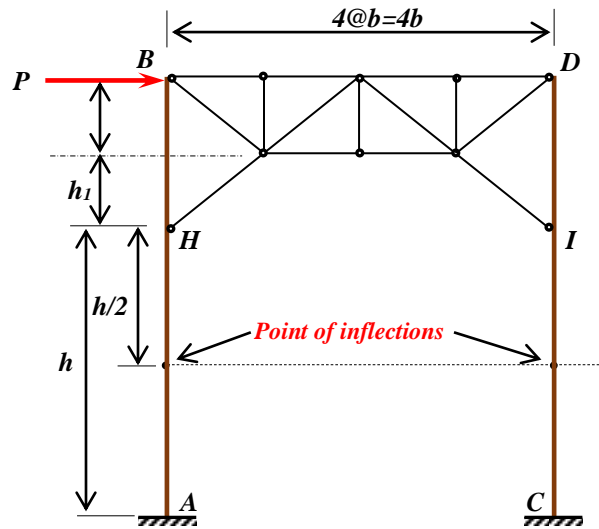
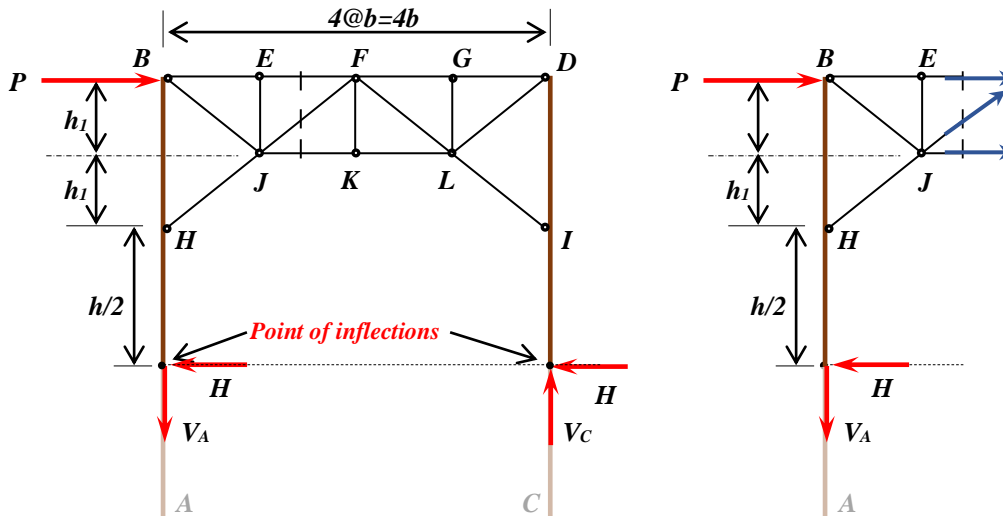


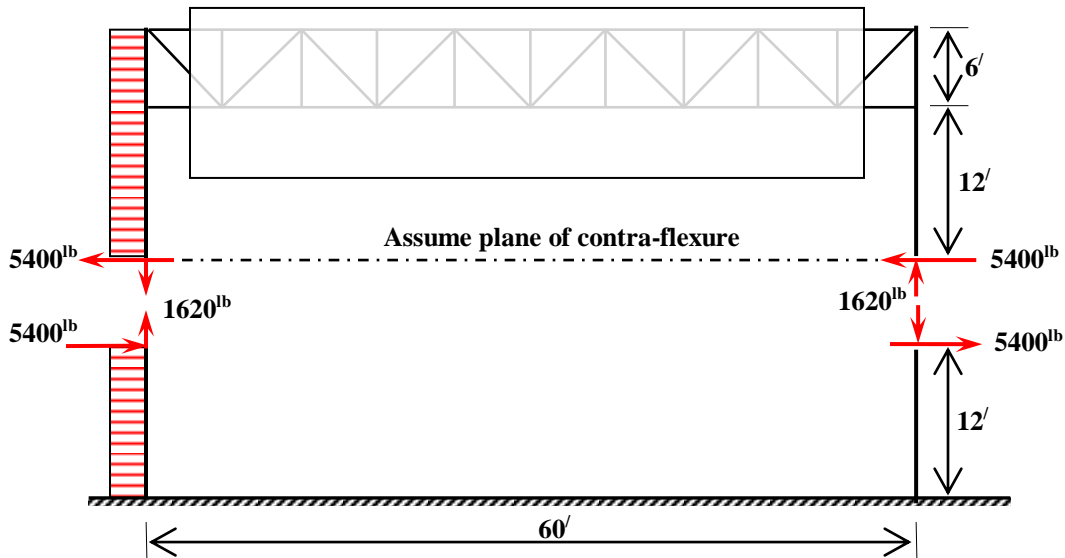
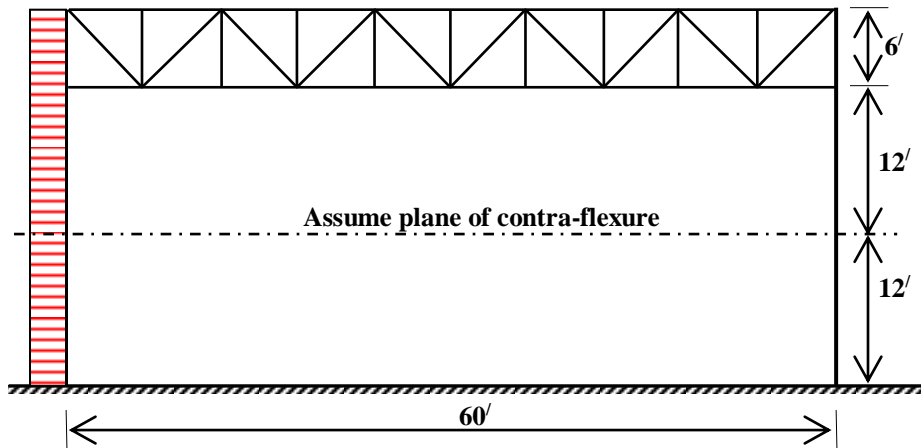
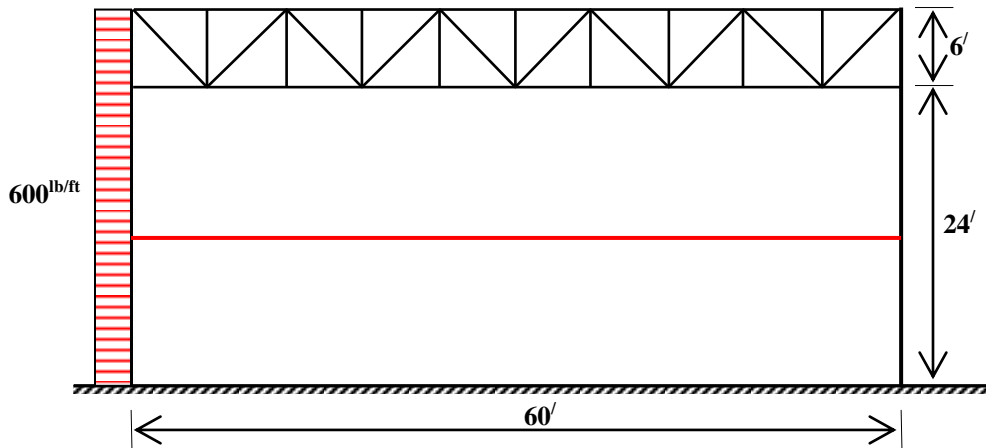
Portals for bridges are often arranged in a manner as follows

