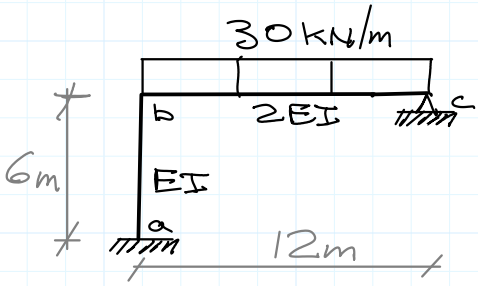
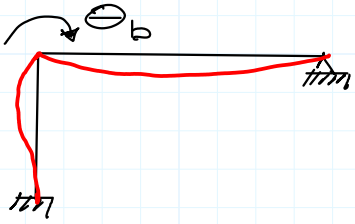
Example 2r – Determine member end forces and reactions



– redo previous example using revised S-D eqns

1) determine DOF



– no need to treat rotation @ C as a D.O.F as we will use s-d equations that have been modified to account for that pinned end for member bc.

2) fixed end moments

$$M^F_{ab} = M^F_{ba} = 0$$

$$M^F_{bc} = -\frac{30 \times 12^2}{8} = -540 \text{ kN-m}$$

$$M^F_{cb} = 0$$

3) S-D eqns

$$M_{ab} = \frac{EI}{6m} \times 2\theta_b = \frac{EI}{3m}\theta_b$$

$$M_{ba} = \frac{EI}{6m} \times 4\theta_b = \frac{2EI}{3m}\theta_b$$

$$M_{bc} = \frac{2EI}{12m} \times 3\theta_b - 540 \text{ kN-m} = \frac{EI}{2m}\theta_b - 540 \text{ kN-m}$$

$$M_{cb} = 0$$

4) Equilibrium

$$M_{ba} + M_{bc} = 0$$

$$\frac{2EI}{3m}\theta_b + \frac{EI}{2m}\theta_b - 540 \text{ kN-m} = 0$$

5) Solve for displacements

$$\frac{7EI}{6m}\theta_b = 540 \text{ kN-m}$$

$$\theta_b = \frac{3240 \text{ kN-m}^2}{7EI}$$

6) back subst. in S-D eqns.

$$M_{ab} = \frac{EI}{3m} \times \frac{3240\ kN\text{-}m^2}{7EI} = +154.3\ kN\text{-}m$$

$$M_{ba} = \frac{2EI}{3m} \times \frac{3240\ kN\text{-}m^2}{7EI} = +308.6\ kN\text{-}m$$

$$M_{bc} = \frac{EI}{2m} \times \frac{3240\ kN\text{-}m^2}{7EI} - 540\ kN\text{-}m = -308.6\ kN\text{-}m$$

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$$M_{cb} = 0$$

7) member end shears & summary

- as above (Example 2)