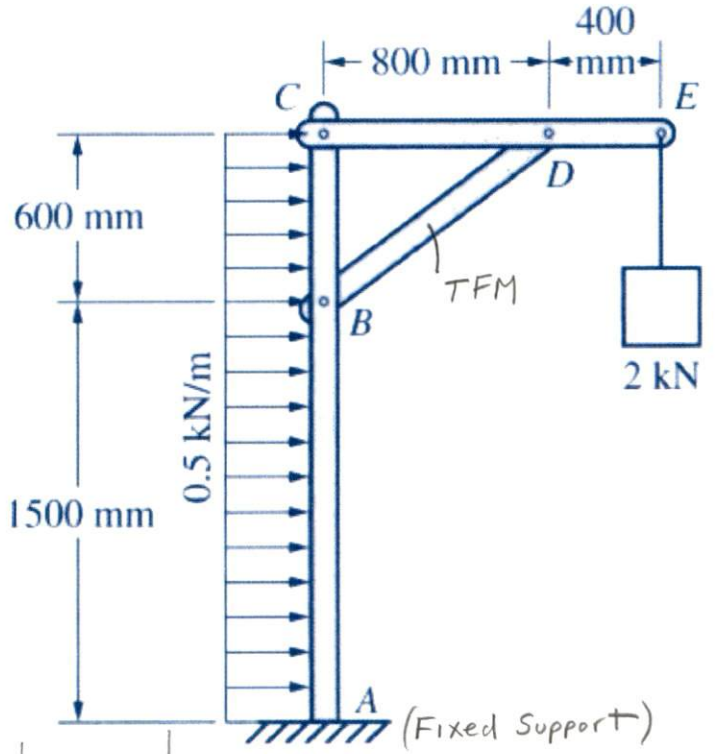
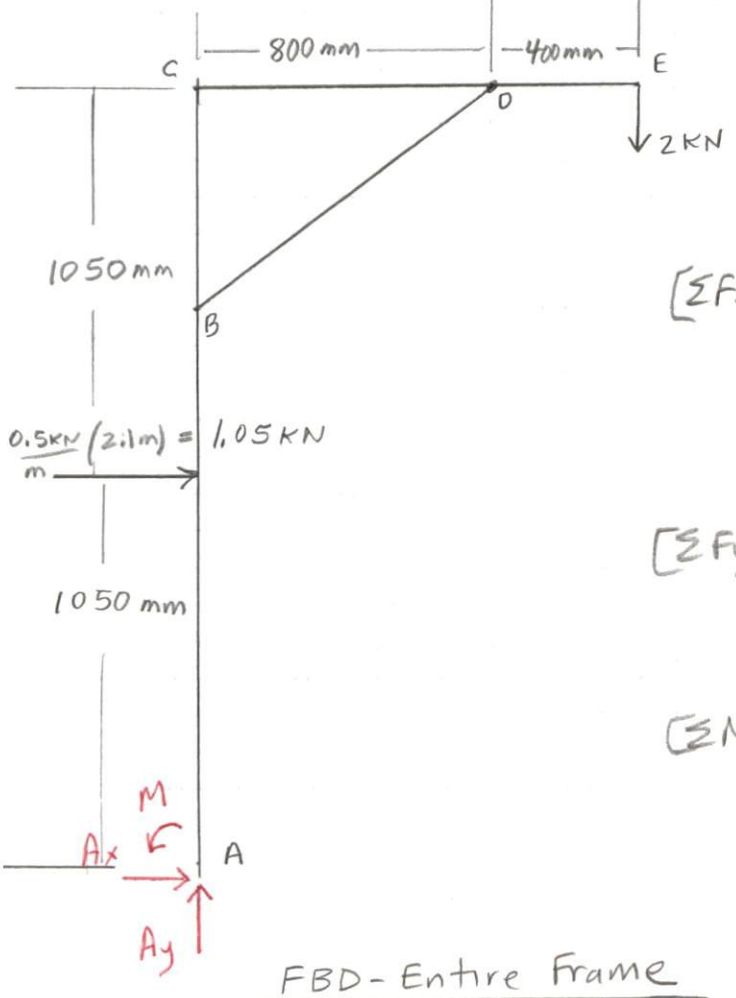
4-31 Refer to Fig. P4-31. Determine the forces acting on vertical member ABC due to the 2-kN load and the uniformly distributed wind load shown.
Solution.