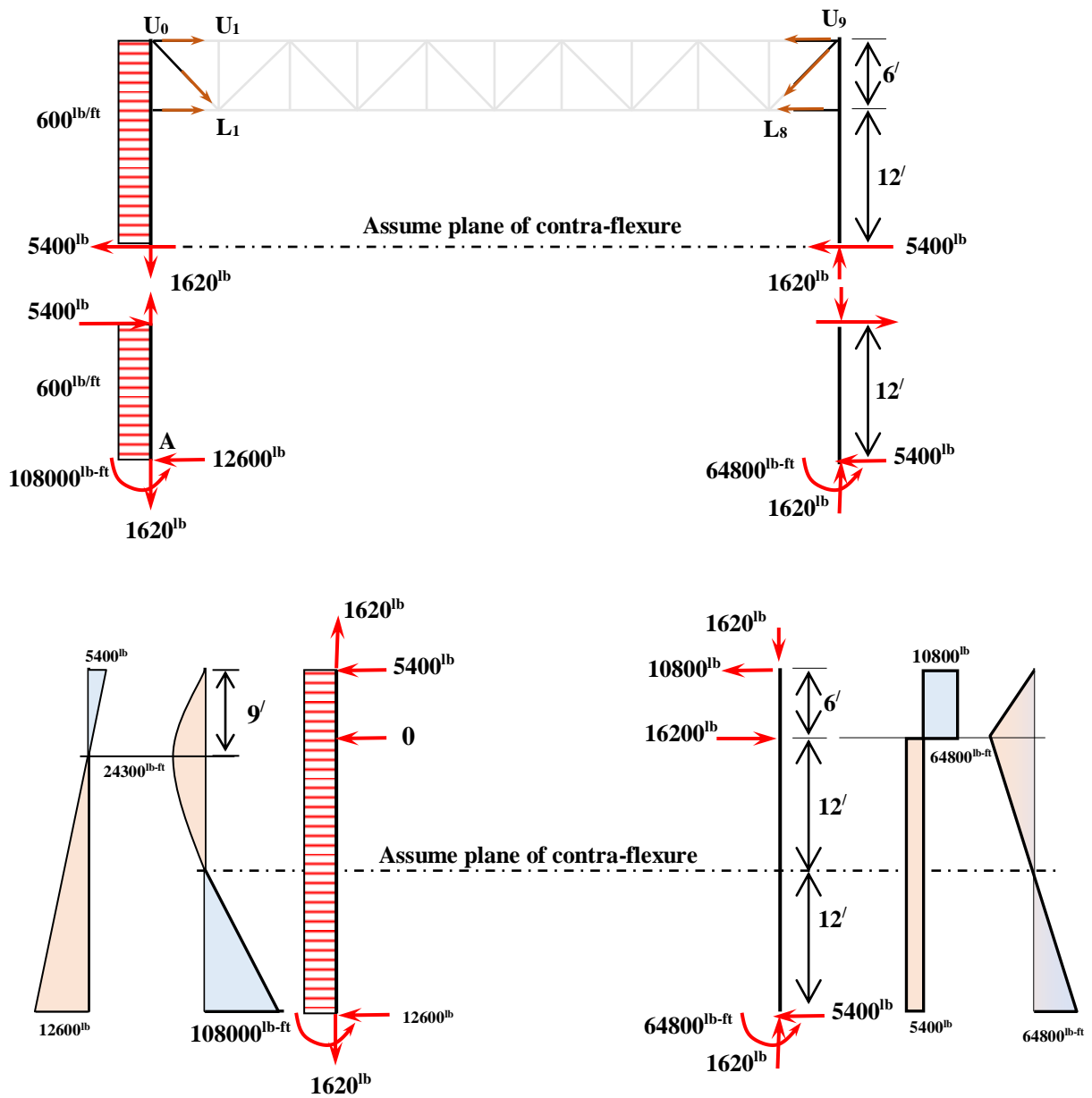


Assumptions

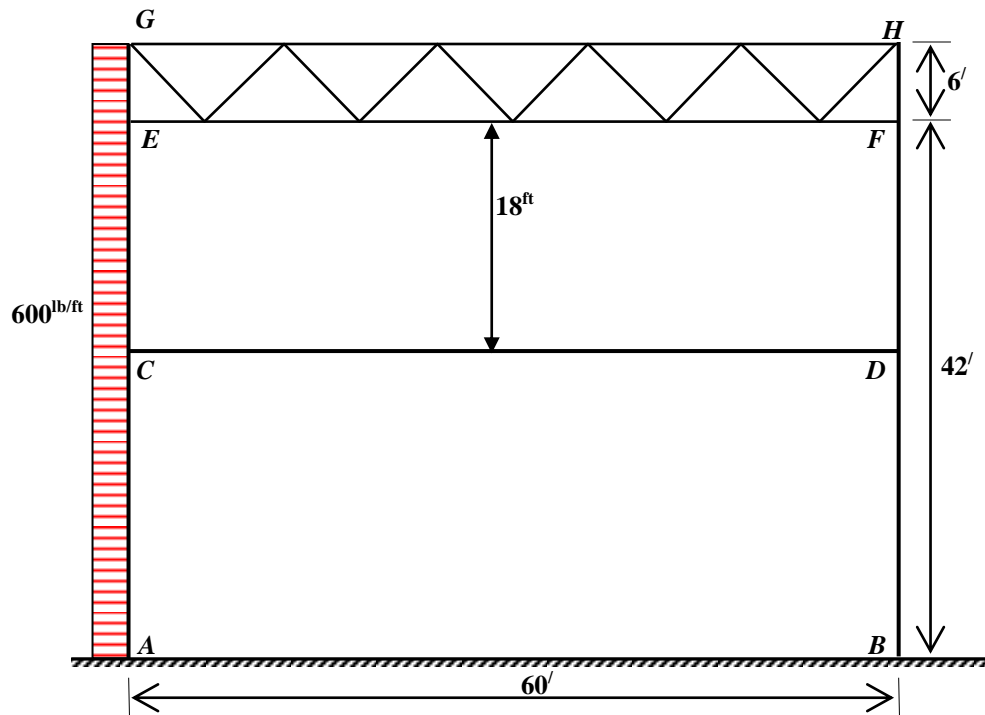
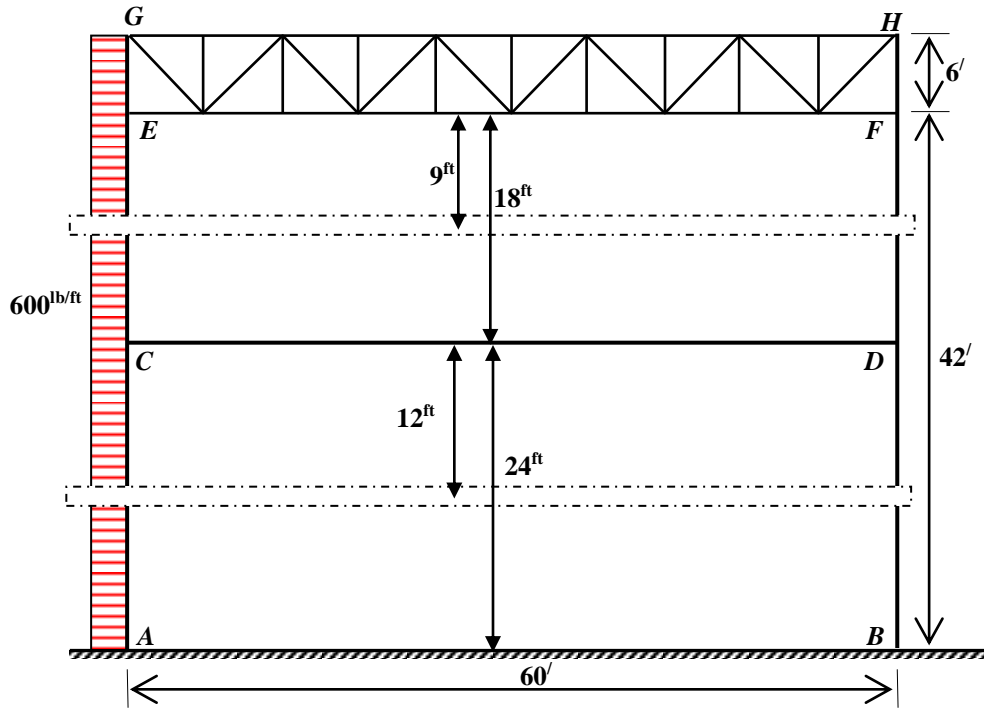
1. Horizontal reactions are equal.
2. A point of inflection occurs midway between the base A of the leg AB and the end H of the knee brace for leg AB . (Half of AH)
3. A point of inflection occurs midway between the base C of the leg CD and the end I of the knee brace for leg CD .

