1) The frame shown below has pinned-supports at *D* and *E*. There is an internal hinge at *C*. A point load of 10 kips acting downwards is applied at *A*. Uniformly distributed downward load of 2 kips/ft is applied on *BCD*.

The amplitude and direction of the reaction forces at the supports are

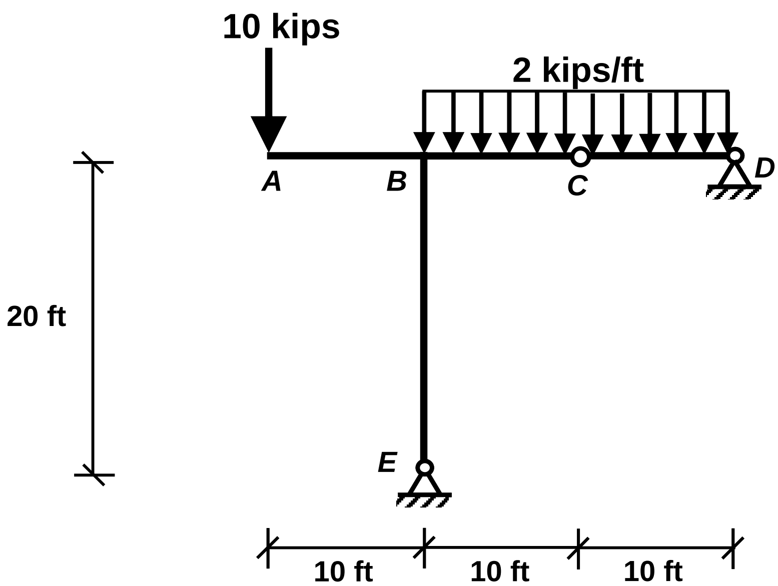
$D_{horizontal} = 5 \text{ kips} \quad \leftarrow$ $\qquad E_{horizontal} = 5 \text{ kips} \quad \rightarrow$

$D_{vertical} = 10 \text{ kips} \quad \uparrow$ $\qquad E_{vertical} = 40 \text{ kips} \quad \uparrow$

a) Draw the shear force diagram for the structure.

b) Draw the bending moment diagram for the structure.

c) Sketch the deflected shape.



2) An 8-meter long beam with constant *EI* is attached to a pinned-support at *B* and a roller-support at *C*. The beam is continuous over these supports.

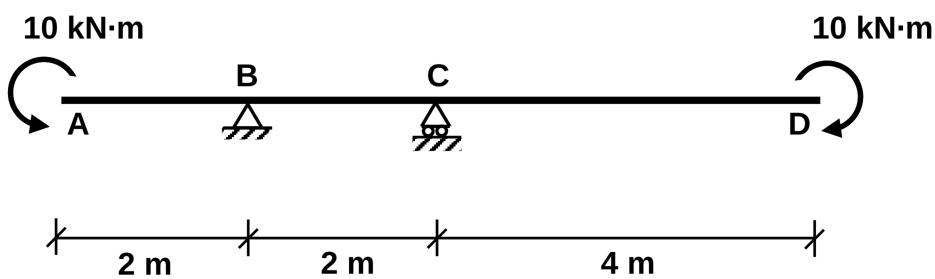
A counter-clockwise moment of 10 kN·m is applied at the left end of the beam (point *A*) and a clockwise moment of 10 kN·m is applied at the right end of the beam (point *D*).

a) Sketch the deflected shape.

<u>Use *either* the moment-area method *or* the conjugate-beam method</u> to analyze the beam.

b) Find the slope of the beam at *C*.

c) Find the vertical deflection of the beam at *D*.



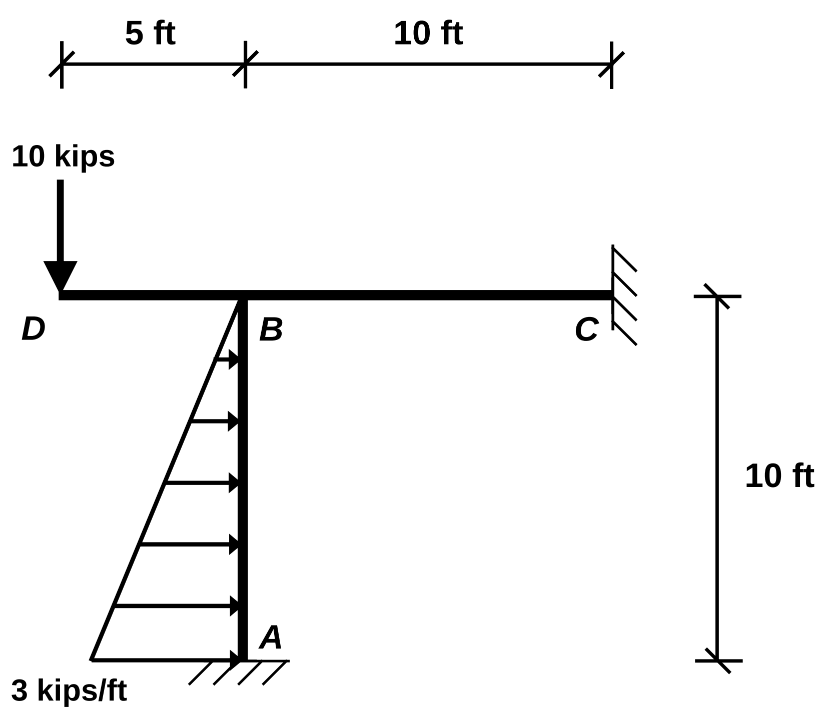
3) <u>Use slope-deflection method</u> to analyze the frame shown below. The frame has fixed-supports at *A* and *C*. Joint *B* is rigid. As shown on the figure, triangularly distributed lateral load acting towards right and with maximum intensity of 3 kips/ft is applied along *AB*. A 10 kips point load is applied downwards at the free end *D*. *EI* is constant throughout the frame.