FBD - Entire Frame

ccw +M ↻
cw -M ↺

Equilibrium Equations

$[\Sigma F_x = 0]$ $A_x + 1.05\,kN = 0$

$A_x = -1.05\,kN \rightarrow$

and $\boxed{A_x = 1.05\,kN \leftarrow}$

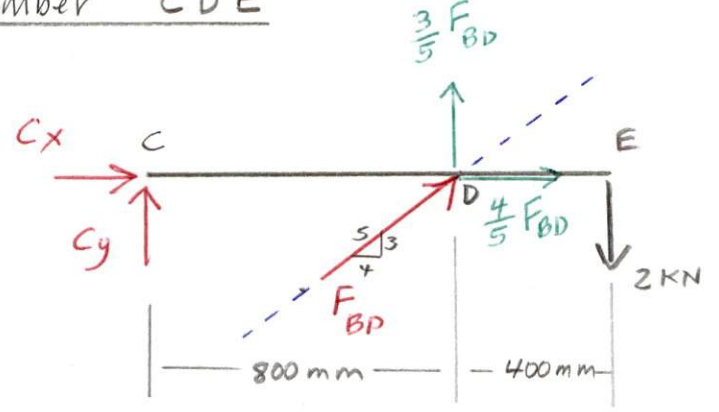
$[\Sigma F_y = 0]$ $A_y - 2kN = 0$

$A_y = 2\,kN \uparrow$

$[\Sigma M_A = 0]$ $M - 1.05\,kN(1.05m) - 2kN(1.2m) = 0$

$M = 3.5025\,kN \cdot m$ ↺

Member CDE



FBD - member CDE

ccw +M ↺
cw −M ↻

Equilibrium Equations

$[\Sigma M_c = 0]$ $\quad \frac{3}{5} F_{BD} (0.8m) - 2kN(1.2m) = 0$

$$F_{BD} = \frac{5}{3} \frac{(2.4 kN \cdot m)}{0.8 m} = 5 kN \ (C)$$

$[\Sigma F_x = 0]$ $\quad C_x + \frac{4}{5} F_{BD} = 0$

$$C_x = -\frac{4}{5}(5kN) = -4 kN \rightarrow$$

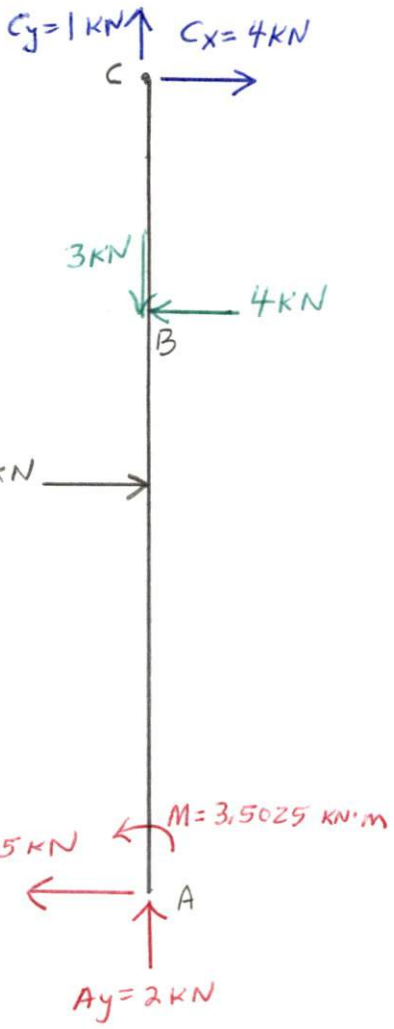
and $\boxed{C_x = 4 kN \leftarrow}$

$[\Sigma F_y = 0]$ $\quad C_y + \frac{3}{5} F_{BD} - 2kN = 0$

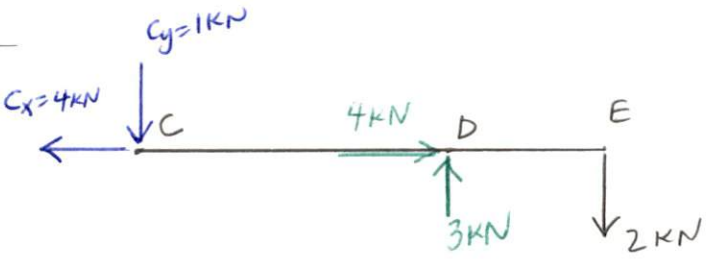
$$C_y = 2kN - \frac{3}{5}(5kN) = -1 kN \uparrow$$

and $\boxed{C_y = 1 kN \downarrow}$

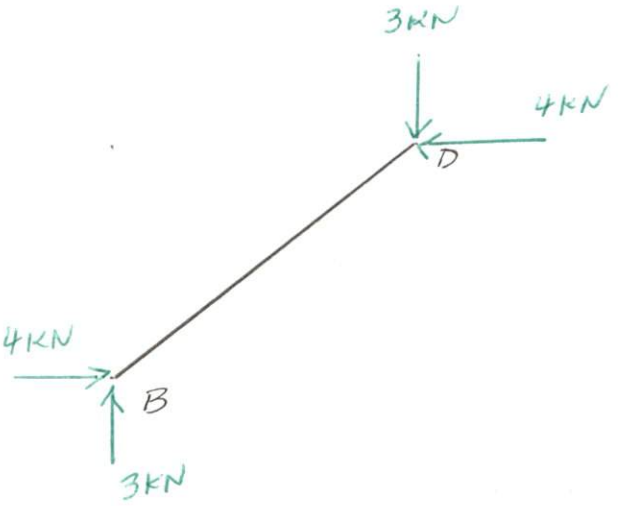
Summarize Results



Member ABC



Member CDE



Member BD (TFM)

All members are in equilibrium ✓