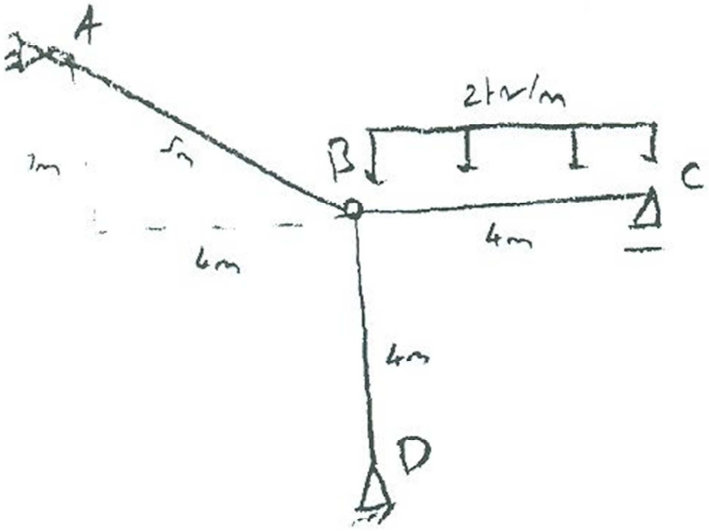
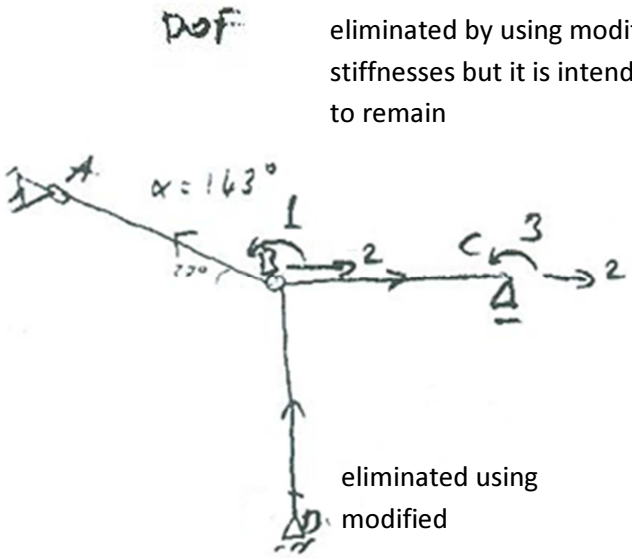




DOF #3 can also be eliminated by using modified stiffnesses but it is intended to remain

eliminated using modified

$AE = 1 \times 10^4$ kN for bar

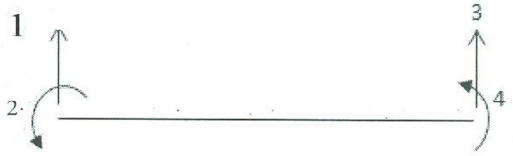
$EI = 2 \times 10^4$ kNm^2 for beams

beams are axially rigid

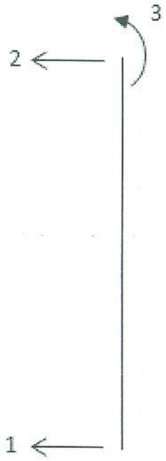
Find bar force (F_{AB}) using stiffness assembly method.

$EI := 2 \cdot 10^4 \qquad EA := 1 \cdot 10^4$

$$kbc(L) := \begin{bmatrix} 12\cdot\frac{EI}{L^3} & 6\cdot\frac{EI}{L^2} & -\left(12\cdot\frac{EI}{L^3}\right) & 6\cdot\frac{EI}{L^2} \\ 6\cdot\frac{EI}{L^2} & 4\cdot\frac{EI}{L} & -\left(6\cdot\frac{EI}{L^2}\right) & 2\cdot\frac{EI}{L} \\ -\left(12\cdot\frac{EI}{L^3}\right) & -\left(6\cdot\frac{EI}{L^2}\right) & 12\cdot\frac{EI}{L^3} & -\left(6\cdot\frac{EI}{L^2}\right) \\ 6\cdot\frac{EI}{L^2} & 2\cdot\frac{EI}{L} & -\left(6\cdot\frac{EI}{L^2}\right) & 4\cdot\frac{EI}{L} \end{bmatrix}$$



