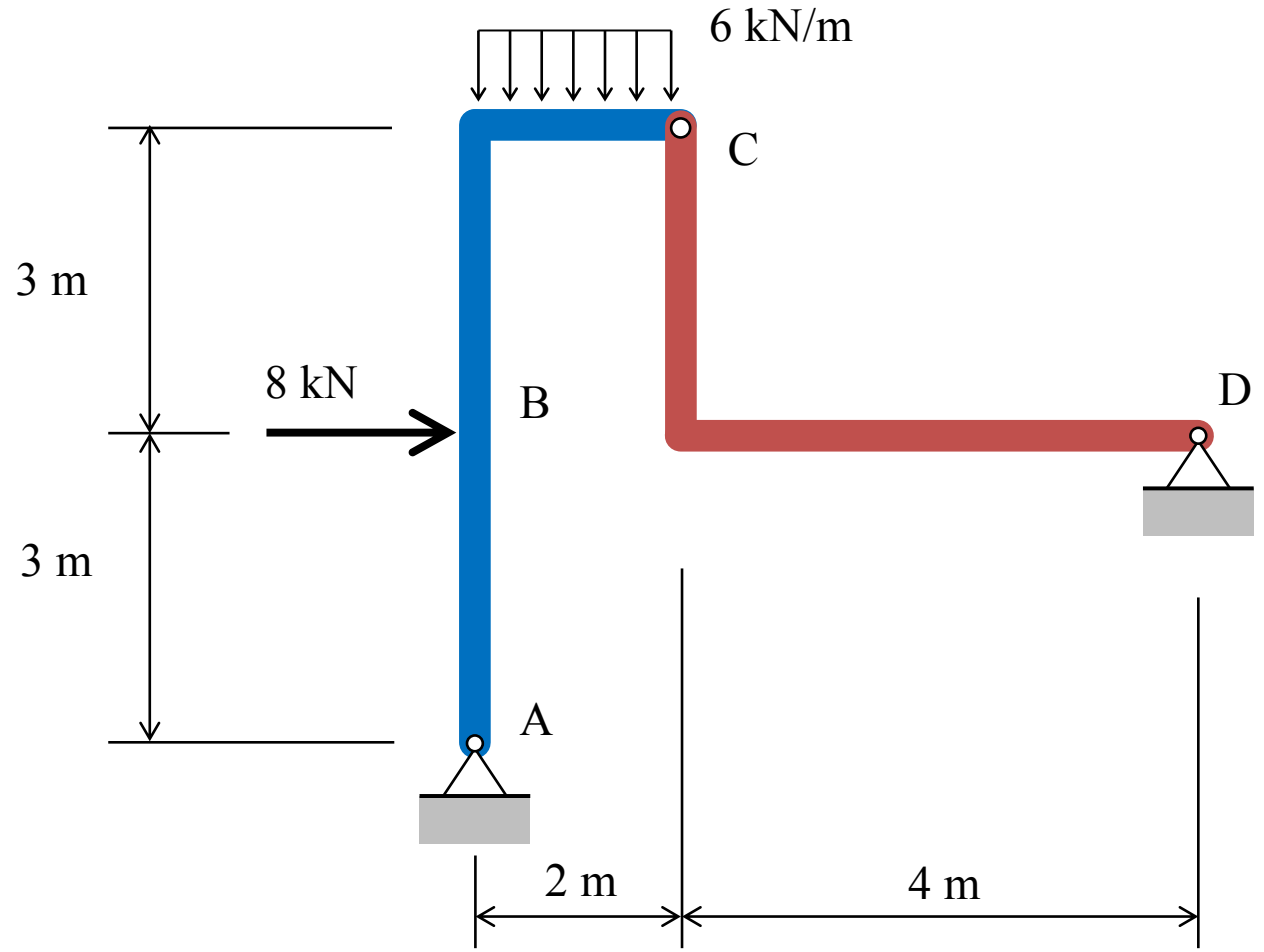
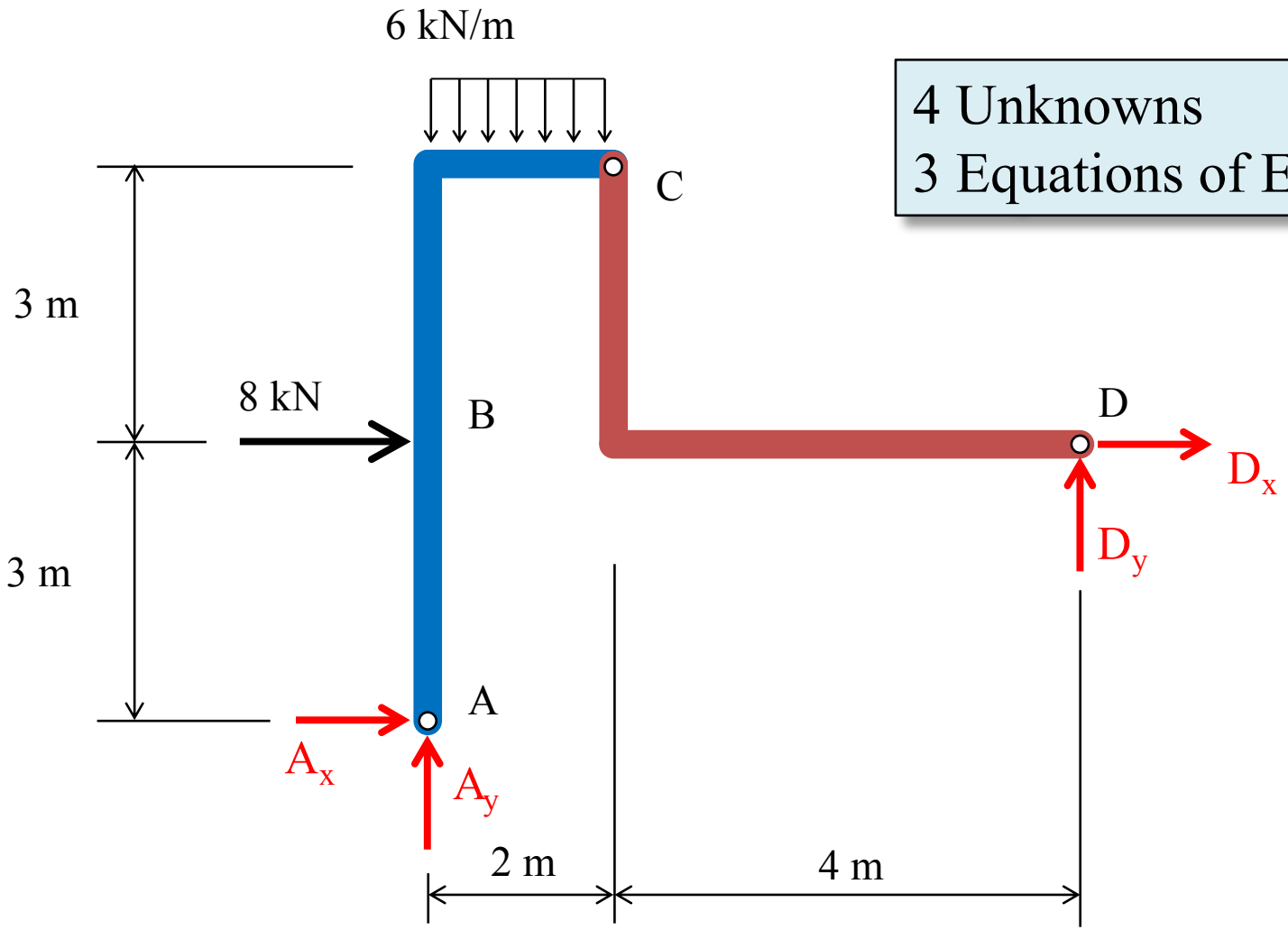
Analysis of a Two-Dimensional Body with a Two-Force Member

