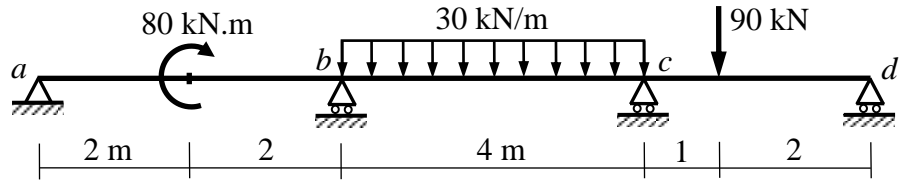


Final Exam

Total Marks: 70

No. of Questions: 40 (Attempt all questions)

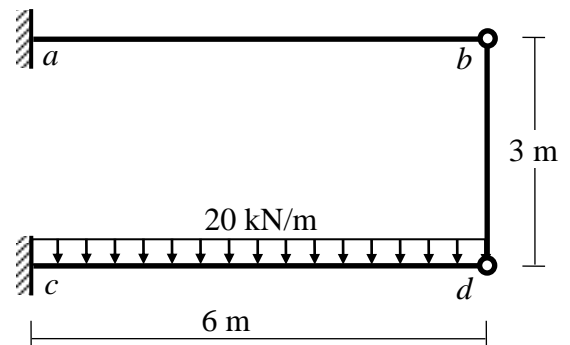
For the shown beam, use the **three-moment equation** to draw the shear force and the bending moment diagrams.



Choose the nearest answer.

- The shown beam has ... unknown moments at supports.
(A) 1 (B) 2 (C) 3 (D) 4
- In M_o -diagram due to the given loads, the maximum moment in the span ab is:
(A) 20 kN.m (B) 80 kN.m (C) 40 kN.m (D) 90 kN.m
- In M_o -diagram due to the given loads, the maximum moment in the span bc is:
(A) 15 kN.m (B) 30 kN.m (C) 40 kN.m (D) 60 kN.m
- The elastic reaction at the support b from span ba (r_{ba}) is:
(A) zero (B) 13.33 (C) 20 (D) 40
- The elastic reaction at the support b from span bc (r_{bc}) is:
(A) 30 (B) 60 (C) 80 (D) 120
- The elastic reactions at the support c (r_{cb} & r_{cd}) are:
(A) 80 & 50 (B) 60 & 50 (C) 120 & 90 (D) 80 & 45
- The final moment at the support b is:
(A) -22.7 kN.m (B) -25.4 kN.m (C) -30.3 kN.m (D) -49.2 kN.m
- The final moment at the support c is:
(A) -25.4 kN.m (B) -49.2 kN.m (C) -55.2 kN.m (D) -42.1 kN.m
- The final maximum positive moment in the span ab is:
(A) 47.3 kN.m (B) 72.2 kN.m (C) 28.7 kN.m (D) 51.4 kN.m
- The final shear force at a is:
(A) zero (B) 12.2 kN (C) -25.7 kN (D) -36.4 kN
- The final shear force at d is:
(A) -76.2 kN (B) -12.2 kN (C) -25.7 kN (D) -13.6 kN

For the shown frame, use the **consistent deformations (virtual work)** method to draw the bending moment diagram. **Take the main system by replacing the fixed support at C by hinged support.** EI is constant.

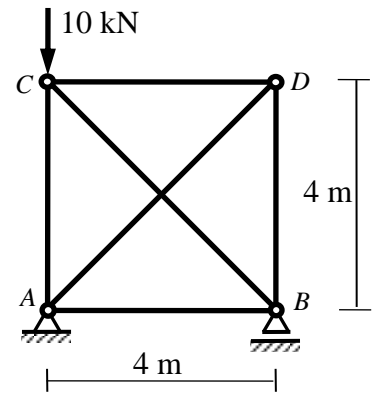


Choose the nearest answer.

- The moment at a in M_o -diagram due to the given loads is:
(A) -900 kN.m (B) zero (C) -360 kN.m (D) -450 kN.m
- The moment at c in M_o -diagram due to the given loads is:
(A) 20 kN.m (B) 120 kN.m (C) zero (D) 60 kN.m
- The value of the moment at a in M_1 -diagram due to the moment redundant $X_1 = 1$ kN.m at c is:
(A) zero (B) 1 kN.m (C) 3 kN.m (D) 6 kN.m
- The value of the moment at c in M_1 -diagram due to the moment redundant $X_1 = 1$ kN.m at c is:
(A) zero (B) 1 kN.m (C) 3 kN.m (D) 6 kN.m
- The value of the deflection δ_{10} is:
(A) $900/EI$ (B) $2250/EI$ (C) $200/EI$ (D) $400/3EI$
- The value of the deflection δ_{11} is:
(A) $16/EI$ (B) $2/EI$ (C) $8/EI$ (D) $4/EI$
- The value of the final moment reaction at the fixed support c ($X_1 = M_c$) is:
(A) 225 kN.m (B) 562.5 kN.m (C) 107.5 kN.m (D) 82.3 kN.m
- The value of the final moment at a is:
(A) 270 kN.m (B) 180 kN.m (C) 337.5 kN.m (D) 135 kN.m
- The value of the final moment at b is:
(A) 1 kN.m (B) 4 kN.m (C) 135 kN.m (D) zero

