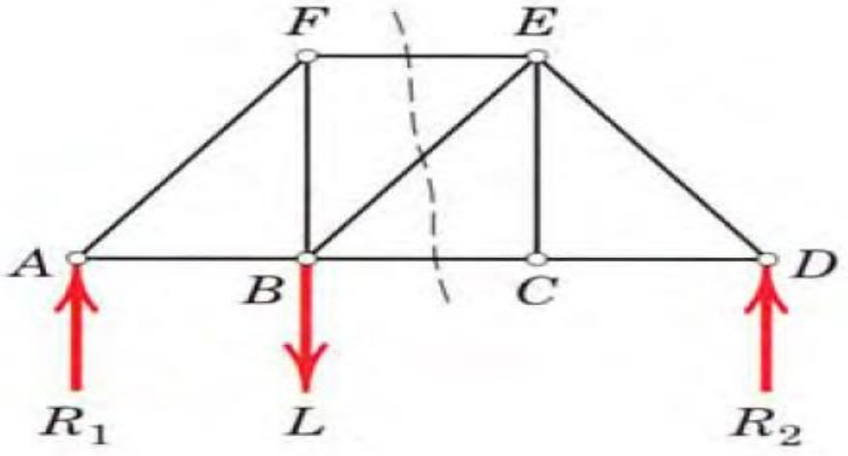
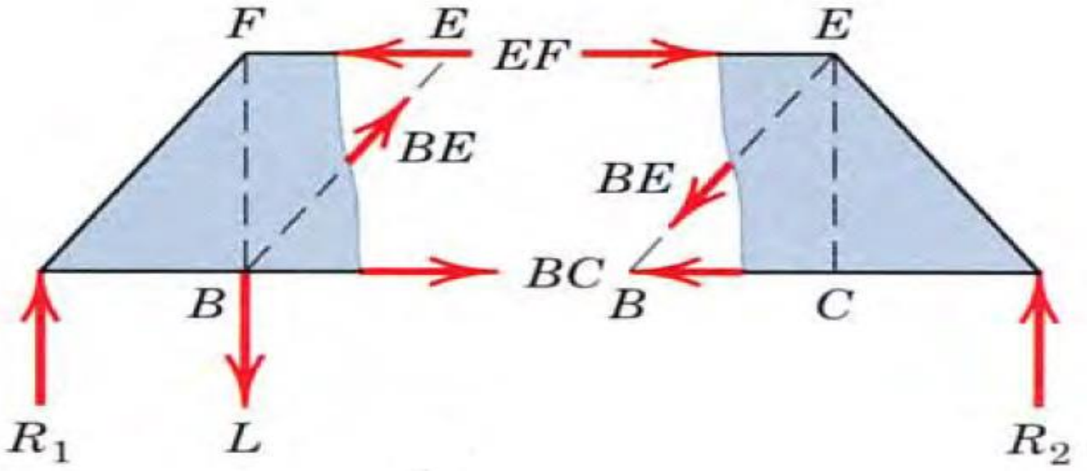
CHAPTER 4

STRUCTURES

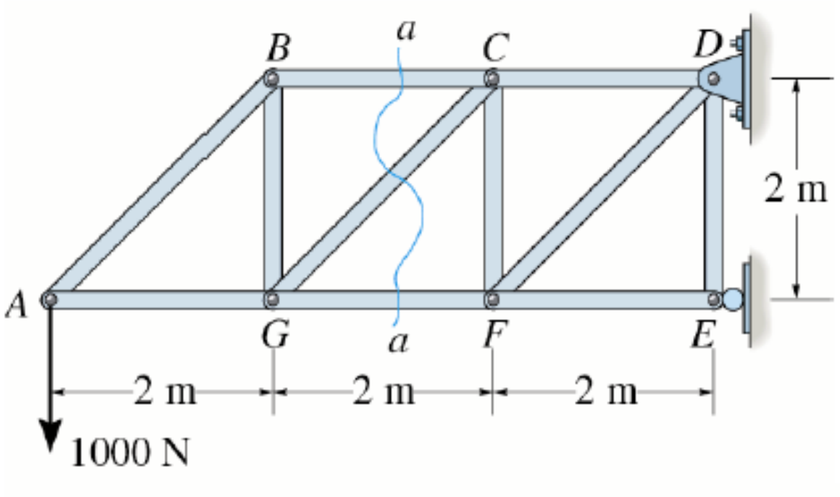
Method of Sections

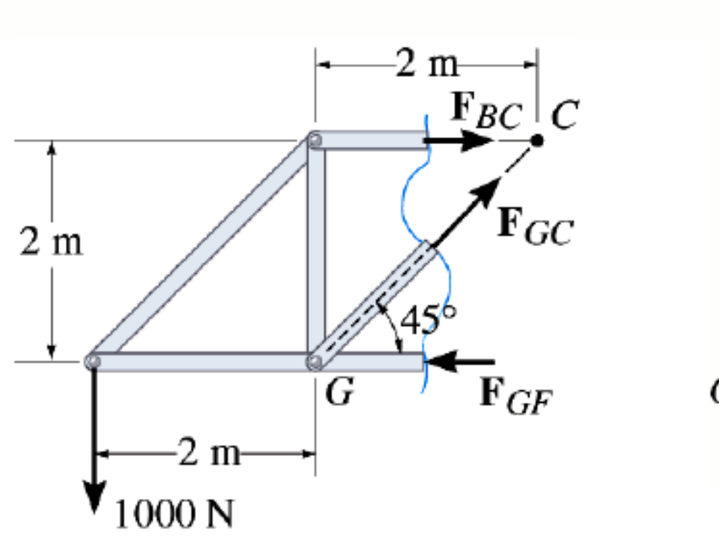
- When we need to *find* the *force* in only *a few members* of a truss, we can analyze the truss using the *method of sections*.
- We can use the *third equilibrium equation* which is *moment equation* with method of sections.