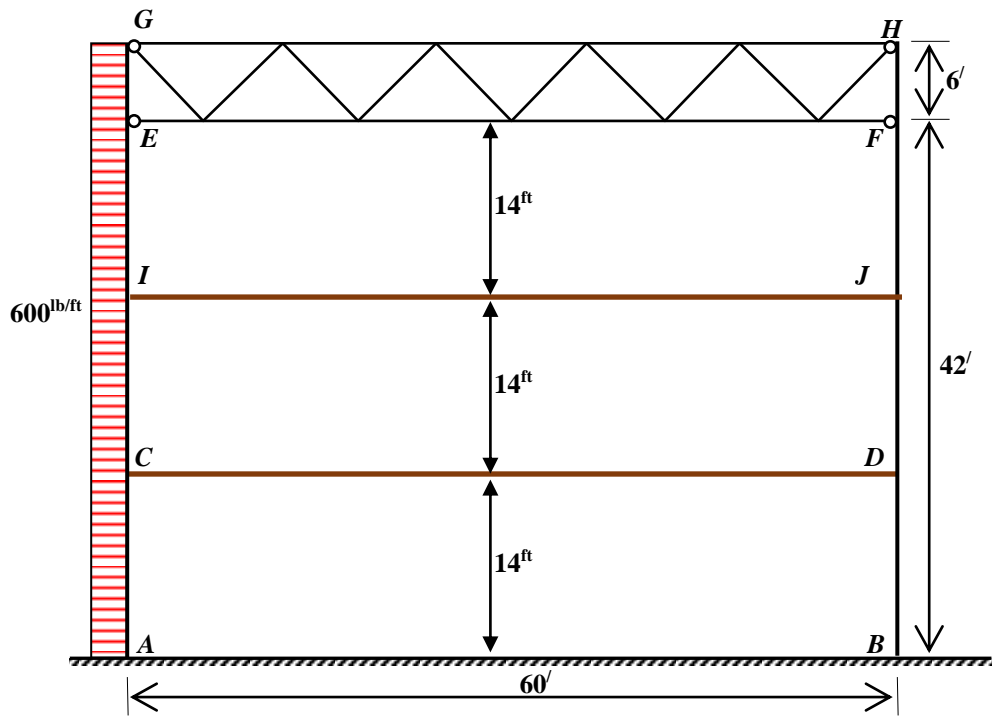




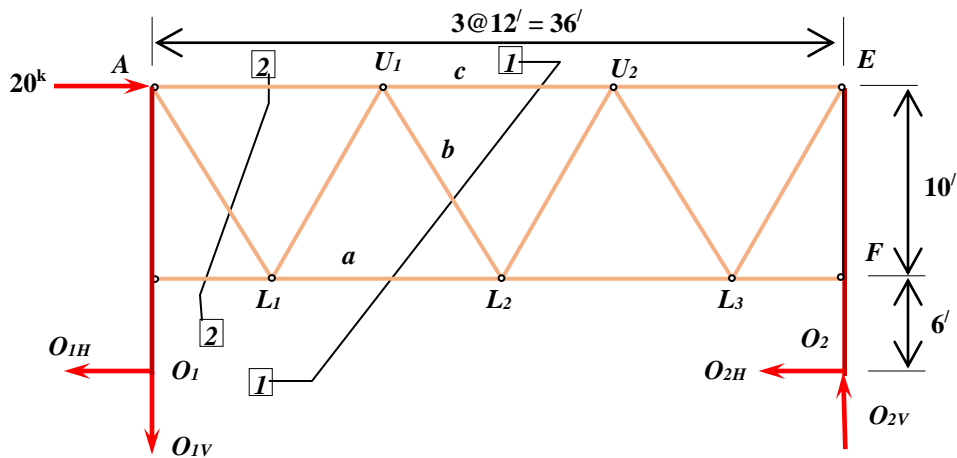
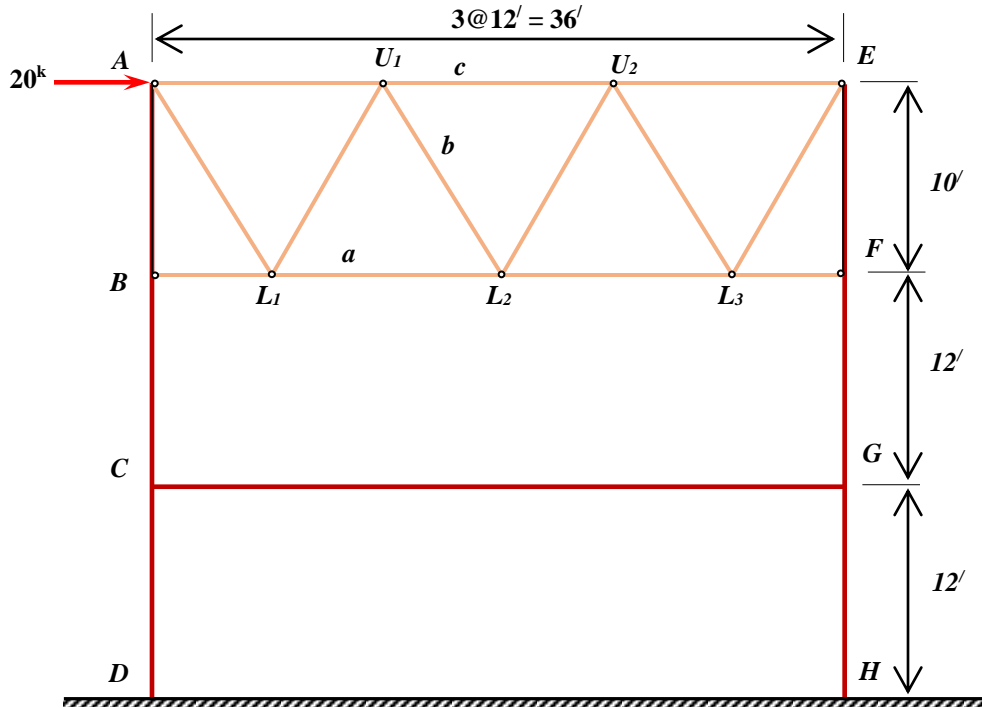


Solve the above problem considering hinges at the bases of columns.





Example 5 Determine the stresses in the members a , b , and c of the portal frame as shown in figure below. Also draw SF and BM diagram of vertical members.

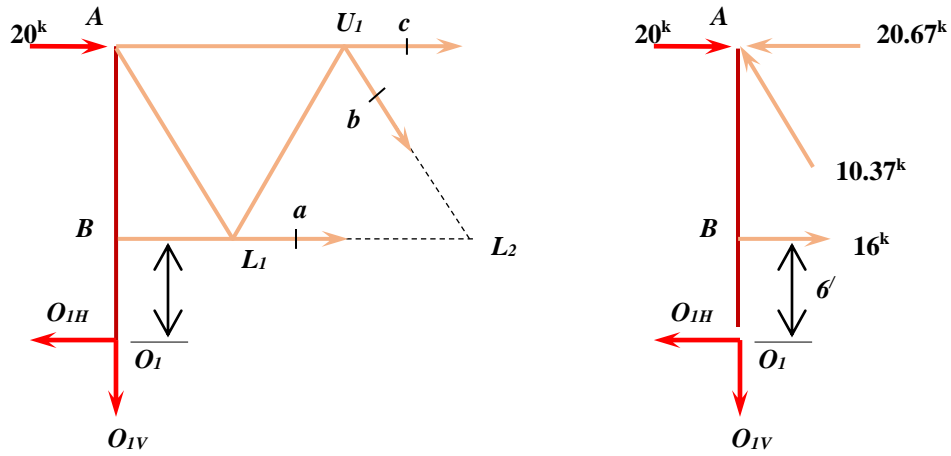


$$\sum F_x = 20 - O_{1H} - O_{2H} = 20 - 2 * O_{1H} = 0; \quad O_{1H} = 10^k = O_{2H}$$