Steven Vukazich
San Jose State University

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.

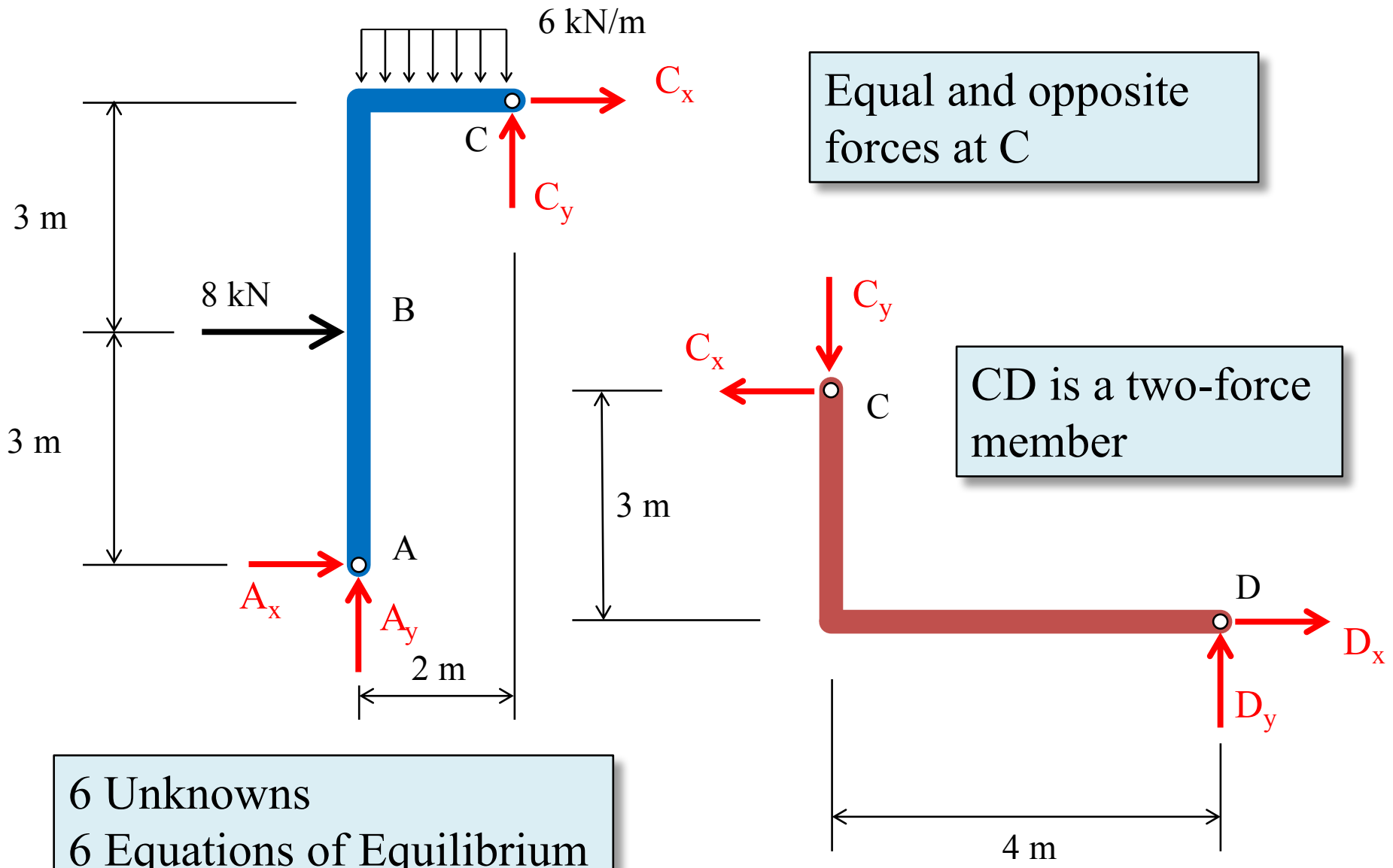


FBD of Entire Structure



4 Unknowns
3 Equations of Equilibrium

FBDs of ABC and CD

