Question (1):

By using the three moment theorem, draw shear force and bending moment diagrams for the structure shown. [I constant]

![Structure Diagram]
Determine all support reactions and draw the bending moment diagram for the frame, using the method of consistent deformations. [ I constant ]
Question (2):

Determine the member moments for the structure (use the moment distribution method)

\[ k_{AB} = \frac{4EI}{8} = \frac{EI}{2}, \quad k_{BC} = \frac{4(2EI)}{12} = \frac{2EI}{3}, \quad k_{CD} = \frac{4EI}{10} = \frac{2EI}{5} \]

\[ DF_{AE} = DF_{EB} = 0, \quad DF_{BA} = \frac{1}{2} = \frac{1}{2}, \quad DF_{CB} = \frac{3}{4}, \quad DF_{DC} = \frac{1}{4} = \frac{1}{4} \]

\[ (FEM)_{AB} = (FEM)_{BA} = 0 \]

\[ (FEM)_{BC} = -30 \times \frac{2}{4} = -15 \]

\[ (FEM)_{CD} = 30 \times \frac{3}{8} = 11.25 \]

\[ (FEM)_{DC} = 33.33 \]
Question (3):
Determining the force in each member of the two-member truss shown. (use the stiffness method)

Element 1: \[ \begin{bmatrix} 2 \to 3 \end{bmatrix} \]
- \[ \theta = 0 \]
- \[ \alpha = 1 \]
- \[ S = 0 \]
- \[ \theta = 13.12^\circ \]
- \[ \alpha = 0 \]
- \[ S = 0.8 \]

\[ K = \begin{bmatrix} E_{A1} \end{bmatrix} \]
- \[ L \]
- \[ c \]
- \[ -1 \]
- \[ 0 \]

Element 2: \[ \begin{bmatrix} 2 \to 1 \end{bmatrix} \]
- \[ \theta = 0 \]
- \[ \alpha = 1 \]
- \[ S = 0 \]
- \[ \theta = 90^\circ \]
- \[ \alpha = 0 \]
- \[ S = 0.8 \]

\[ K = \begin{bmatrix} E_{A2} \end{bmatrix} \]
- \[ L \]
- \[ c \]
- \[ -1 \]
- \[ 0 \]

\[ K = \begin{bmatrix} 0.86 \times 10^6 \end{bmatrix} \]
- \[ 0 \]
- \[ 0 \]
- \[ 0 \]

\[ K = \begin{bmatrix} -0.16 \times 10^6 \end{bmatrix} \]
- \[ 0 \]
- \[ 0 \]
- \[ 0 \]
Question (4):

Use the stiffness method to determine the reactions at supports and draw the bending moment diagram.
01) Using the moment-distribution method, prove that the following frame will not sideways.

(EI is constant) Draw B.M.D.
Q2) Determine the internal moments at the supports of the beam and draw the BMD. The support at B is displaced (settles) 20 mm. Take: $E=200\,\text{GPa}$, $I=5\times10^6\,\text{mm}^4$. 

[Diagram of a beam with dimensions and support]
Q4) Determine the deflection at joint (3) and the reactions on the beam. 

*Take* \( E = 200 \text{ GPa} \), and \( I = 22(10^6) \text{ m}^4 \).
Using Moment Distribution method, determine the internal moment acting at each joint.

Assume A is pinned and D and C are fixed joints.

\( EI \) is constant.

\[
K_{AB} = \frac{3EI}{4} \quad K_{BC} = \frac{4EI}{3} \quad K_{BD} = \frac{9EI}{3}
\]

\[
DF_{AB} = 1 \quad DF_{BA} = \frac{3EI}{4} \quad DF_{BD} = 0
\]

\[
DF_{BD} = \frac{4}{2} - 0.992 \quad DF_{DB} = 0
\]

\[
DF_{BC} = \frac{1}{2} + 0.329 \quad DF_{CB} = 0
\]

\[
FEM_{BA} = \frac{wl^2}{8} = \frac{15(9)^2}{8} = 50 \text{ kN.m}
\]

\[
FEM_{BD} = -\frac{PL}{8} = \frac{50(9)}{8} = -10.75 \text{ kN.m}
\]

\[
FEM_{DB} = +10.75 \text{ kN.m}
\]

\[
FEM_{BC} = -\frac{100(9)}{8} = -50 \text{ kN.m}
\]

\[
FEM_{CB} = 50 \text{ kN.m}
\]

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