$$\sum M_{O_2} = 20 * 16 - O_{1V} * 36 = 0; \quad O_{1V} = 8.89^k$$

$$\sum F_y = 8.89 - O_{2V} = 0; \quad O_{2V} = 8.89^k$$

Considering left side of section 1-1

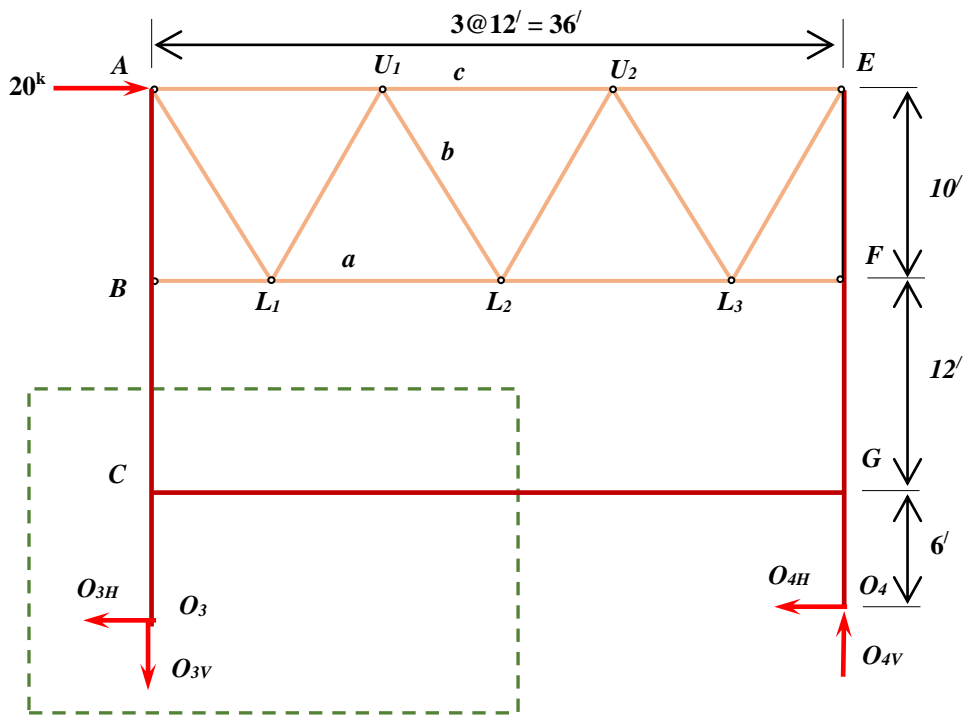


$$\sum M_{U_1} = 10 * 16 - 8.89 * 12 - F_a * 10 = 0; \quad F_a = 5.33^k (T)$$

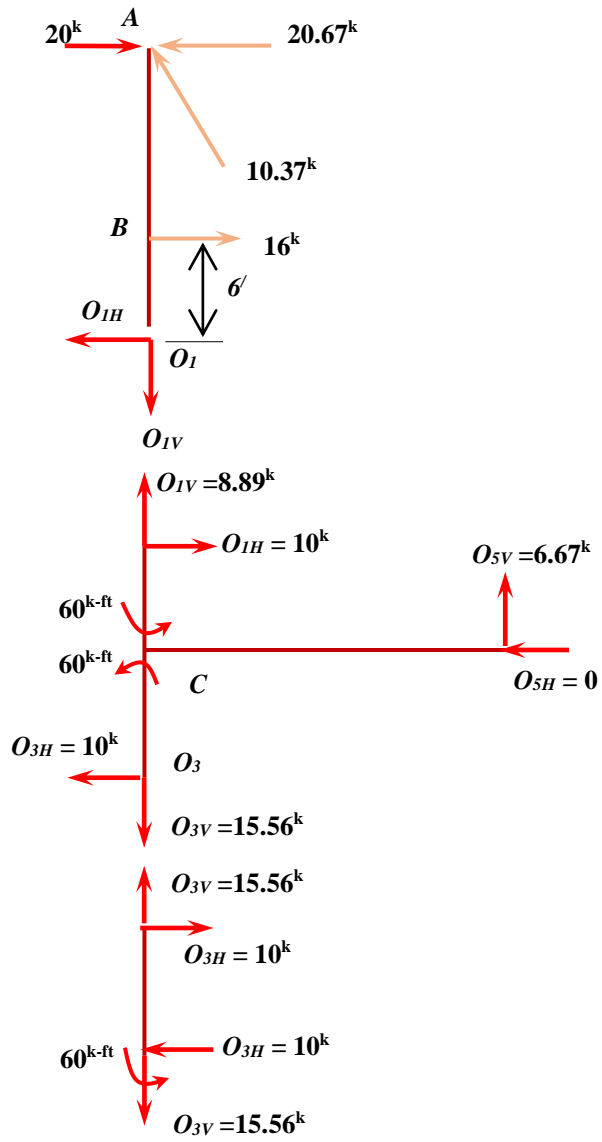
$$\sum F_y = F_{bV} + 8.89 = 0; \quad F_{bV} = -10.34^k (C)$$

$$\sum M_{L_2} = 20 * 10 + 10 * 6 - 8.89 * 18 + F_c * 10 = 0; \quad F_c = -9.99^k (C)$$

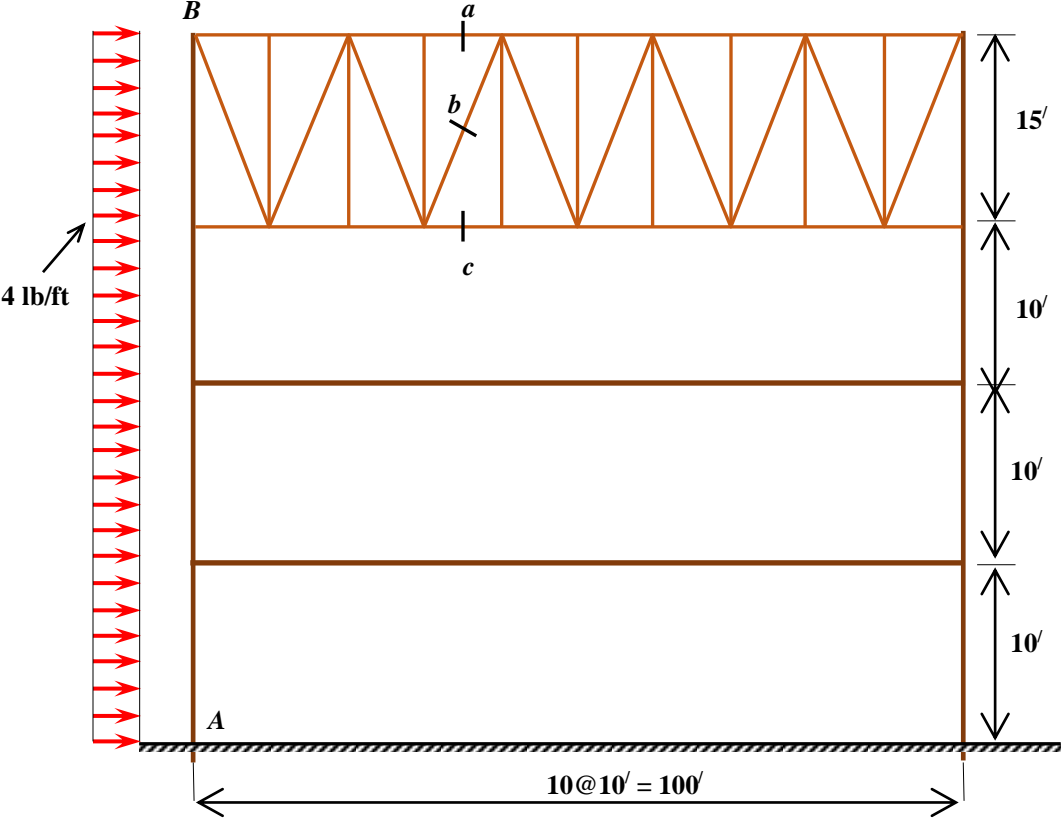
Considering left of section 2-2



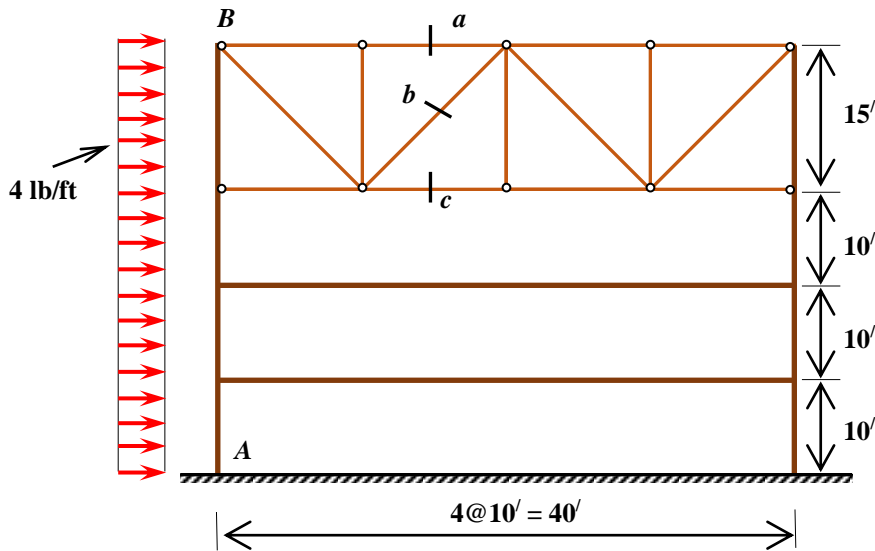
$$\sum M_{O_4} = 20 * 28 - O_{3V} * 36 = 0; \quad O_{3V} = 15.56^k; \quad O_{4V} = 15.56^k$$