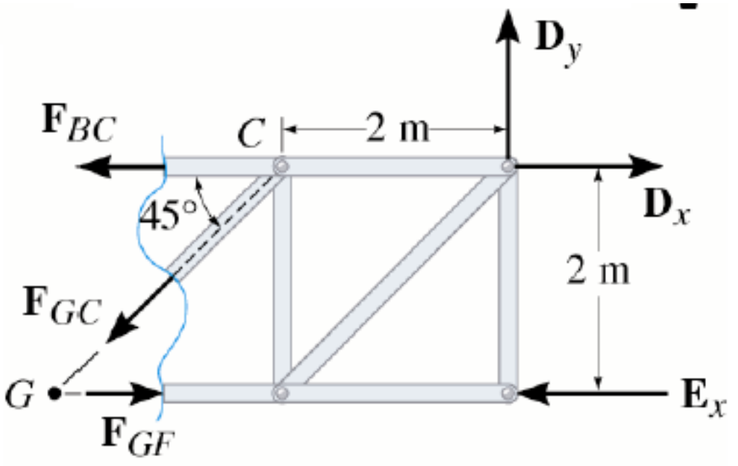




$$\Sigma F_x = 0 \qquad \Sigma F_y = 0 \qquad \Sigma M_O = 0$$


B
a
C
D
A
G
a
F
E
2 m
2 m
2 m
2 m
1000 N


2 m
$\mathbf{F}_{BC}$
C
$\mathbf{F}_{GC}$
2 m
45°
G
$\mathbf{F}_{GF}$
2 m
1000 N

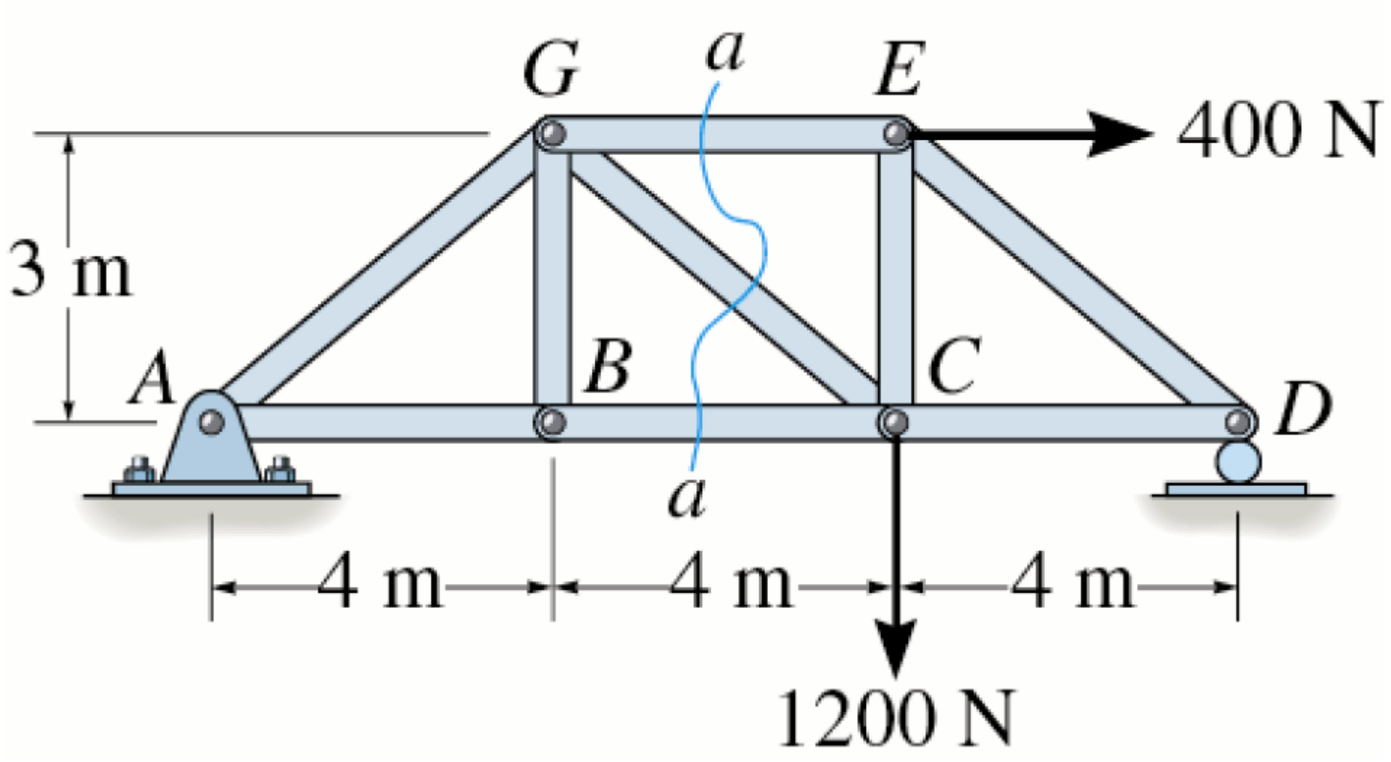

$\mathbf{D}_y$
$\mathbf{F}_{BC}$
C
2 m
45°
$\mathbf{D}_x$
2 m
$\mathbf{F}_{GC}$
G
$\mathbf{E}_x$
$\mathbf{F}_{GF}$

