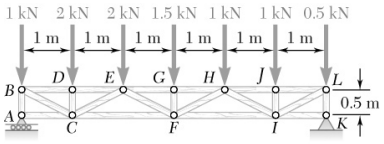
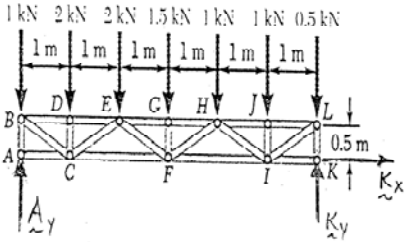
PROBLEM 6.46



A floor truss is loaded as shown. Determine the force in members *CF*, *EF*, and *EG*.

SOLUTION

FBD Truss:



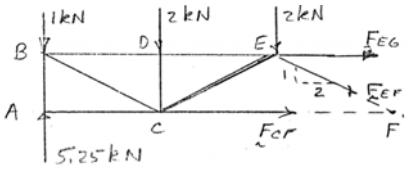
$$\circlearrowleft \Sigma M_K = 0: (1\text{ m})\big[1\text{ kN} + 2(1\text{ kN}) + 3(1.5\text{ kN}) + 4(2\text{ kN}) + 5(2\text{ kN}) + 6(1\text{ kN}) - 6A_y\big] = 0$$

$$\mathbf{A}_y = 5.25\text{ kN} \uparrow$$

$$\circlearrowleft \Sigma M_E = 0: (1\text{ m})\big[1(2\text{ kN}) + 2(1\text{ kN} - 5.25\text{ kN})\big] + (0.5\text{ m})F_{CE} = 0$$

$$F_{CF} = 13.0\text{ kN} \qquad F_{CF} = 13.00\text{ kN T} \blacktriangleleft$$

FBD Section:

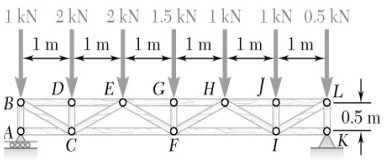


$$\circlearrowleft \Sigma M_F = 0: (1\text{ m})\big[1(2\text{ kN}) + 2(2\text{ kN}) + 3(1\text{ kN} - 5.25\text{ kN})\big] - (0.5\text{ m})F_{EG} = 0$$

$$F_{EG} = -13.5\text{ kN} \qquad F_{EG} = 13.50\text{ kN C} \blacktriangleleft$$

$$\uparrow \Sigma F_y = 0: 5.25\text{ kN} - 1\text{ kN} - 2\text{ kN} - 2\text{ kN} - \frac{1}{\sqrt{5}}F_{EF} = 0$$

$$F_{EF} = \frac{\sqrt{5}}{4} = 0.5590\text{ kN} \qquad F_{EF} = 559\text{ N T} \blacktriangleleft$$

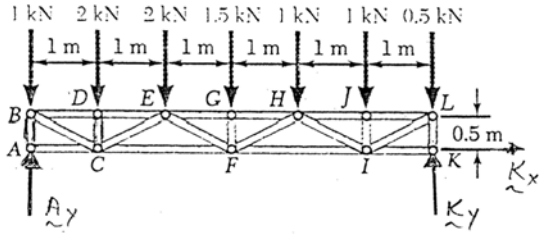


PROBLEM 6.47

A floor truss is loaded as shown. Determine the force in members *FI*, *HI*, and *HJ*.

SOLUTION

FBD Truss:

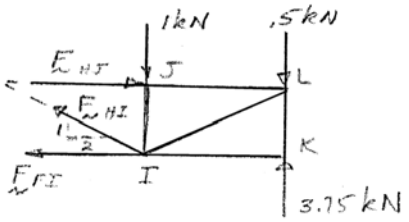


$$\rightarrow \Sigma F_x = 0: \mathbf{K}_x = 0$$

$$\circlearrowleft \Sigma M_A = 0: (1\text{m})\left[6\left(K_y - 0.5\text{ kN}\right) - 5(1\text{ kN}) - 4(1\text{ kN}) - 3(1.5\text{ kN}) - 2(2\text{ kN}) - 1(2\text{ kN})\right] = 0$$

$$\mathbf{K}_y = 3.75\text{ kN} \uparrow$$

FBD Section:



$$\circlearrowleft \Sigma M_I = 0: \ (1\text{ m})(3.75\text{ kN} - .5\text{ kN}) - (.5\text{ m})F_{HJ} = 0$$

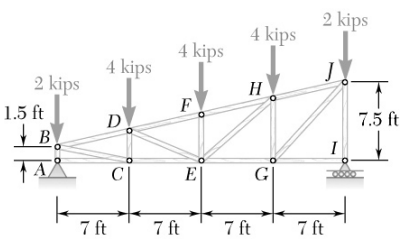
$$F_{HJ} = 6.5\text{ kN} \qquad F_{HJ} = 6.50\text{ kN C} \blacktriangleleft$$

$$\uparrow \Sigma F_y = 0: \frac{1}{\sqrt{5}}F_{HI} - 1\text{ kN} - 0.5\text{ kN} + 3.75\text{ kN} = 0$$

$$F_{HI} = -2.25\sqrt{5}\text{ kN} \qquad F_{HI} = 5.03\text{ kN C} \blacktriangleleft$$

$$\rightarrow \Sigma F_y = 0: -\frac{2}{\sqrt{5}}F_{HI} - F_{FI} + F_{HJ} = 0$$

$$F_{FI} = 2\left(2.25\text{ kN}\right) + 6.50\text{ kN} \qquad F_{FI} = 11.00\text{ kN T} \blacktriangleleft$$