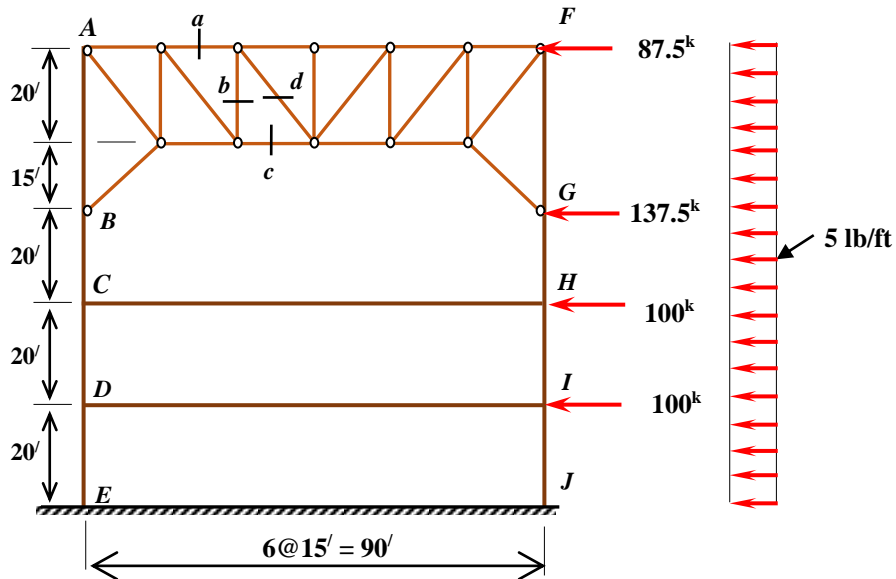
Prob. 6 Determine stresses in members a, b, c, and d. Also draw SF and BM diagram of columns and girders.



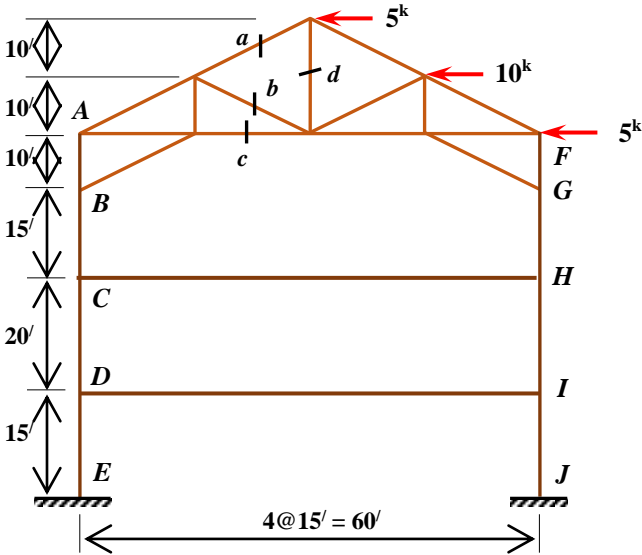
Prob. 7 Determine stresses in members a, b, c, and d. Also draw SF and BM diagram of columns and girders.



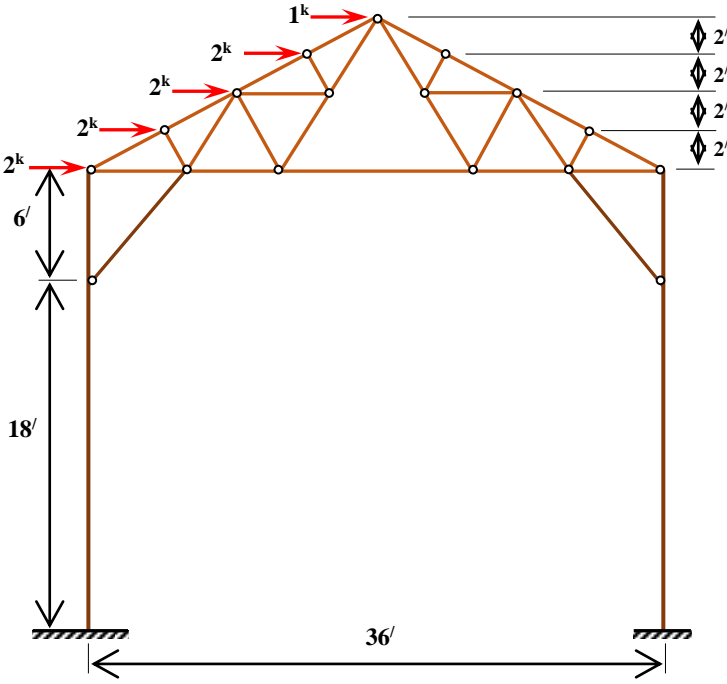
Prob. 8 Determine stresses in members a, b, c, and d. Also draw SF and BM diagram of columns and girders.