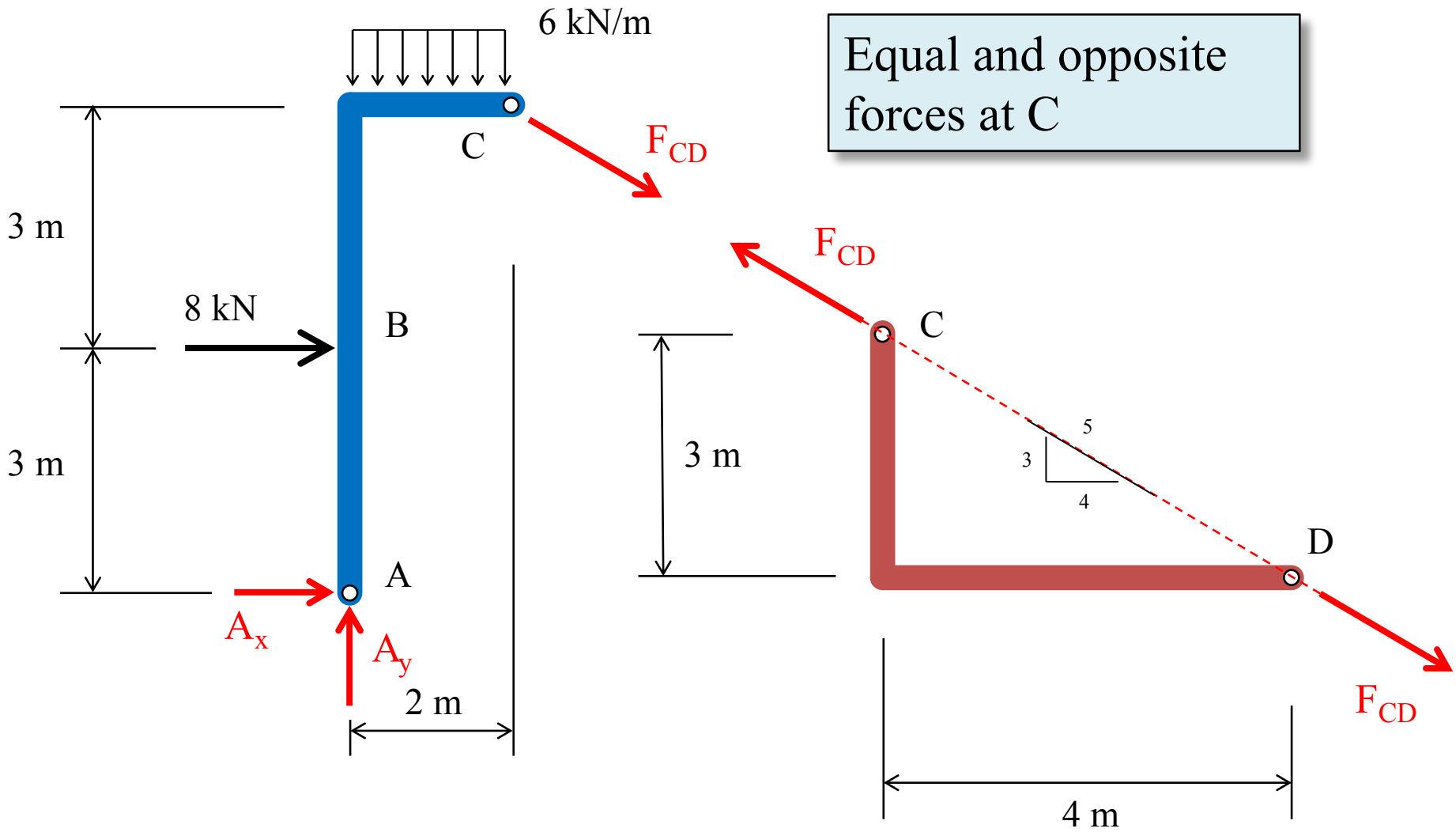


Equal and opposite forces at C

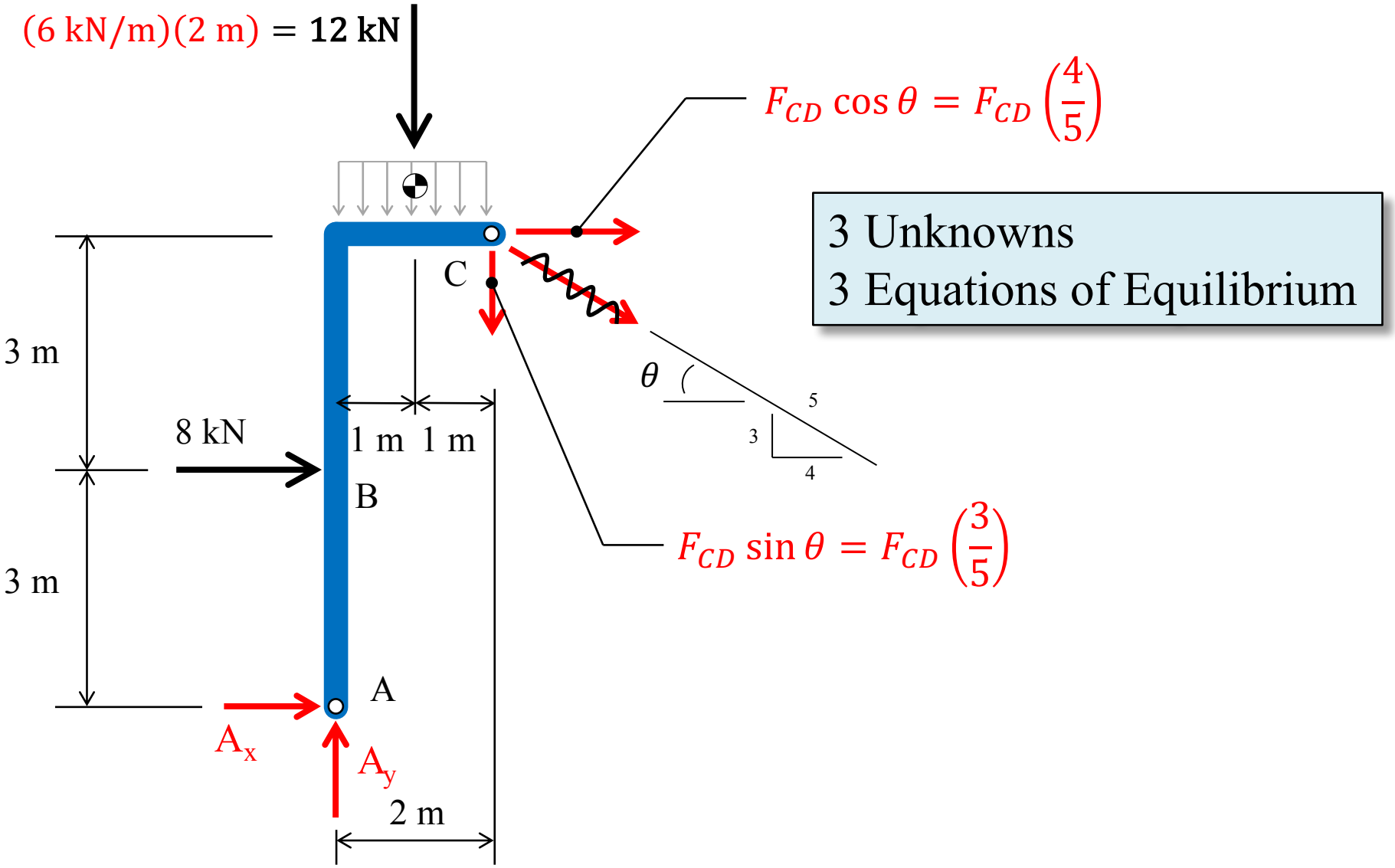
CD is a two-force member

6 Unknowns
6 Equations of Equilibrium

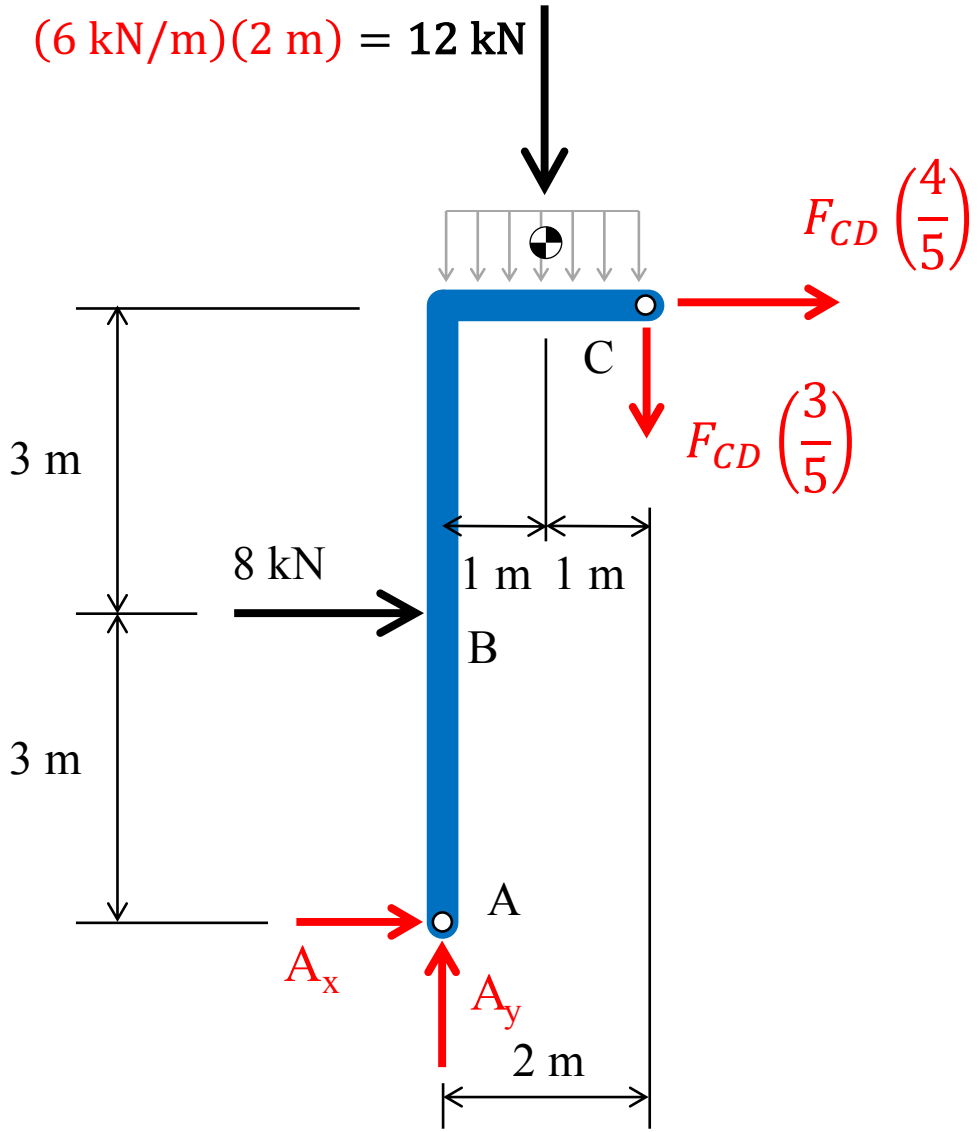
FBDs of ABC and CD recognizing that CD is a two-force member



FBD of ABC


(6 kN/m)(2 m) = 12 kN
$F_{CD}\cos\theta = F_{CD}\left(\frac{4}{5}\right)$
3 Unknowns
3 Equations of Equilibrium
C
3 m
8 kN
1 m
1 m
B
3 m
θ
5
3
4
$F_{CD}\sin\theta = F_{CD}\left(\frac{3}{5}\right)$
A
A_x
A_y
2 m