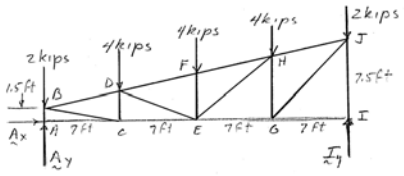


PROBLEM 6.48

A pitched flat roof truss is loaded as shown. Determine the force in members *CE*, *DE*, and *DF*.

SOLUTION

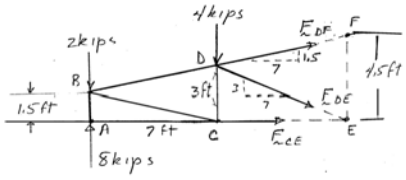
FBD Truss:



$\rightarrow \Sigma F_x = 0$: $\mathbf{A}_x = 0$

By load symmetry: $\mathbf{A}_y = \mathbf{I}_y = 8$ kips $\uparrow$

FBD Section:



$\circlearrowleft \Sigma M_D = 0$: $(7 \text{ ft})(2 \text{ kips} - 8 \text{ kips}) + (3 \text{ ft})(F_{CE}) = 0$

$F_{CE} = 14$ kips $\qquad F_{CE} = 14.00$ kips T ◀

$\circlearrowleft \Sigma M_E = 0$: $(7 \text{ ft})\left[1(4 \text{ kips}) + 2(2 \text{ kips} - 8 \text{ kips})\right]$

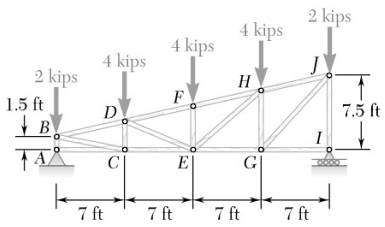
$$(4.5 \text{ ft})\frac{7}{\sqrt{51.25}} F_{DF} = 0$$

$$F_{DF} = \frac{8\sqrt{51.25}}{4.5} \text{ kips} \qquad F_{DF} = 12.73 \text{ kips C} \blacktriangleleft$$

$\uparrow$

$$\Sigma F_y = 0: 8 \text{ kips} - 2 \text{ kips} - 4 \text{ kips} + \frac{1.5}{\sqrt{51.25}} \frac{8\sqrt{51.25}}{4.5} \text{ kips} - \frac{3}{\sqrt{58}} F_{DE} = 0$$

$F_{DE} = -1.692$ kips $\qquad F_{DE} = 1.692$ kips C ◀

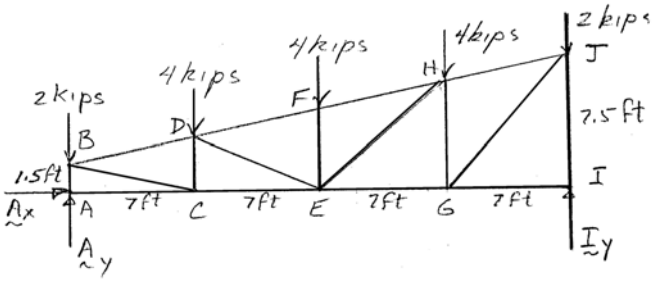


PROBLEM 6.49

A pitched flat roof truss is loaded as shown. Determine the force in members *EG*, *GH*, and *HJ*.

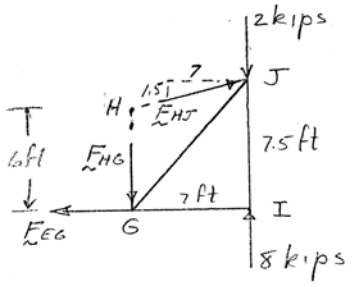
SOLUTION

FBD Truss:



By load symmetry: $\mathbf{A}_y = \mathbf{I}_y = 8 \text{ kips} \uparrow$

FBD Section:



$$\circlearrowleft \Sigma M = 0: (7 \text{ ft})(8 \text{ kips} - 2 \text{ kips}) - (6 \text{ ft}) F_{EG} = 0$$

$$F_{EG} = 7.00 \text{ kips T} \blacktriangleleft$$

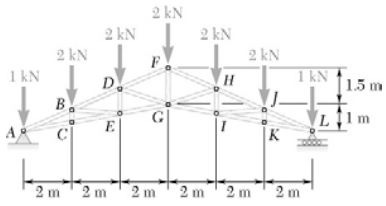
$$\rightarrow \Sigma F_x = 0: \frac{7}{\sqrt{51.25}} F_{HJ} - 7.00 \text{ kips} = 0$$