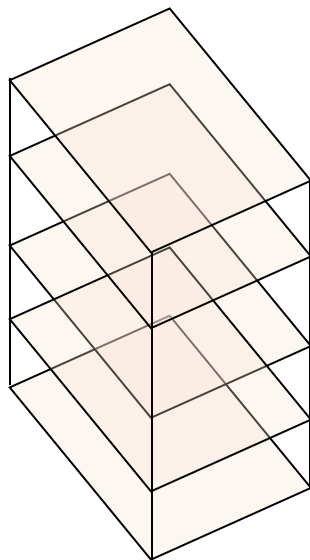


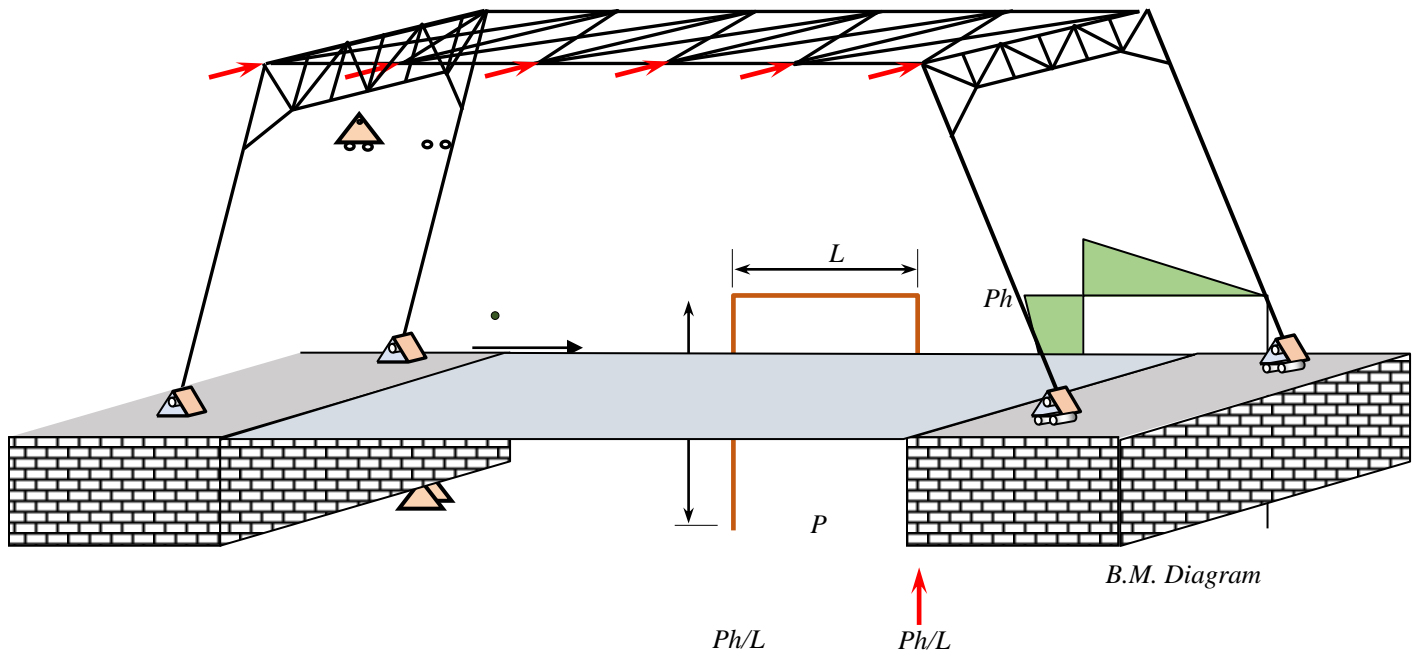
Prob. 9 Determine stresses in member *a*, *b*, *c*, and *d*. Draw SF and BM diagram for members CE and AB.



Prob. 10 Determine stresses in member *a*, *b*, *c*, and *d*. Draw SF and BM diagram for members CE and AB.







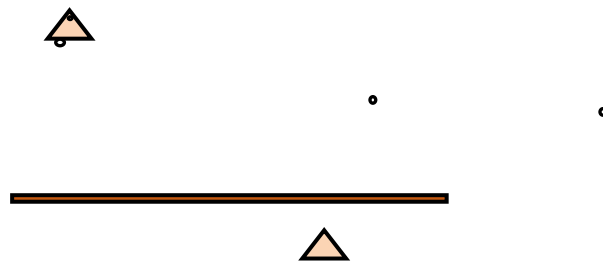
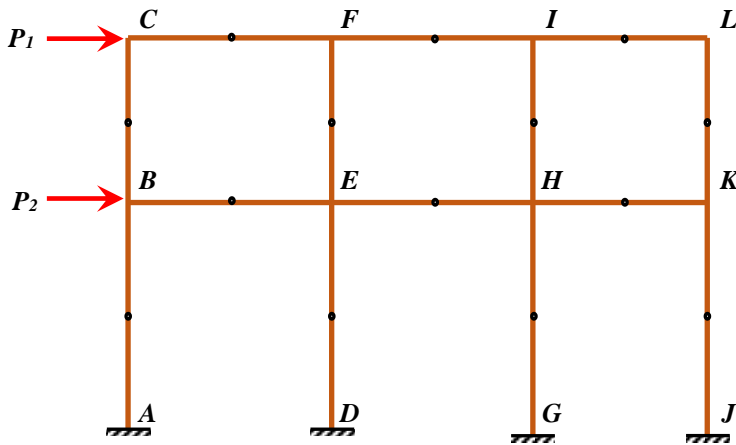
Approximate analysis of statically indeterminate structures

1. Approximate analysis due to vertical load
2. Portal Method
3. Cantilever Method
4. ~~Factor Method~~

The Portal Method

