

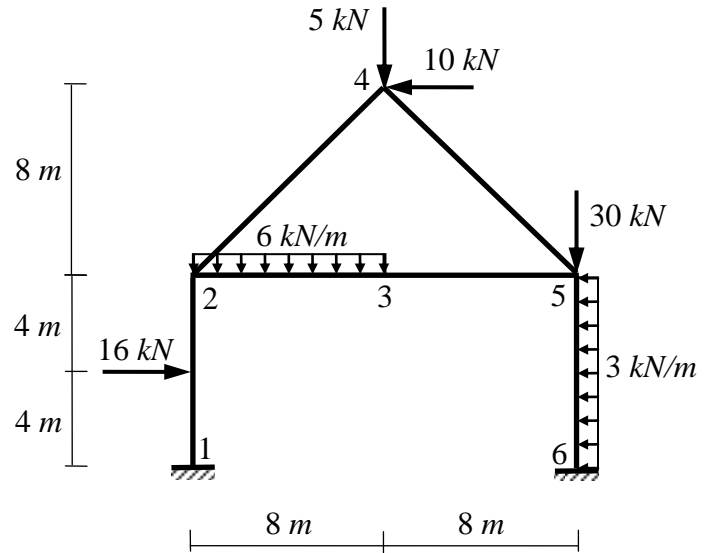
Question (1): (10 Marks)

The matrix equilibrium equation of the shown frame is:

$$\{F\} = [K] \{\Delta\} + \{F^f\}$$

Write

- the nodal forces vector $\{F\}$
- the nodal displacements vector $\{\Delta\}$
- the fixed end solution $\{F^f\}$



Solution:

$$\{F\} = \begin{Bmatrix} X_1 \\ Y_1 \\ M_1 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -10 \\ -5 \\ 0 \\ 0 \\ -30 \\ 0 \\ X_6 \\ Y_6 \\ M_6 \end{Bmatrix} \quad \{\Delta\} = \begin{Bmatrix} 0 \\ 0 \\ 0 \\ u_2 \\ v_2 \\ \theta_2 \\ u_3 \\ v_3 \\ \theta_3 \\ u_4 \\ v_4 \\ \theta_4 \\ u_5 \\ v_5 \\ \theta_5 \\ 0 \\ 0 \\ 0 \end{Bmatrix} \quad \{F^f\} = \begin{Bmatrix} -8 \\ 0 \\ 16 \\ -8 \\ 24 \\ 16 \\ 0 \\ 24 \\ -32 \\ 0 \\ 0 \\ 0 \\ 12 \\ 0 \\ 16 \\ 12 \\ 0 \\ -16 \end{Bmatrix}$$