EXAMPLE

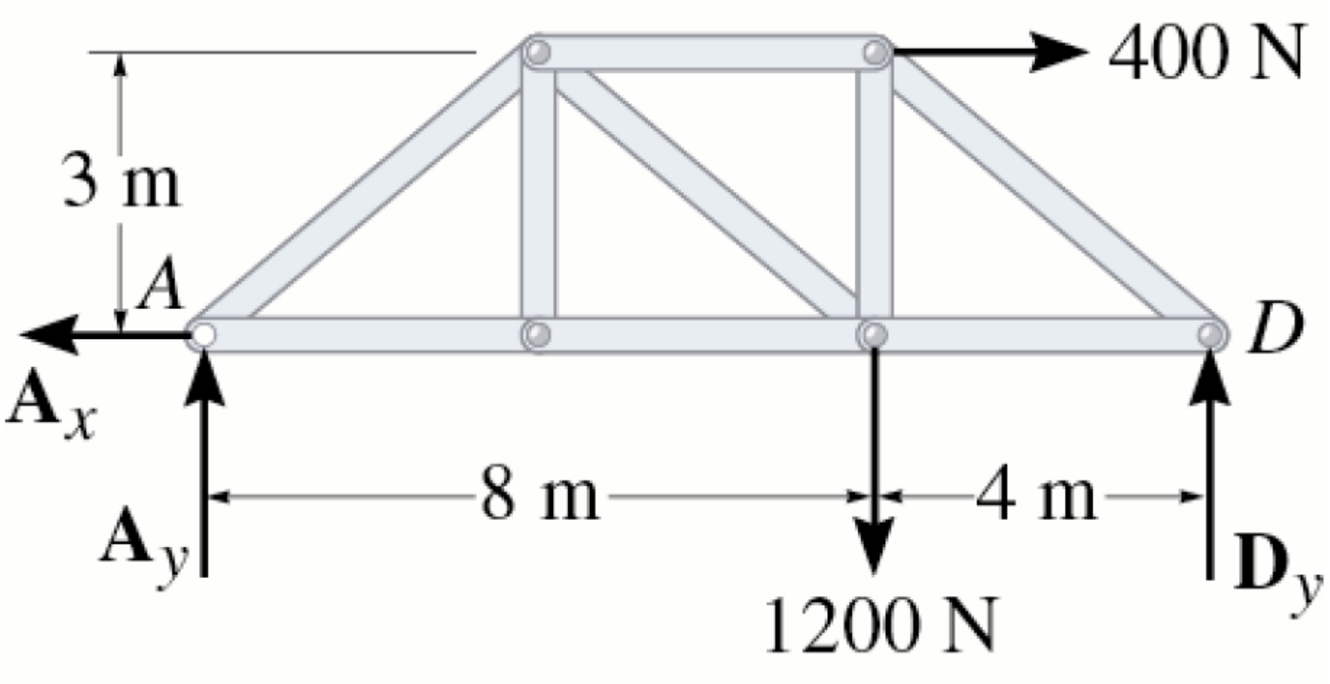
Method of Sections

Example 1

- Find forces at members GE, GC and BC.



