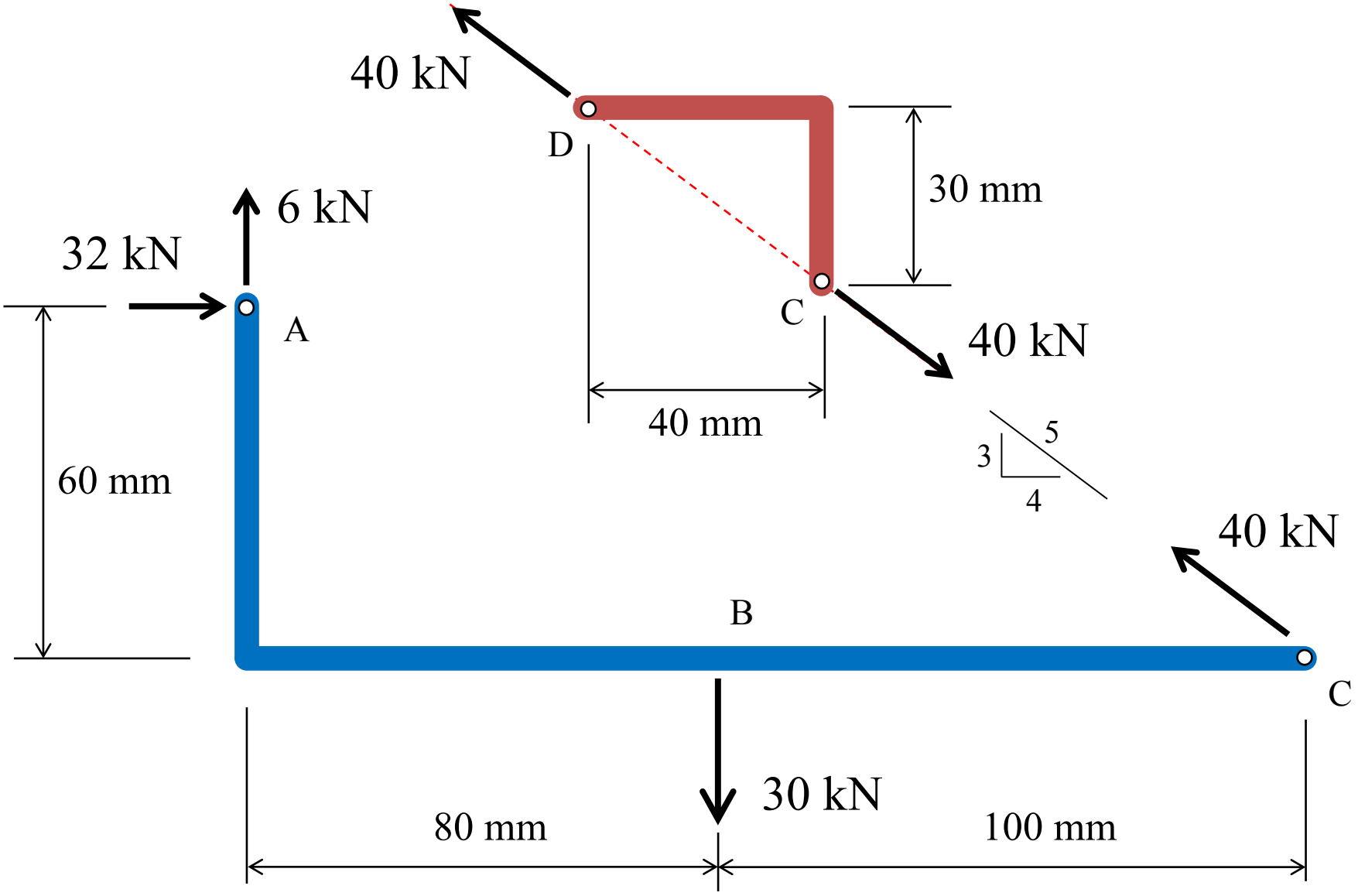
Equilibrium of ABC



$$\xrightarrow{+} \sum F_x = 0$$

$A_x = 32$ kN

Show results on a FBDs of ABC and CD



ABC is a Three-Force Member

For Equilibrium, the three forces acting on a Three-Force Member intersect at one point or are parallel.