Assumptions

1. There is a point of inflection at the center of each girder.
2. There is a point of inflection at the center of each column.
3. The total horizontal shear on each story is divided between the columns of that story in a manner such that each interior column carries twice as much shear as each exterior column.



The approx. analysis of a statically determinate structure dose not depend on the elastic properties of its members. For

Approximate analysis due to vertical load

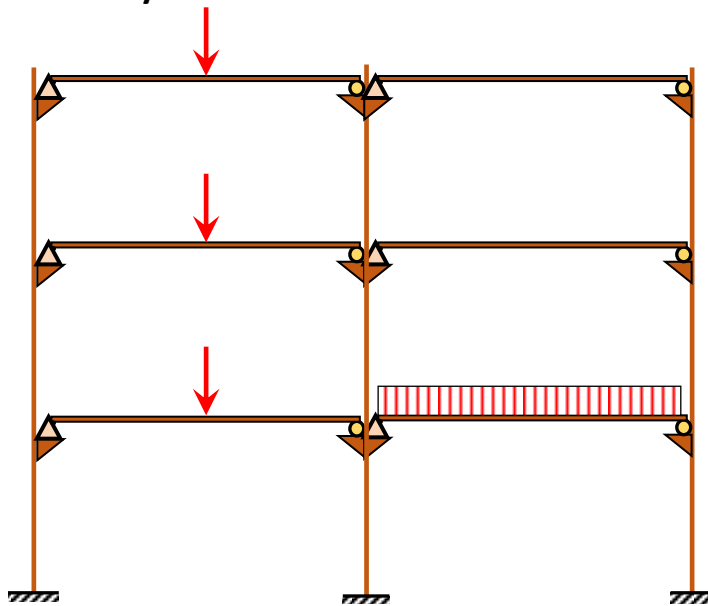
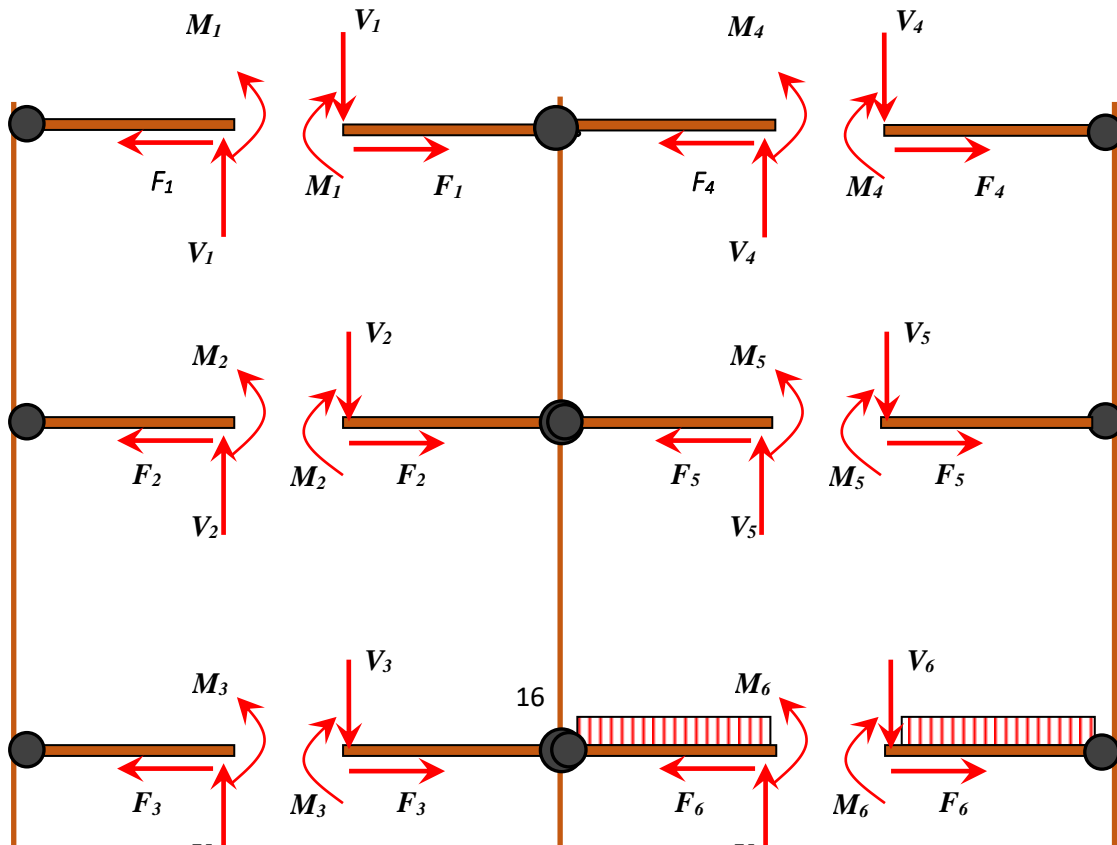