Solution 1



$$\sum F_x = 0$$

$$400 - A_x = 0$$

$$A_x = 400 \ \text{N}$$

$$\sum F_y = 0$$

$$A_y + D_y - 1200 = 0$$

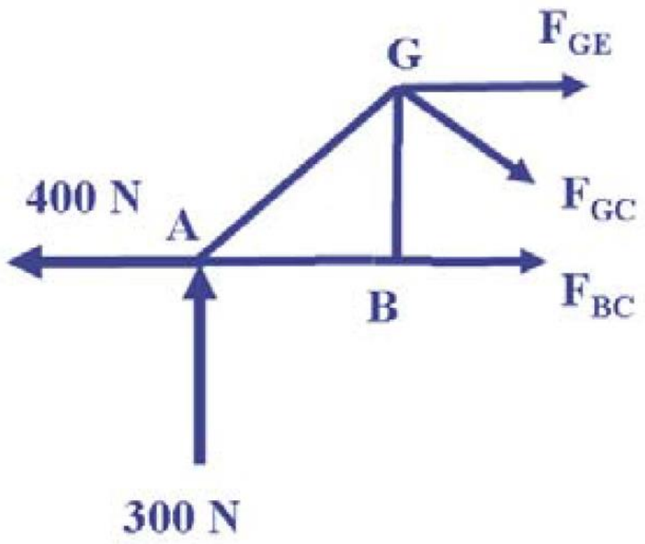
$$\sum M_A = 0$$

$$-1200(8) - 400(3) + D_y(12) = 0$$

$$D_y = 900 \ \text{N}$$

$$A_y = 300 \ \text{N}$$

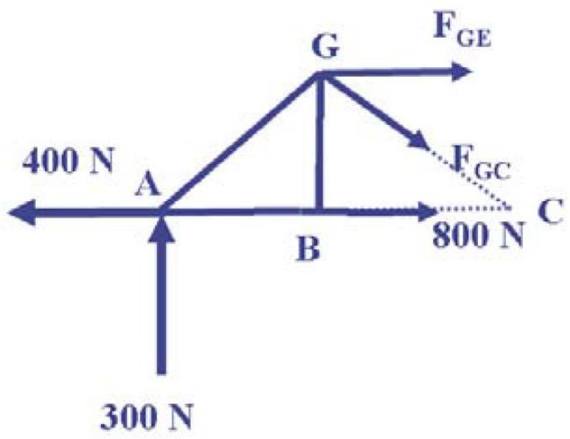
Sol. 1



$$\sum M_G = 0$$

$$-300(4) - 400(3) + F_{BC}(3) = 0$$

$$F_{BC} = 800 \ \text{N} \ \ (\text{T})$$

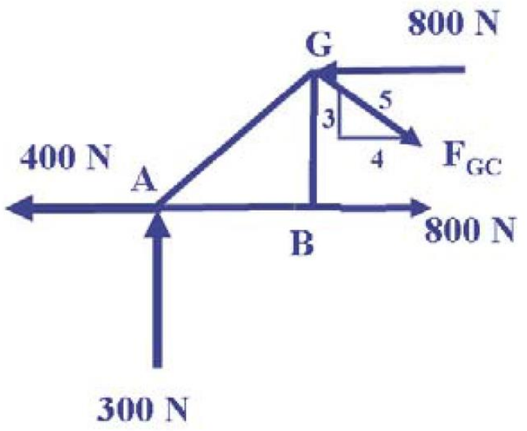


$$\sum M_C = 0$$

$$-300(8) - F_{GE}(3) = 0$$

$$F_{GE} = -800 \ \text{N}$$

$$F_{GE} = 800 \ \text{N} \ \ (\text{C})$$



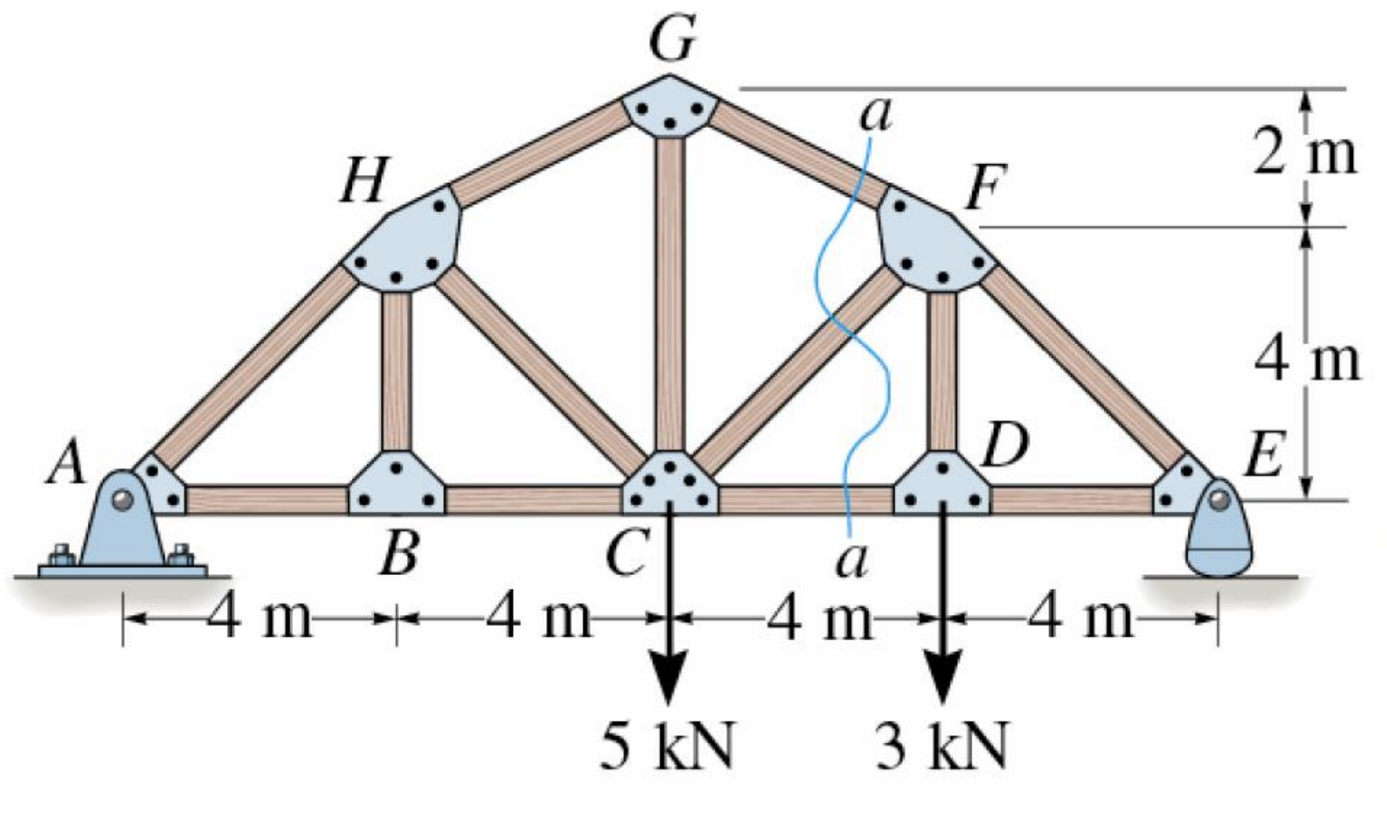
$$\sum F_y = 0$$

$$-300 - F_{GC}\left(\frac{3}{5}\right) = 0$$

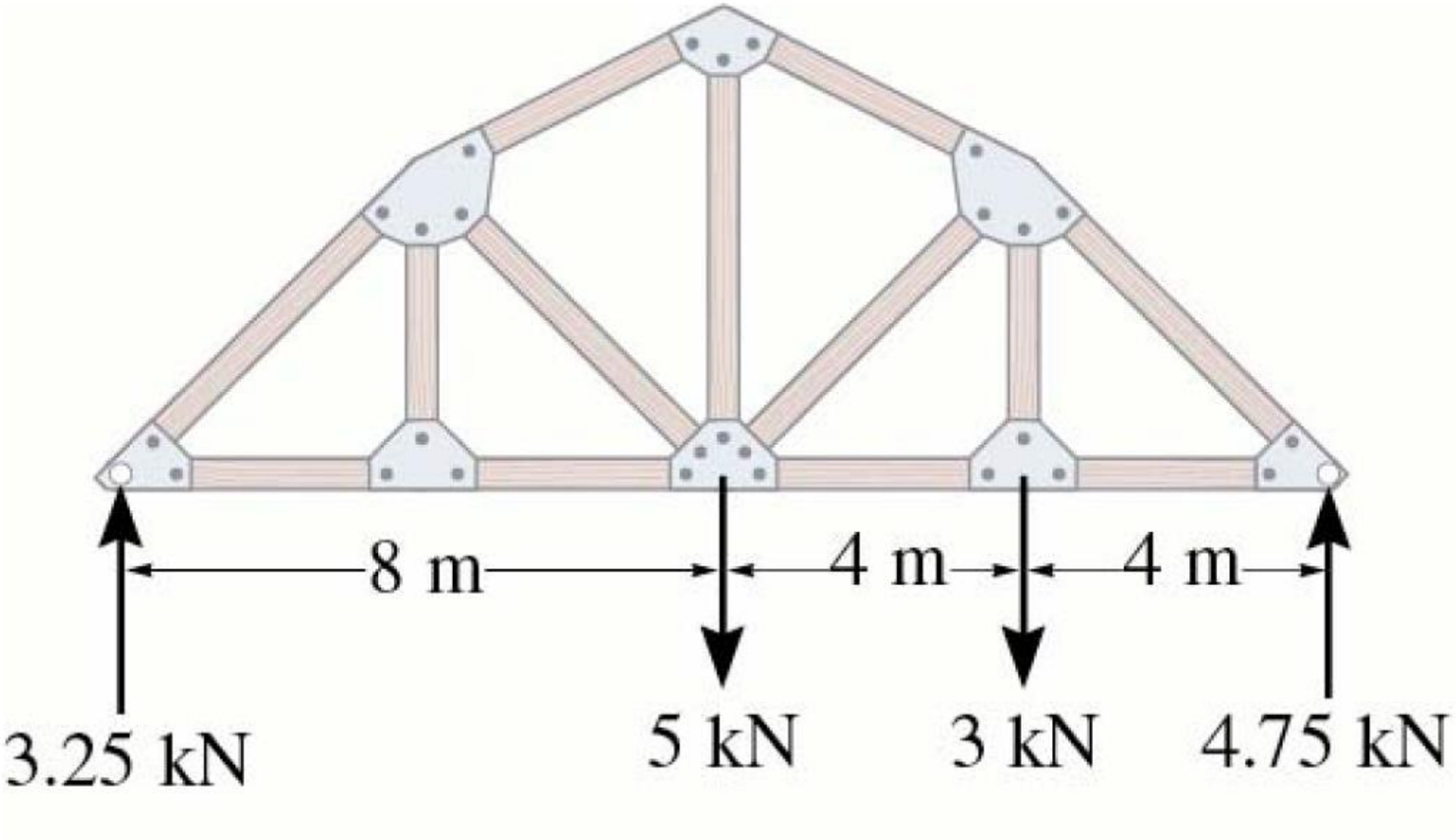
$$F_{GC} = 500 \ \text{N} \ \ (\text{T})$$