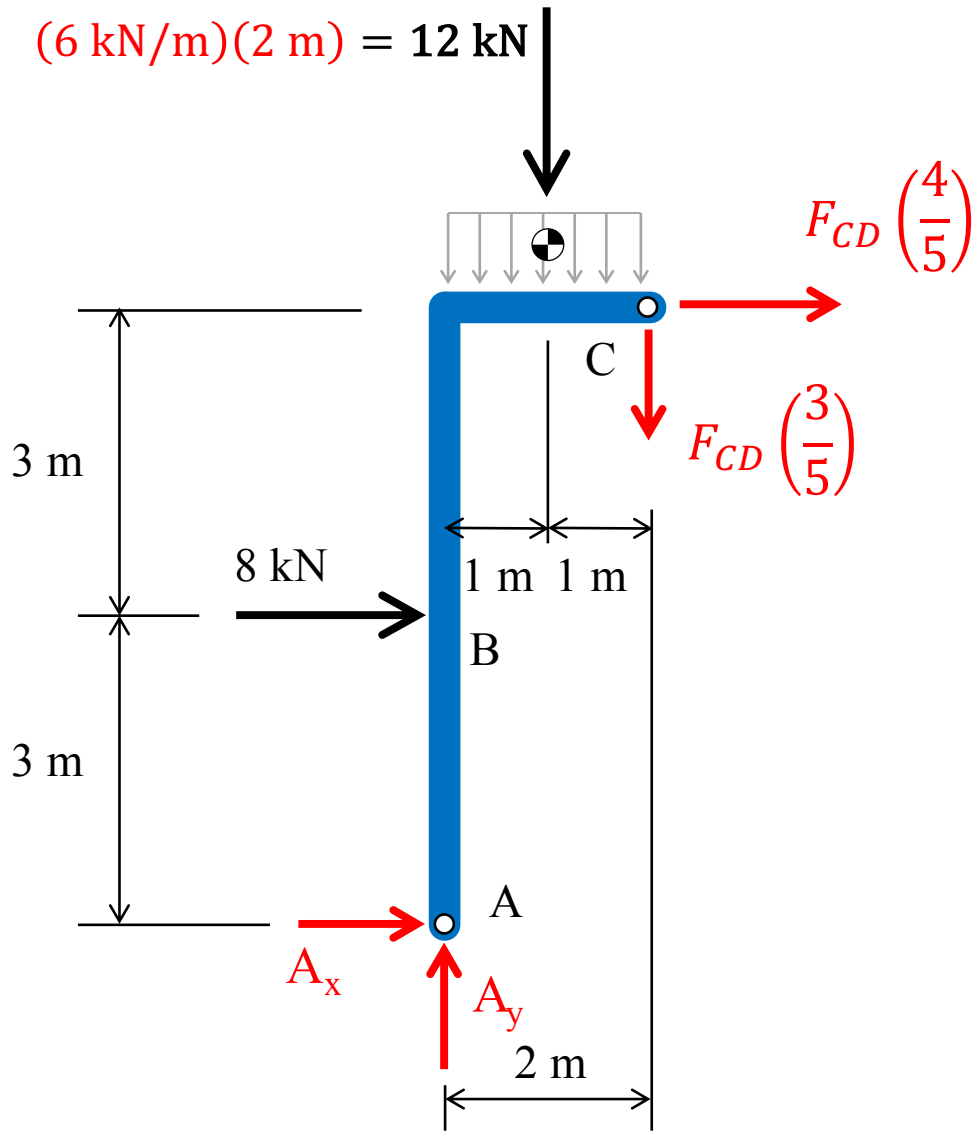
Equilibrium of ABC



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

$F_{CD} = -6$ kN

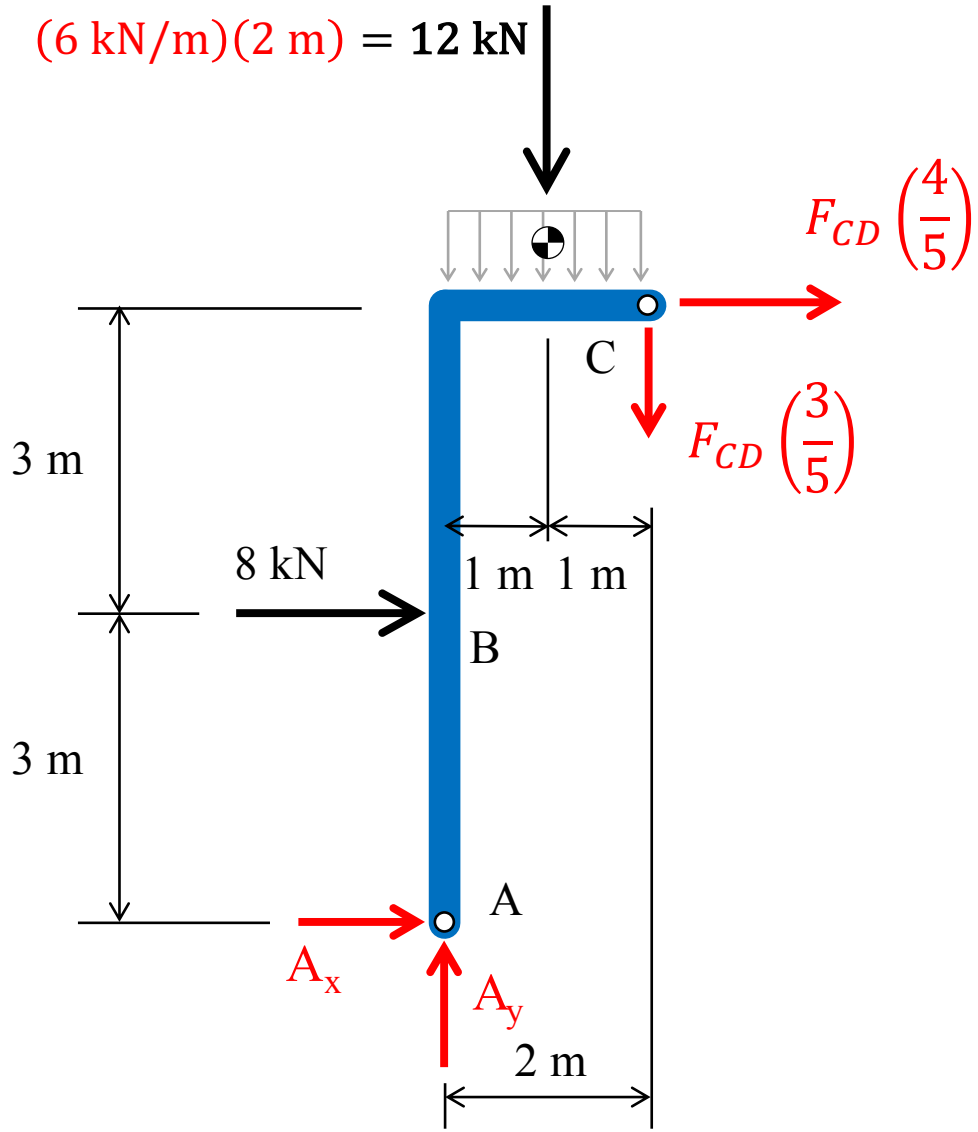