Please turn over

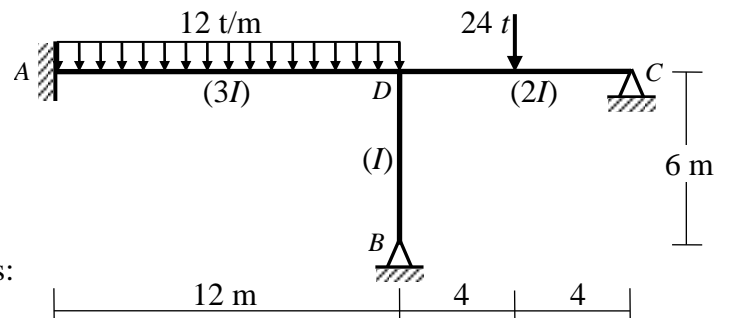
For the shown truss, use the **consistent deformations (virtual work)** method to determine the forces in the members. **Take the main system by removing the member BC.** Assume EA is constant for all members.



Choose the nearest answer.

21. The vertical reaction at the hinged support A due to the given loads (N_o) is:
 (A) zero (B) 5 kN \uparrow (C) 20 N \uparrow (D) 10 kN \uparrow
22. The force in member AC due to the given loads (N_o) is:
 (A) 10 kN C (B) zero (C) 5 kN C (D) 10 kN T
23. The value of the force in member AC due to force $X_I=1$ kN in member CB is:
 (A) zero (B) 1 kN (C) 0.71 kN (D) 1.41 kN
24. The value of the deflection δ_{10} is:
 (A) $28.3/EA$ (B) $83.2/EA$ (C) $0.54/EA$ (D) $13.2/EA$
25. The final force in member AC is:
 (A) 8.96 C (B) 7.28 kN C (C) 6.71 kN C (D) 7.91 kN T
26. The final force in member AB is:
 (A) 1 C (B) 1 T (C) zero (D) 0.71 kN C

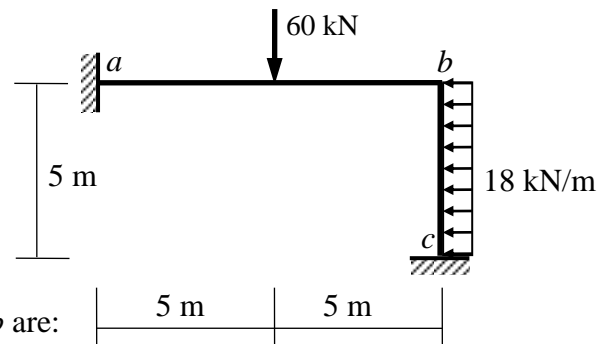
For the shown frame, use **the slope deflection method** to draw the bending moment diagram. Note that E is constant and the relative moments of inertia are given between brackets. Neglect axial deformation.



Choose the nearest answer.

27. The value of the fixed end moments of span AD is:
 (A) 12 m.t (B) 9 m.t (C) 36 m.t (D) 144 m.t
28. The value of the fixed end moment of span DC at D is:
 (A) 12 m.t (B) 9 m.t (C) 144 m.t (D) 36 m.t
29. The value of the fixed end moment of column DB at D is:
 (A) zero (B) 6 m.t (C) 12 m.t (D) 16 m.t
30. The value of the unknown displacement θ_D is:
 (A) $48/EI$ (B) $3/EI$ (C) $300/EI$ (D) $183/EI$
31. The value of the final moment at A is:
 (A) 12 m.t (B) 3 m.t (C) 168 m.t (D) 48 m.t
32. The final maximum negative moment in the span DC is:
 (A) -6 m.t (B) -12 m.t (C) -72 m.t (D) -27 m.t
33. The value of the final maximum moment in the column BD is:
 (A) zero (B) 9 m.t (C) 24 m.t (D) 90 m.t

For the shown frame, use **the moment distribution method** to draw the bending moment diagram. EI is constant.



Choose the nearest answer.

34. The value of the fixed end moment of span ab at b is:
 (A) 150 kN.m (B) 60 kN.m (C) 75 kN.m (D) 500 kN.m
35. The value of the fixed end moment of column bc at b is:
 (A) 11.25 kN.m (B) 18 kN.m (C) 56.25 kN.m (D) 37.5 kN.m
36. The distribution factors of the excess bending moment at joint b are:
 (A) $4/7$ & $3/7$ (B) $1/3$ & $2/3$ (C) $10/3$ & $5/3$ (D) $1/2$ & $1/2$
37. The final bending moment at a is:
 (A) -81.25 kN.m (B) -62.25 kN.m (C) -25.25 kN.m (D) -75.25 kN.m
38. The final bending moment at b is:
 (A) -32.5 kN.m (B) -12.8 kN.m (C) -37.5 kN.m (D) -62.5 kN.m
39. The final bending moment at c is:
 (A) -51.2 kN.m (B) -25 kN.m (C) -96 kN.m (D) 20 kN.m
40. The final bending moment at the middle of column bc is:
 (A) 25 kN.m (B) 12.5 kN.m (C) 37.5 kN.m (D) -62.5 kN.m

With my best wishes

Dr. M. Abdel-Kader