Problem 4 | The beam ABCDE shown below has simple supports at A, C, and E; and a hinge (or pin) at D. A load of 4 kN acts at the end of the bracket that extends from the beam at B, and a load of 2 kN acts at the midpoint of member DE. Draw the shear force and bending moment diagrams for this beam.

Given:
1) A 6m member is pin connected to a 2m member
2) The 6m member is simply supported at 0m and 4m
3) The 2m member is simply supported 2m from the pin connection
4) A 4kN load is applied to the end of a bracket located at 2m, with a horizontal dimension of -1m

Assumptions:
1) All components start out straight
2) Linear-elastic deformation
3) Small deflections.
4) The pin joint is frictionless.

Find:
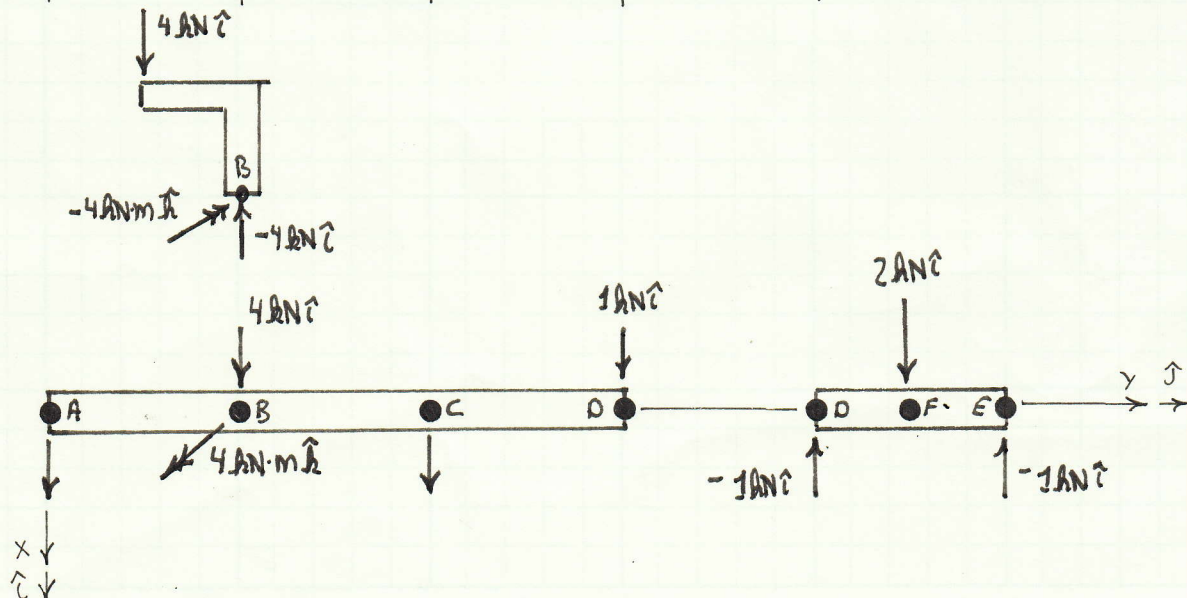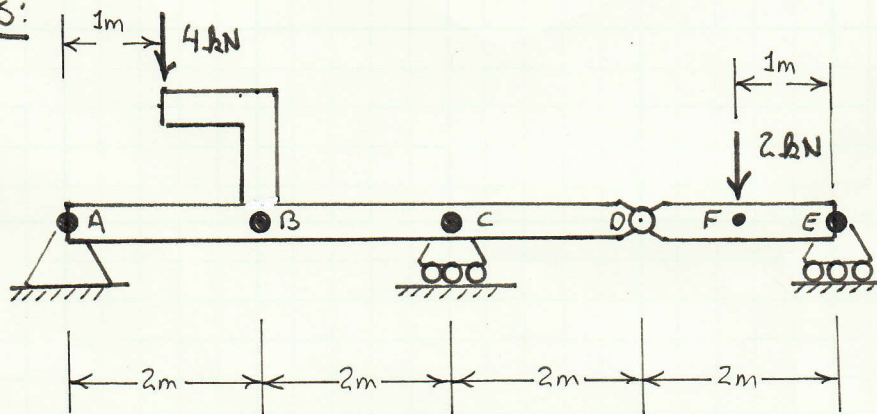1. Shear force diagram
2. Bending moment diagram

