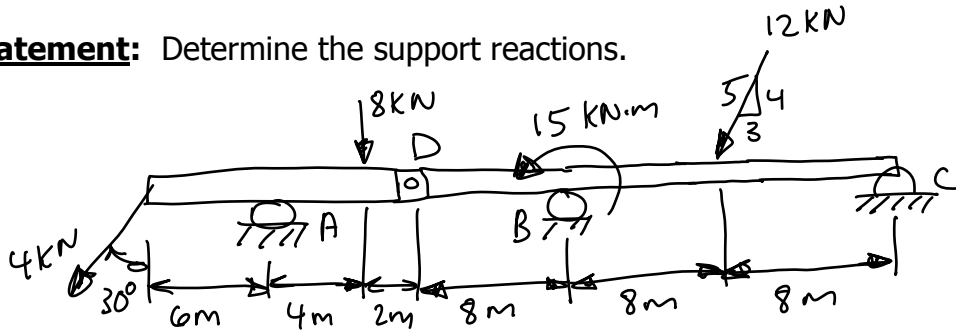


# Frames

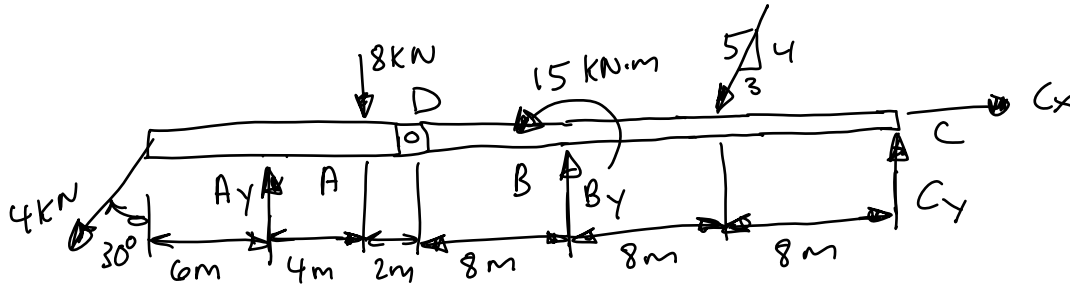
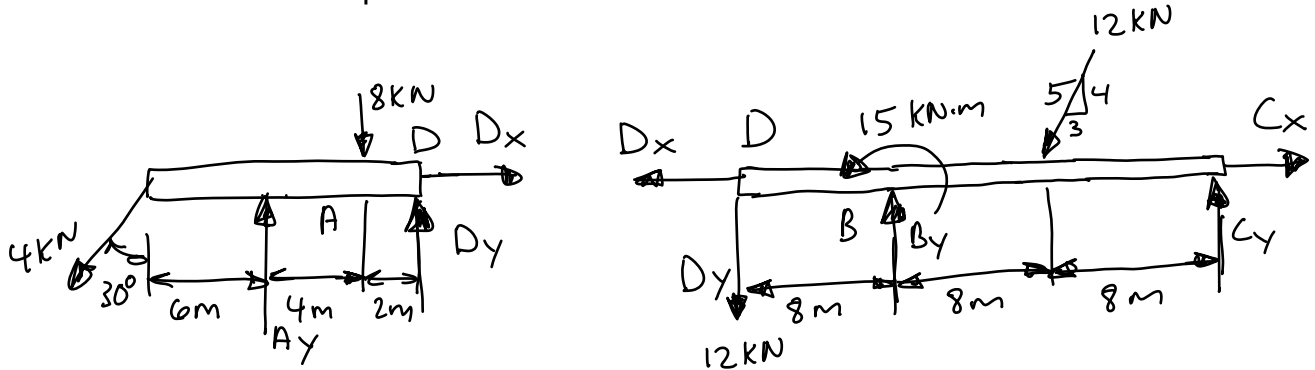
**Problem Statement:** Determine the support reactions.



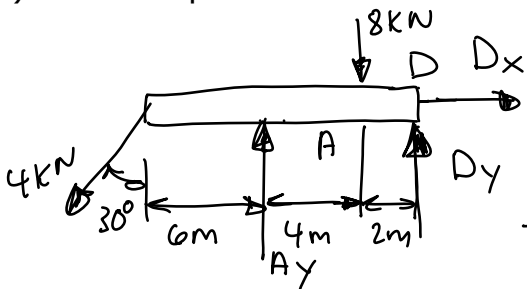
1.) Divide the frame into components.

Separate at the pin at D

2.) Draw the FBD of each component and the entire frame.



3.) Enforce equilibrium.



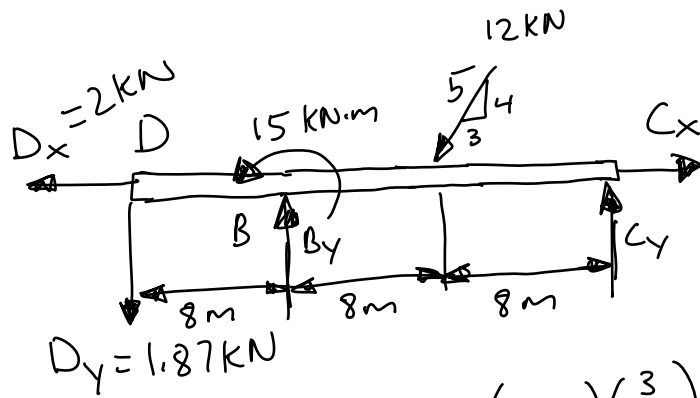
$$\sum F_x = 0 \Rightarrow -(4 \text{ kN})(\sin 30^\circ) + D_x = 0$$

$$\boxed{D_x = 2 \text{ kN}}$$

$$\sum F_y = 0 \Rightarrow -(4 \text{ kN})(\cos 30^\circ) + A_y - 8 \text{ kN} + D_y = 0$$

$$\sum M_D = 0 \Rightarrow (8 \text{ kN})(2 \text{ m}) - (A_y)(6 \text{ m}) + (4 \text{ kN})(\cos 30^\circ)(12 \text{ m}) = 0$$

$$\boxed{A_y = 9.59 \text{ kN}} \quad \boxed{D_y = 1.87 \text{ kN}}$$



$$\rightarrow \sum F_x = 0 = -2 \text{ kN} - (12 \text{ kN})\left(\frac{3}{5}\right) + C_x = 0$$

$$C_x = 9.2 \text{ kN}$$

$$\uparrow \sum F_y = 0 \Rightarrow -1.87 \text{ kN} - (12 \text{ kN})\left(\frac{4}{5}\right) + B_y + C_y = 0$$

$$\uparrow \sum M_C = 0 \Rightarrow (12 \text{ kN})\left(\frac{4}{5}\right)(8 \text{ m}) + 15 \text{ kN}\cdot\text{m} - B_y(16 \text{ m}) + (1.87 \text{ kN})(24 \text{ m}) = 0$$

$$B_y = 8.54 \text{ kN}$$

$$C_y = 2.93 \text{ kN}$$