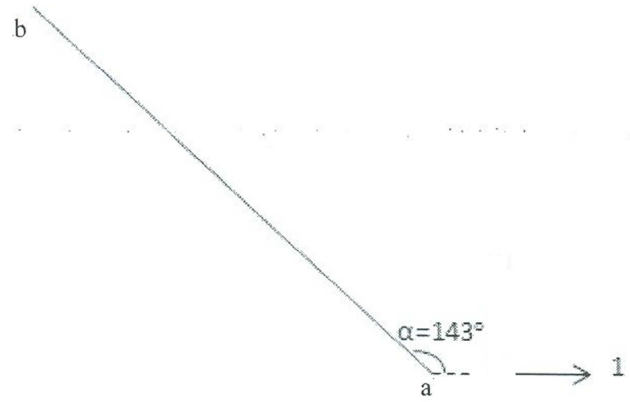
$$kbc(4) = \begin{pmatrix} 3750 & 7500 & -3750 & 7500 \\ 7500 & 20000 & -7500 & 10000 \\ -3750 & -7500 & 3750 & -7500 \\ 7500 & 10000 & -7500 & 20000 \end{pmatrix}$$



$$kbd(L) := \begin{bmatrix} 3\cdot\frac{EI}{L^3} & -\left(3\cdot\frac{EI}{L^3}\right) & 3\cdot\frac{EI}{L^2} \\ -\left(3\cdot\frac{EI}{L^3}\right) & 3\cdot\frac{EI}{L^3} & -\left(3\cdot\frac{EI}{L^2}\right) \\ 3\cdot\frac{EI}{L^2} & -\left(3\cdot\frac{EI}{L^2}\right) & 3\cdot\frac{EI}{L} \end{bmatrix} \qquad kbd(4) = \begin{pmatrix} 937.5 & -937.5 & 3750 \\ -937.5 & 937.5 & -3750 \\ 3750 & -3750 & 15000 \end{pmatrix}$$

$Lab := 5$

$$kab(C) = \frac{EA}{Lab}\left[C^2\right]$$



$$kab\left(\frac{4}{5}\right) = \frac{EA}{Lab}\left[\frac{4}{5}\right]^2 = 1280$$

$$K := \begin{pmatrix} kbd(4)_{3,3} + kbc(4)_{2,2} & -kbd(4)_{2,3} & kbc(4)_{2,4} \\ -kbd(4)_{3,2} & kbd(4)_{2,2} + kab\left(\frac{4}{5}\right)_{1,1} & 0 \\ kbc(4)_{4,2} & 0 & kbc(4)_{4,4} \end{pmatrix} = \begin{pmatrix} 35000 & 3750 & 10000 \\ 3750 & 2217.5 & 0 \\ 10000 & 0 & 20000 \end{pmatrix}$$

$$F := \begin{pmatrix} \frac{-2 \cdot 4^2}{12} \\ 0 \\ \frac{2 \cdot 4^2}{12} \end{pmatrix} = \begin{pmatrix} -2.667 \\ 0 \\ 2.667 \end{pmatrix}$$

$$D := K^{-1} \cdot F = \begin{pmatrix} -1.691 \times 10^{-4} \\ 2.859 \times 10^{-4} \\ 2.179 \times 10^{-4} \end{pmatrix} \begin{matrix} \text{rad} \\ \text{m} \\ \text{rad} \end{matrix}$$

$$Fab := \frac{EA}{Lab}\left[\frac{4}{5}\right] D_2 = 0.457 \text{ kN}$$