Example **2**

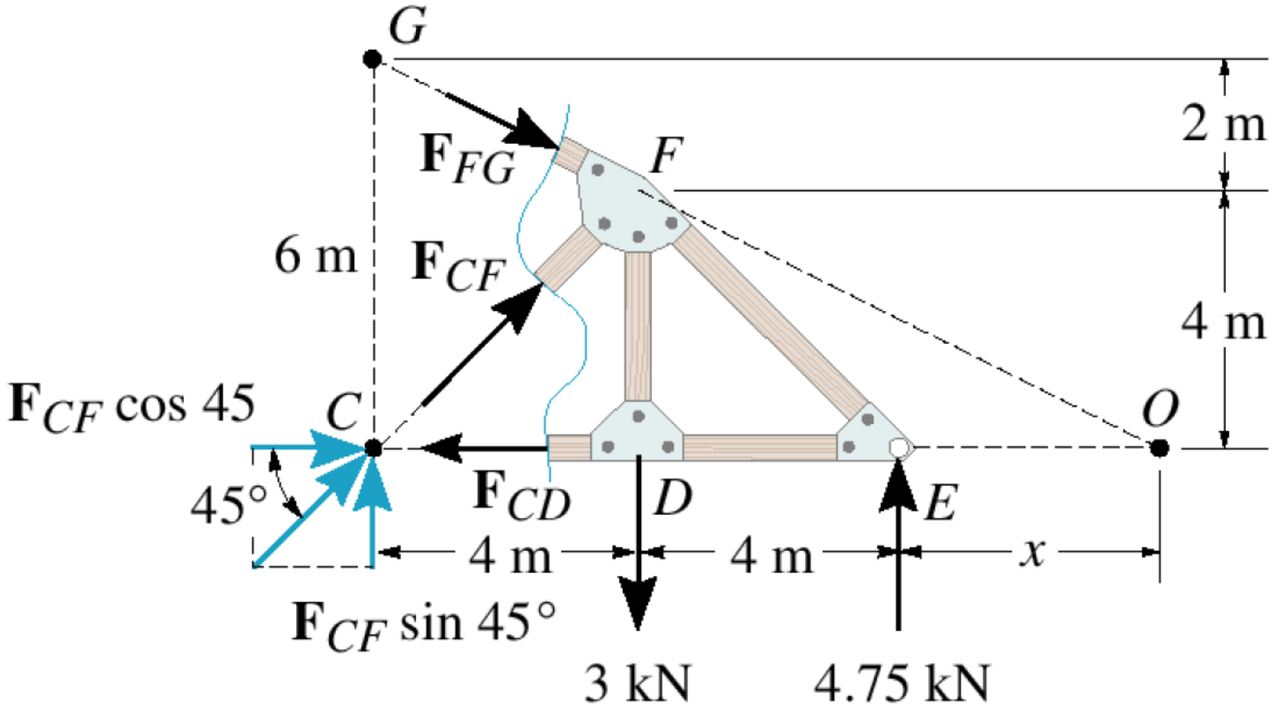
- Find force at member CF.