Supplemental Questions
[3. Elastic curve curvature
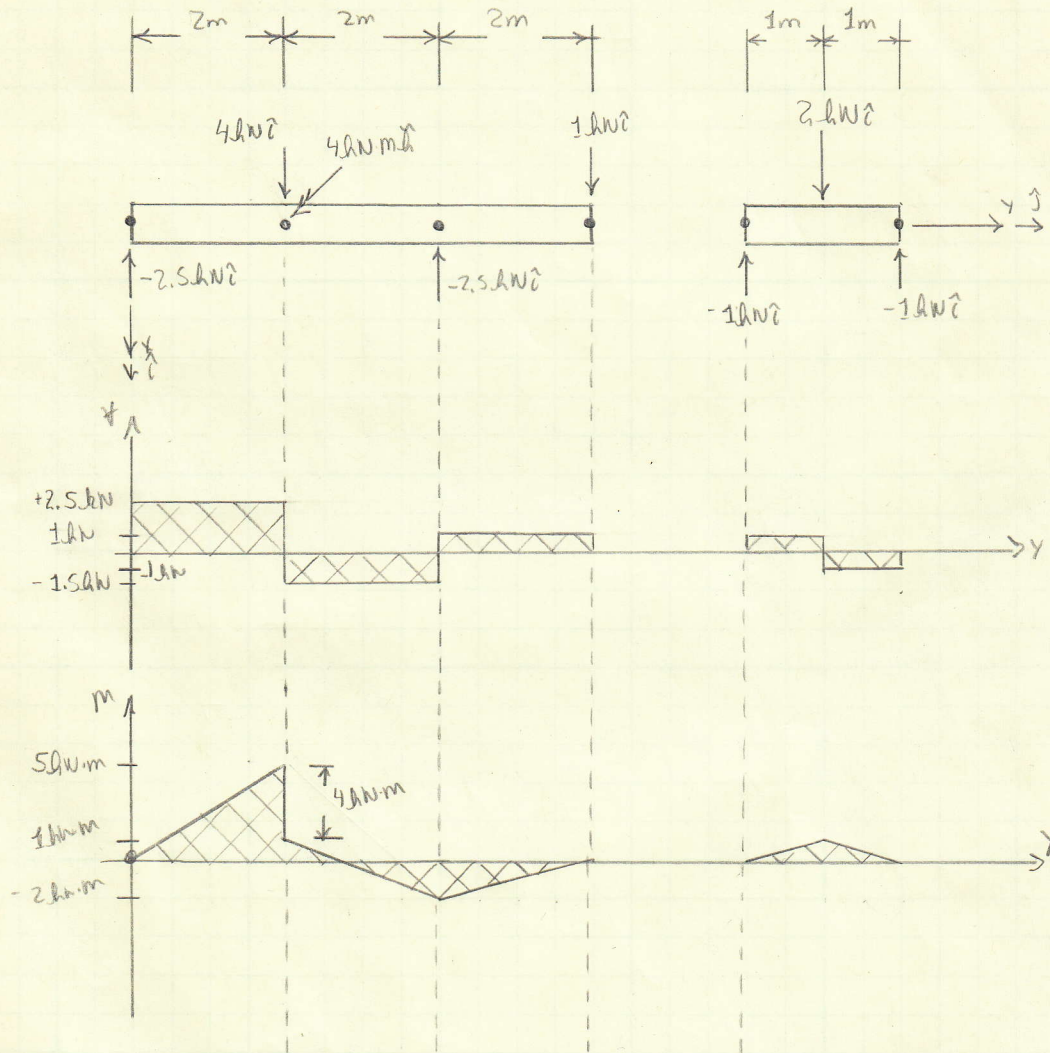 4. Elastic curve deflection]

Figures:

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STATICS:

Starting with the solution to ABCD

$$\sum M_{z|A+D} = 0 = 4\,kN\cdot m - (2m)(4\,kN) - (4m)\cdot C_x - (6m)(1\,kN)$$

$$\Rightarrow \underline{C_x = -2.5\,kN}$$

$$\sum F_x = 0 = A_x + 4\,kN + C_x + 1\,kN \Rightarrow \underline{A_x = -2.5\,kN}$$

(b)

(c)

(d)

SUMMARY:

The equilibrium in this problem is trivial. The shear force and bending moment diagrams are drawn using direct integration.