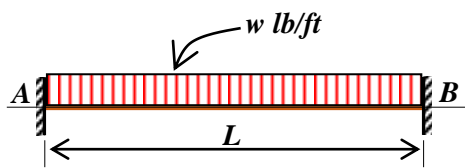
Fig. b

Rigid Frame in which the girders are rigidly connected to the columns so that all members can carry bending moment, shear force, and axial force.

$$\text{DOI} = (3M+R)-3j = (3*15+3*3)-3(12) = 18$$

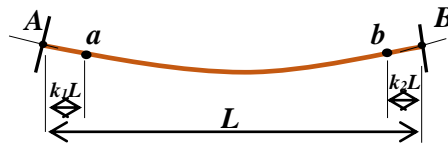


Fully Clamped

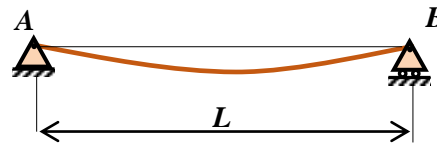
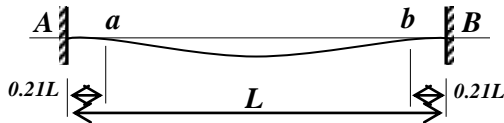


semi

Fig. b



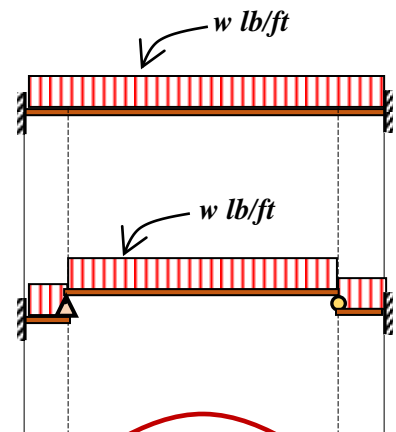
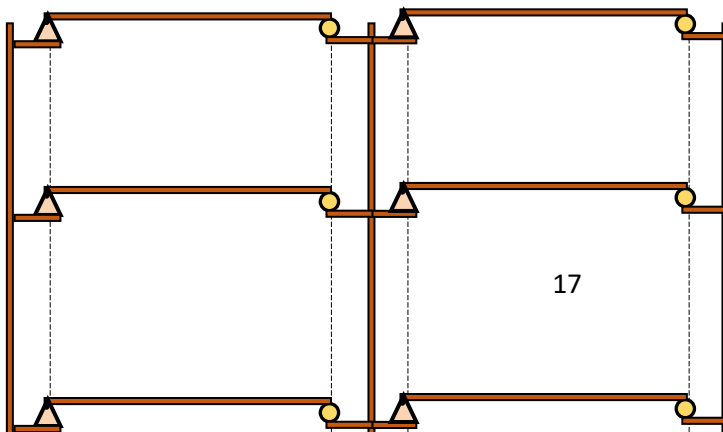
If the girder subjected to UDL w lb/ft, both the joints A and B will rotate as shown above.

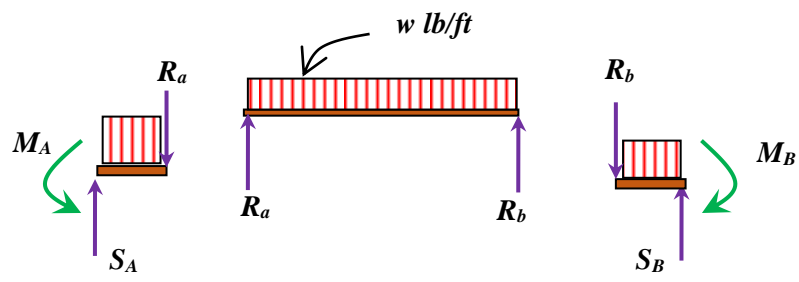


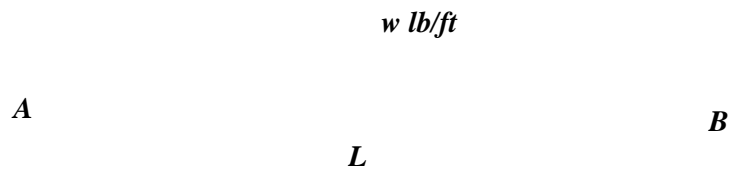
Points of inflection are at points a and b .

Assumptions

- i. The axial force in the girder zero.
- ii. A point of inflection occurs at the one-tenth point measure along the span from the left support.
- iii. A point of inflection occurs at the one-tenth point measure along the span from the right support.







Determine points of inflection.

$$M_{FEM} = wl^2/12$$