Sol 2



Sol 2



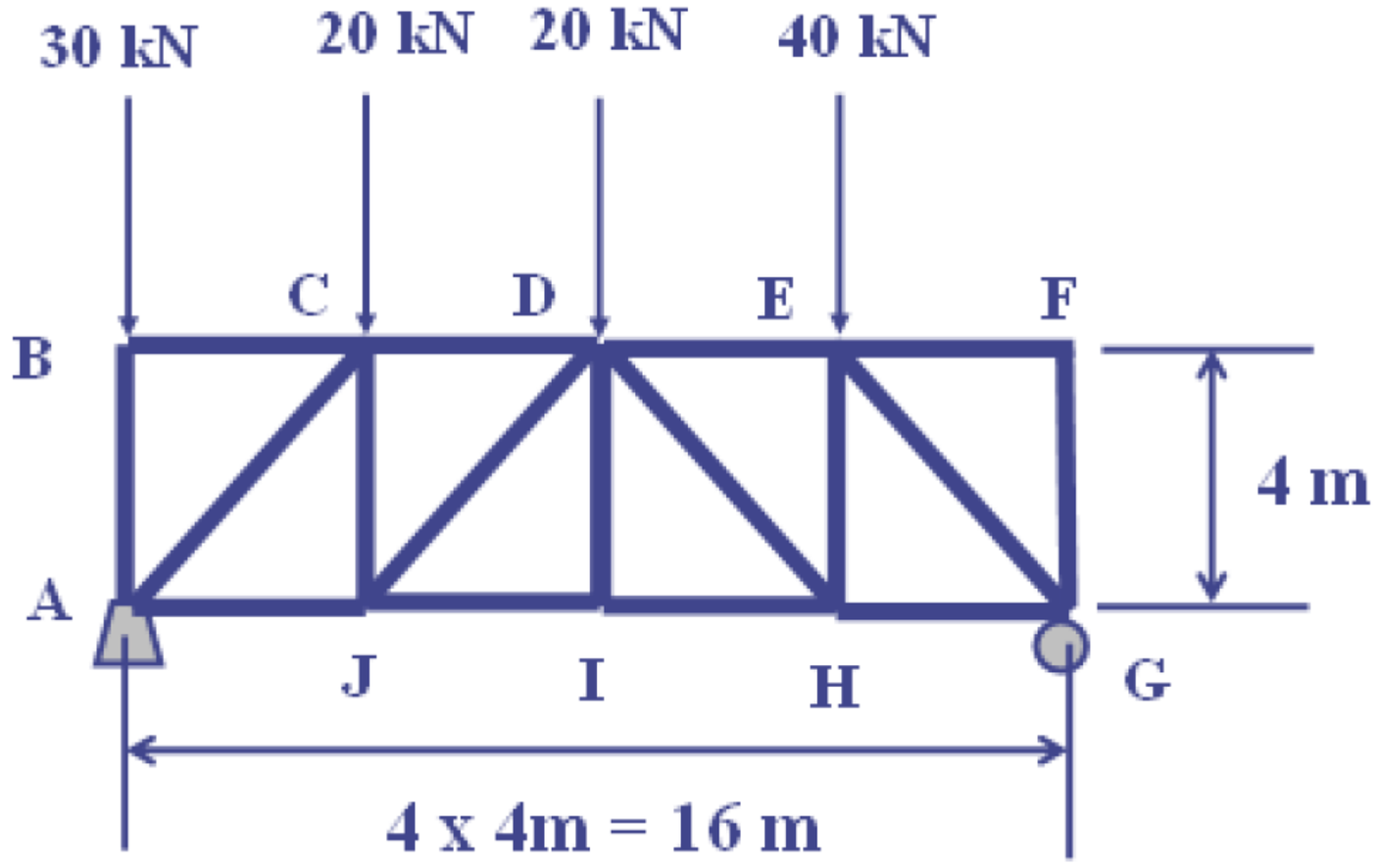
$$\sum \mathbf{M}_O = 0$$

$$-\mathbf{F}_{CF}\sin 45^\circ(12\,\mathrm{m}) + (3\,\mathrm{kN})(8\,\mathrm{m}) - (4.75\,\mathrm{kN})(4\,\mathrm{m}) = 0$$

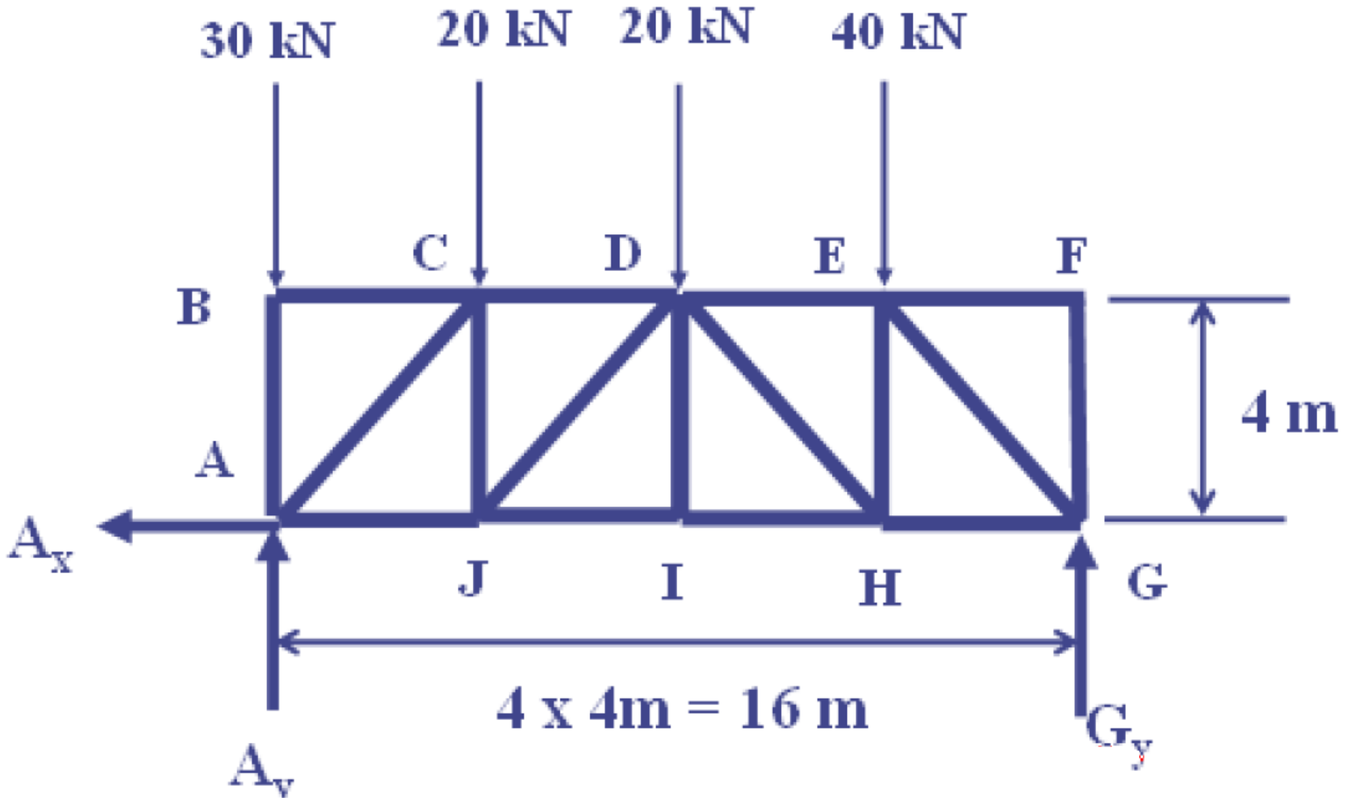
$$\mathbf{F}_{CF} = 0.589\,\mathrm{kN}\,(\mathrm{C})$$

Example 3

- Find the forces at the members DE, EH and HG.



