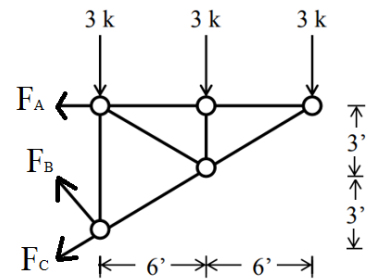
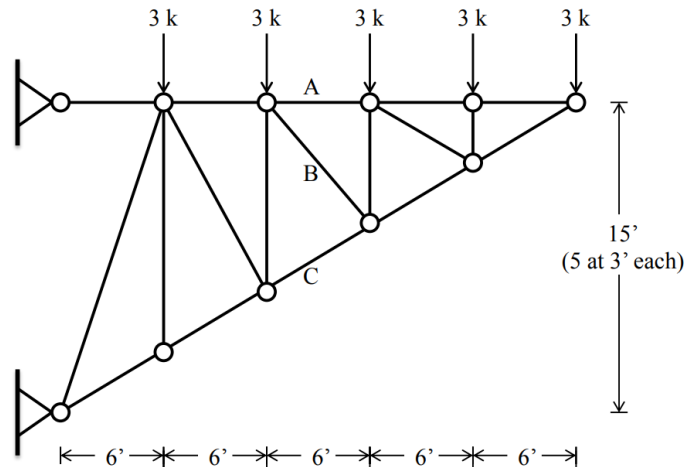


## Homework 02 Solutions

**Question 1: 5 points**

Using method of sections, determine the forces in members A, B, and C. State if the members are in tension or compression.



$$\sum F_x = 0 \rightarrow F_A + \frac{6}{\sqrt{72}} F_B + \frac{6}{\sqrt{45}} F_C = 0$$

$$\sum F_y = 0 \rightarrow \frac{6}{\sqrt{72}} F_B - \frac{3}{\sqrt{45}} F_C - 9 = 0$$

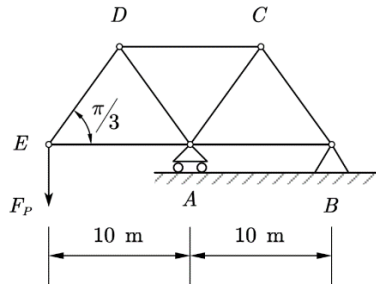
$$\sum M_{BC} = 0 \rightarrow F_A(6) - 3(6) - 3(12) = 0$$

$$F_A = 9 \text{ kips}, F_B = 4.24 \text{ kips}, F_C = -13.42 \text{ kips}$$

Members A and B are in tension, and member C is in compression.

## Question 2: 10 points

If the maximum force that any member can support is 17 kips in tension and 12 kips in compression, determine the maximum force  $F_P$  can be applied on the following structure (all the angles are  $\pi/3$ ).

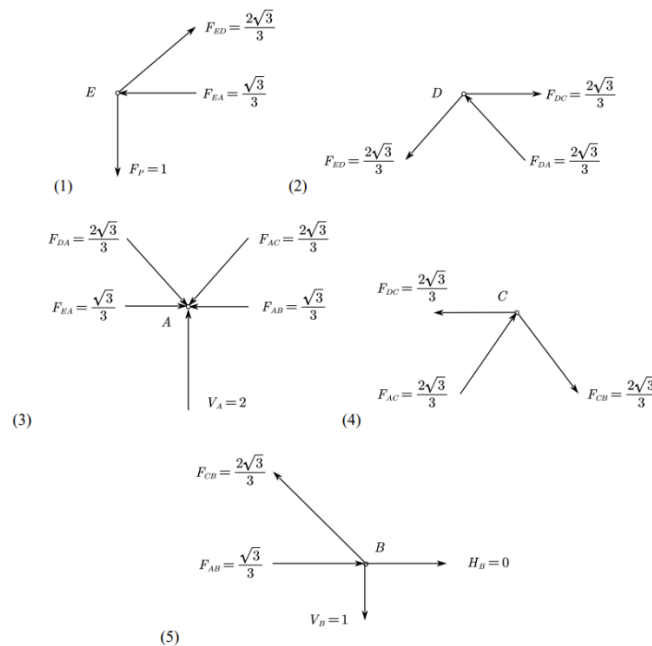


Use method of superposition for this linear elastic structure and assume  $F_P = 1$  kips, the vertical reaction forces at A and B are:

$$\sum M_A = 0 \rightarrow V_B = 1 \text{ kips (downward)}$$

$$\sum F_y = 0 \rightarrow V_A = 2 \text{ kips (upward)}$$

Use the method of joint to calculate the force in each member starting from joint E:



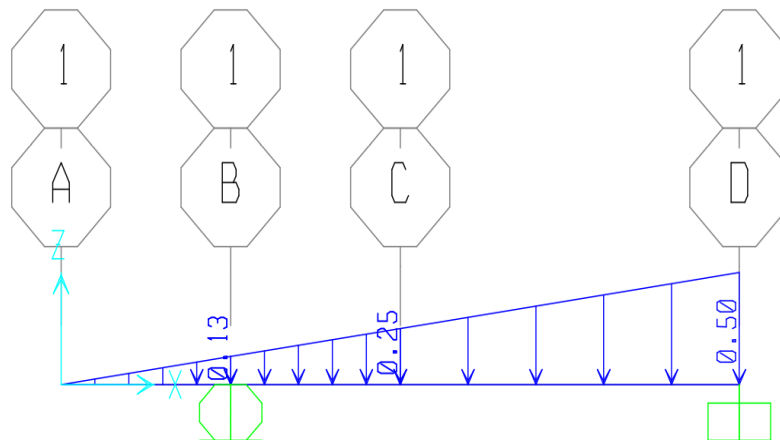
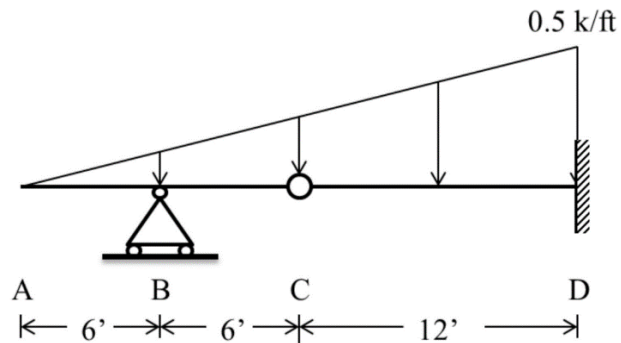
Hence, the maximum tension and compression forces are the same and have the value of  $\frac{2\sqrt{3}}{3}$

Therefore, the compression controls, and the maximum possible value for  $F_P$  is calculated as follows:

$$F_P = \frac{12}{\frac{2\sqrt{3}}{3}} * 1 = \frac{18}{\sqrt{3}} = 6\sqrt{3} = 10.4 \text{ kips}$$

### Question 3: 15 points

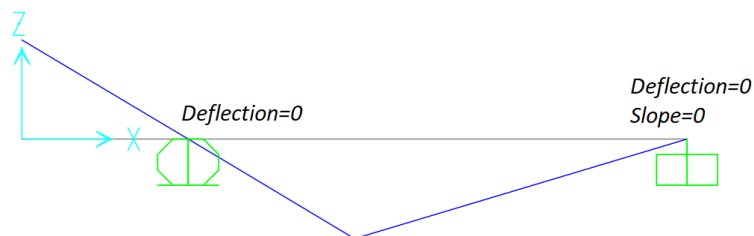
Determine the shear and moment throughout the beam. Draw the shear and moment diagrams for the beam. Draw the deflected shape of the beam.



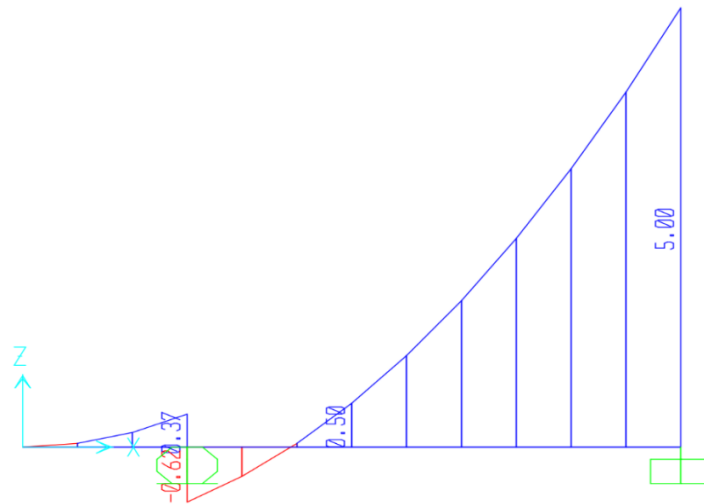
Reactions:  $R_B = 1$  kips,  $R_D = 5$  kips



Deflected Shape:



Shear Diagram:  $V_A = 0$ ,  $V_{B,\text{left}} = 0.375$  kips,  $V_{B,\text{right}} = -0.625$  kips,  $V_C = 0.5$  kips,  $V_D = 5$  kips



Moment Diagram:  $M_A = 0$ ,  $M_B = -0.75$  kips. ft,  $M_C = 0$ ,  $M_D = -30$  kips. ft