a) Calculate the rotation at *B*.

b) Calculate the support moments at *A* and *C*.

c) Sketch the deflected shape.

Hint: $$M_{NF} = 2\left(\frac{EI}{L}\right)_{NF}\left(2\theta_N + \theta_F - 3\frac{\Delta_{NF}}{L_{NF}}\right) + FEM_N$$



4) <u>Use moment-distribution method</u> to analyze the frame shown below.

Segments *AB* and *BD* of the frame have moment of inertia I. Segment *BC* has moment of inertia $2I$. Modulus of elasticity *E* is constant throughout the frame. The frame is supported by fixed-supports at *A* and *D*, and by a roller-support at *C*. Joint *B* is rigid.

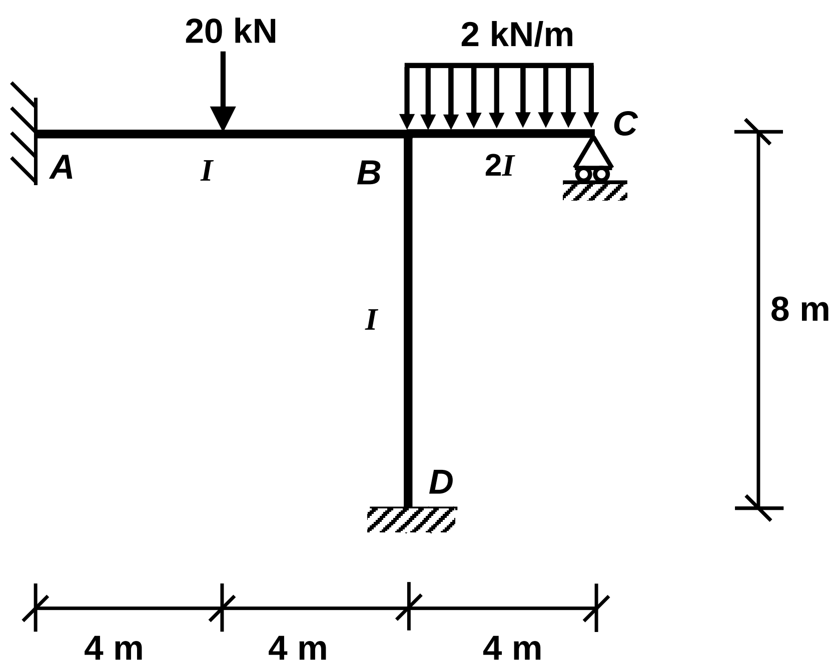
A downward point load of 20 kN is applied at mid-span of *AB*. Uniformly distributed load of intensity 2 kN/m acting downwards is applied along *BC*.

Do not carry out more than three rounds of iterations.

a) Find the resulting member-end moments.

b) Draw the bending moment diagram for the frame.

c) Sketch the deflected shape.



5) The beam *ABCDE* shown below has a roller-support at *A* and a fixed-support at *E*. At *C*, the beam has an internal roller-support over which the beam is continuous. At *B* and *D*, the beam has internal pins (hinges). Distributed downwards live load with uniform intensity ω is to be applied on the beam.

i. Find the influence line for the reaction at *A*. Which segment(s) should be loaded with the distributed uniform intensity live load to maximize upward reaction at *A*?

ii. Find the influence line for the reaction at *C*. Which segment(s) should be loaded with the distributed uniform intensity live load to maximize upward reaction at *C*?

iii. Find the influence line for the vertical reaction at *E*. Which segment(s) should be loaded with the distributed uniform intensity live load to maximize the upward vertical reaction at *E*?

iv. Find the influence line for the moment reaction at *E*. Which segment(s) should be loaded with the distributed uniform intensity live load to maximize the moment reaction at *E*?

v. If the beam is loaded along its full length with 2 kips/ft uniform load, i.e., all segments are loaded with 2 kips/ft uniform load, what will be the moment reaction at *E*?