Sol 3



$$\sum F_x = 0 \qquad \sum M_A = 0$$

$$-A_x = 0 \qquad -20(4) - 20(8) - 40(12) + G_y(16) = 0$$

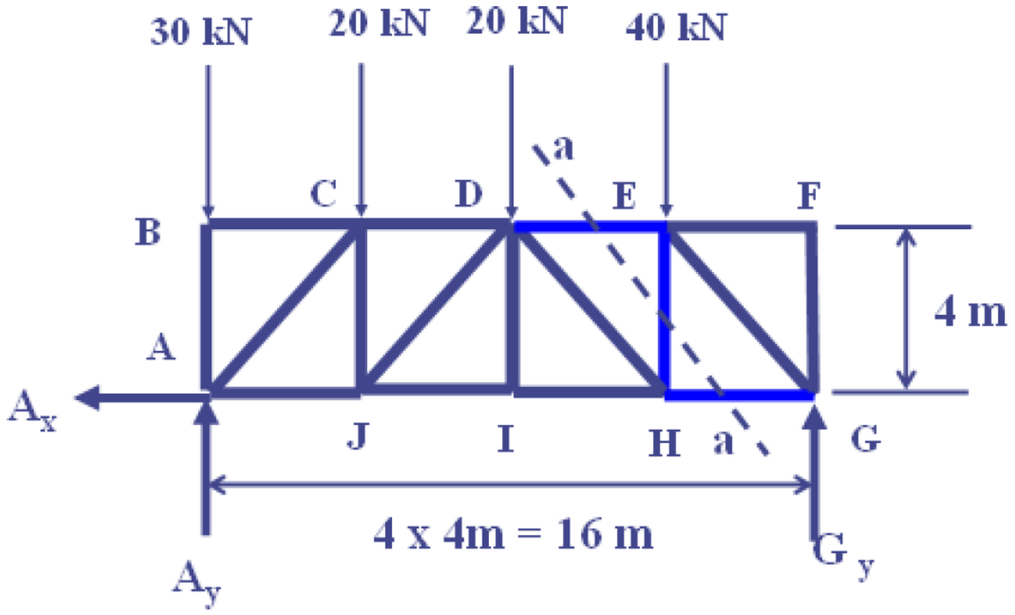
$$A_x = 0 \qquad G_y = 45 \ \text{kN}$$

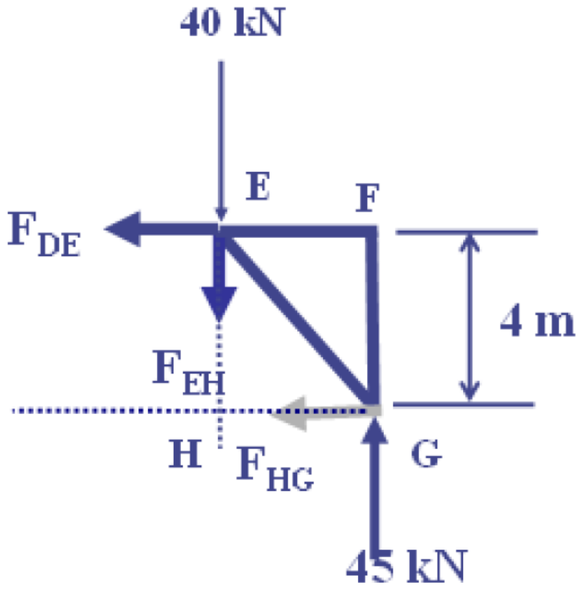
$$\sum F_y = 0$$

$$A_y + G_y - 30 - 20 - 20 - 40 = 0$$

$$A_y = 65 \ \text{kN}$$

Sol 3





$$\sum M_H = 0$$

$$45(4) + F_{DE}(4) = 0$$

$$F_{DE} = -45\ kN$$

$$F_{DE} = 45\ kN \quad (C)$$

$$\sum F_y = 0$$

$$45 - 40 - F_{EH} = 0$$

$$F_{EH} = 5\ kN \quad (T)$$

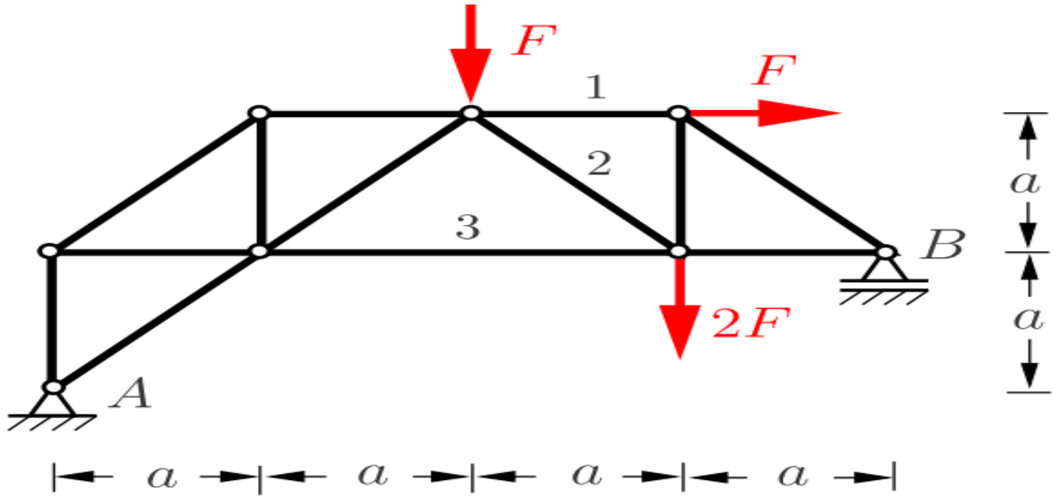
$$\sum F_x = 0$$

$$45 - F_{HG} = 0$$

$$F_{HG} = 45\ kN \quad (T)$$

Example 4

Find the forces at members 1,2 and 3.



$$S_1 = -3F/2\,, \quad S_2 = -\sqrt{2}\,F/2\,, \quad S_3 = 3F.$$

Review Problems

Determine the forces in the members 1, 2 and 3 of the truss shown in Fig. 6.14.