Equilibrium of ABC



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

$A_y = 8.4$ kN

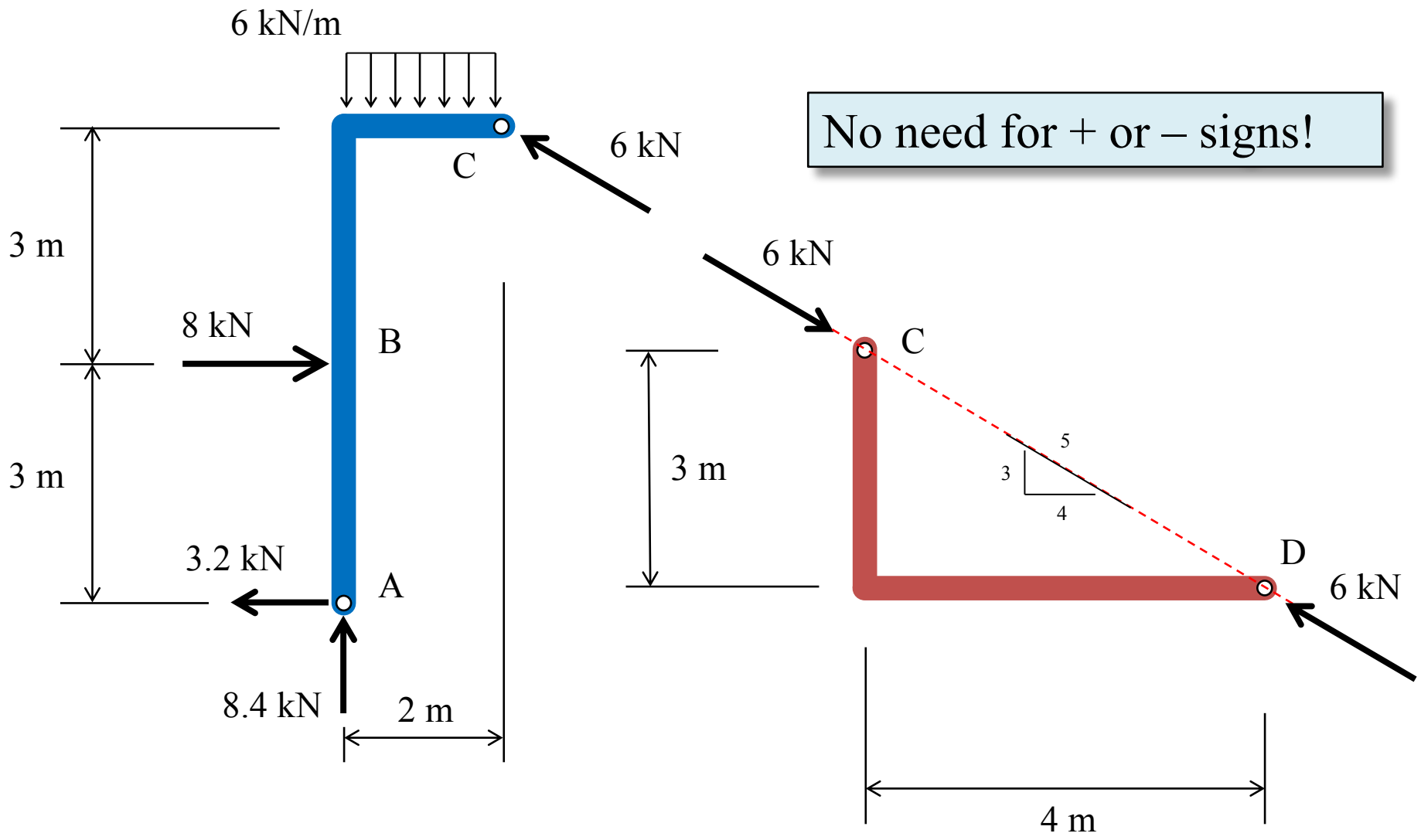
Equilibrium of ABC



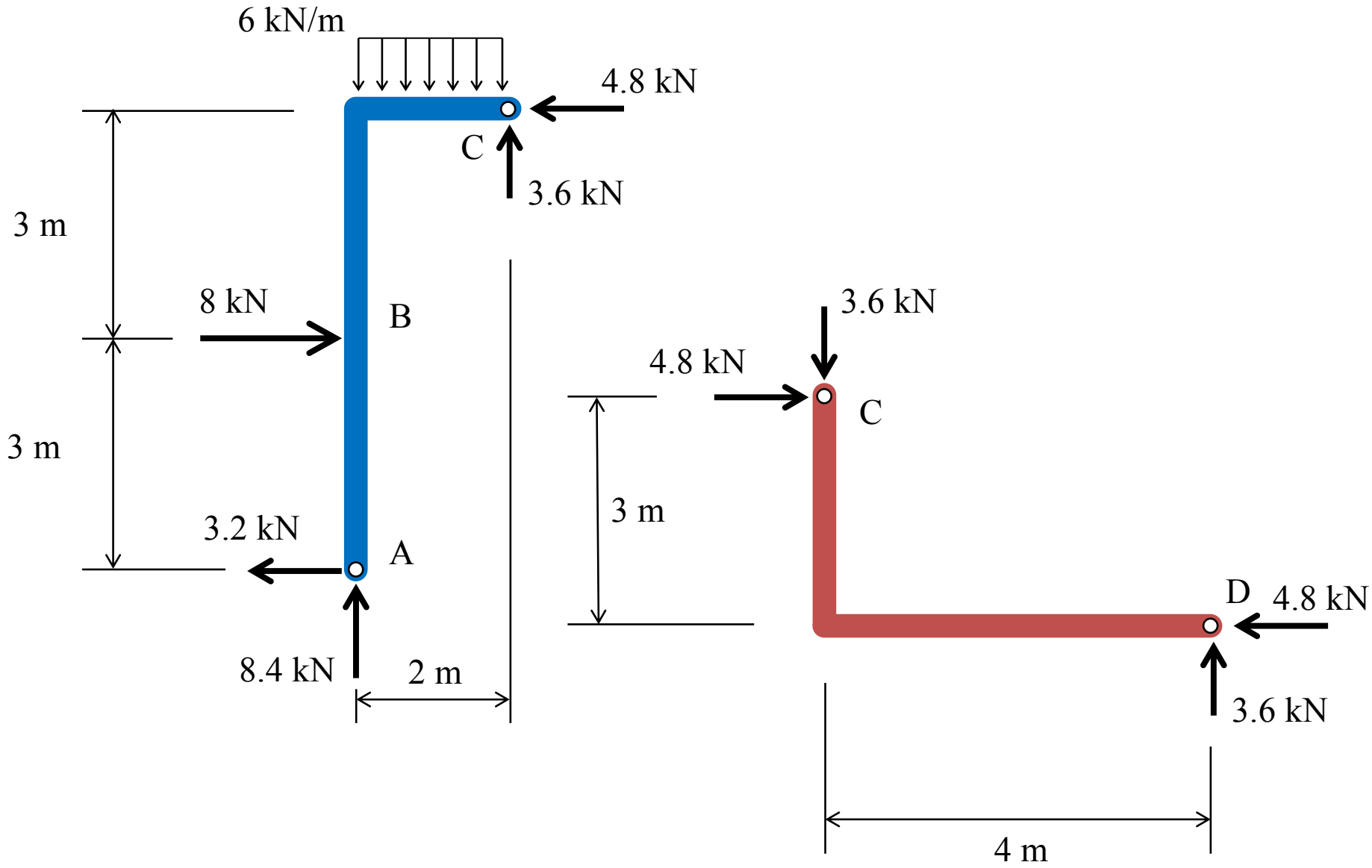
$$\xrightarrow{+} \sum F_x = 0$$

A_x = -3.2 kN

Show results on a FBDs of ABC and CD



Results in terms of components



FBD of Entire Structure in Equilibrium