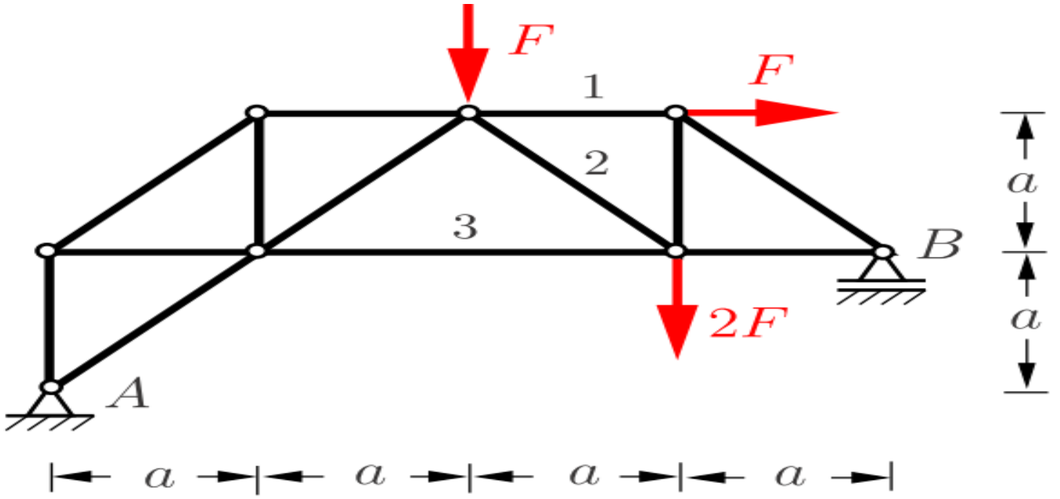
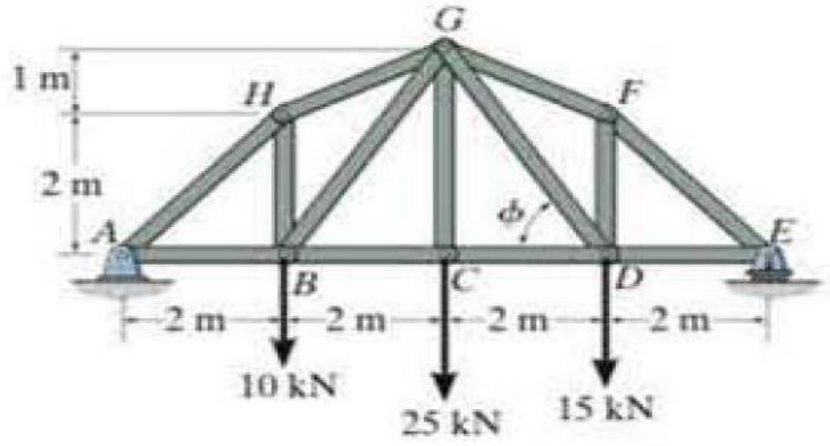


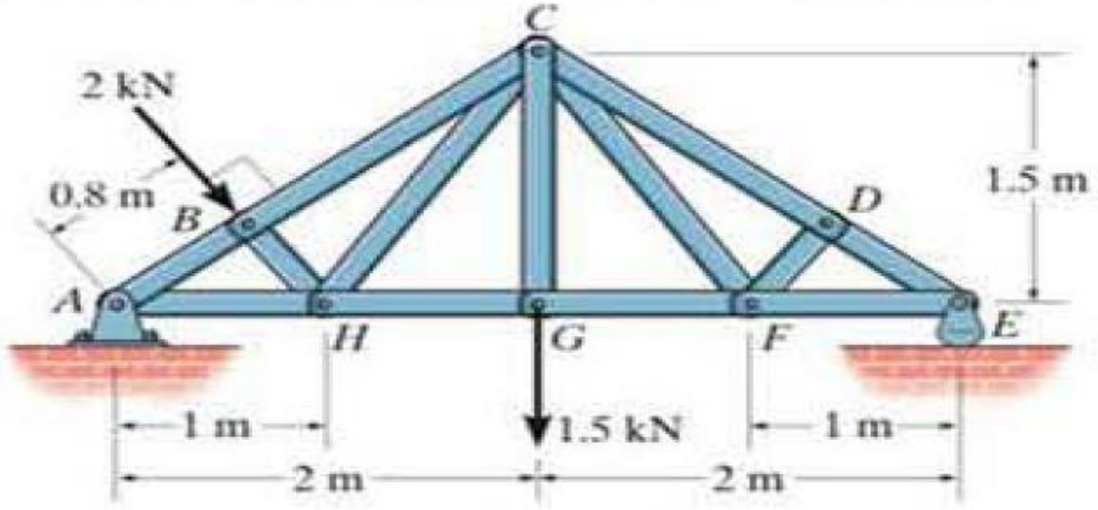
Fig. 6.14

Results: $S_1 = -3F/2\,, \quad S_2 = -\sqrt{2}\,F/2\,, \quad S_3 = 3F.$

F6–11. Determine the force in members *GF*, *GD*, and *CD* of the truss. State if the members are in tension or compression.



6–47. Determine the force in members *CD* and *GF* of the truss and state if the members are in tension or compression. Also indicate all zero-force members.



F6–9. Determine the force in members *KJ*, *KD*, and *CD* of the Pratt truss. State if the members are in tension or compression.