$$F_{HJ} = \sqrt{51.25} \text{ kips} \qquad F_{HJ} = 7.16 \text{ kips C} \blacktriangleleft$$

$$\uparrow \Sigma F_y = 0: \frac{1.5}{\sqrt{51.25}} \left(\sqrt{51.25} \text{ kips}\right) - F_{HG} + (8 - 2) \text{ kips} = 0$$

$$F_{HG} = 7.50 \text{ kips C} \blacktriangleleft$$

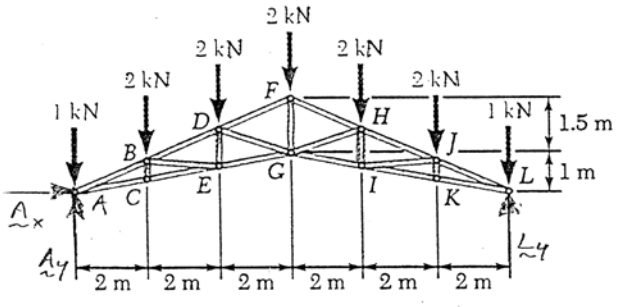
PROBLEM 6.50



A Howe scissors roof truss is loaded as shown. Determine the force in members *DF*, *DG*, and *EG*.

SOLUTION

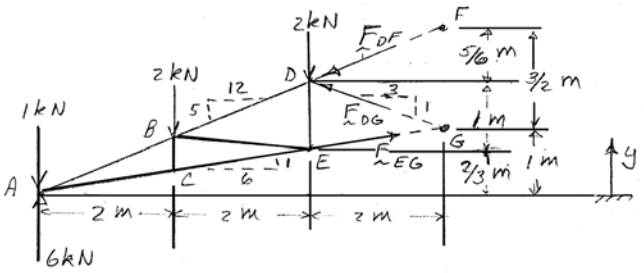
FBD Truss:



$$\rightarrow \Sigma F_X = 0: \quad \mathbf{A}_x = 0$$

By symmetry: $\mathbf{A}_y = \mathbf{L}_y = 6 \text{ kN} \uparrow$

FBD Section:



Notes:

$$y_F = \frac{15}{6} \text{ m}$$

$$y_D = \frac{2}{3} \cdot \frac{5}{2} = \frac{5}{3} \text{ m}$$

$$y_E = \frac{2}{3} \cdot 1 = \frac{2}{3} \text{ m}$$

$$y_F - y_D = \frac{5}{6} \text{ m}$$

$$y_G = 1 \text{ m}$$

$$y_D - y_G = \frac{2}{3} \text{ m}$$

PROBLEM 6.50 CONTINUED

$$\circlearrowleft \Sigma M_D = 0: (1\text{ m})\frac{6}{\sqrt{37}}F_{EG} + (2\text{ m})(2\text{ kN}) + (4\text{ m})(1\text{ kN} - 6\text{ kN}) = 0$$

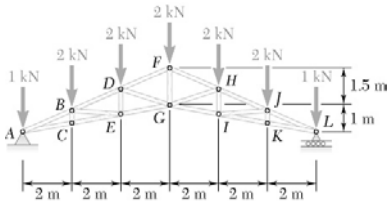
$$F_{EG} = \frac{8}{3}\sqrt{37}\text{ kN} \qquad F_{EG} = 16.22\text{ kN T} \blacktriangleleft$$

$$\circlearrowleft \Sigma M_A = 0: (2\text{ m})(2\text{ kN}) + (4\text{ m})(2\text{ kN}) - (6\text{ m})\left(\frac{1}{\sqrt{10}}F_{DG}\right) - (1\text{ m})\left(\frac{3}{\sqrt{10}}F_{DG}\right) = 0$$

$$F_{DG} = \frac{4}{3}\sqrt{10}\text{ kN} \qquad F_{DG} = 4.22\text{ kN C} \blacktriangleleft$$

$$\rightarrow \Sigma F_x = 0: \frac{6}{\sqrt{37}}F_{EG} - \frac{3}{\sqrt{10}}F_{DG} - \frac{12}{13}F_{DF} = 0 \qquad 16 - 4 - \frac{12}{13}F_{DF} = 0$$

$$F_{DF} = 13\text{ kN} \qquad F_{DF} = 13.00\text{ kN C} \blacktriangleleft$$

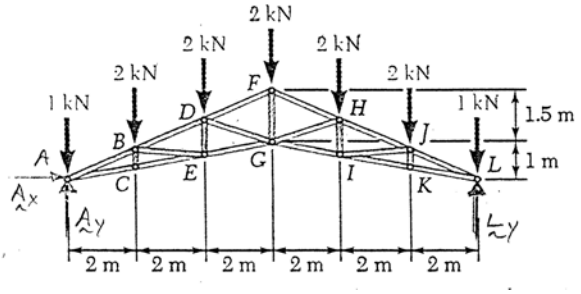


PROBLEM 6.51

A Howe scissors roof truss is loaded as shown. Determine the force in members *GI*, *HI*, and *HJ*.

SOLUTION

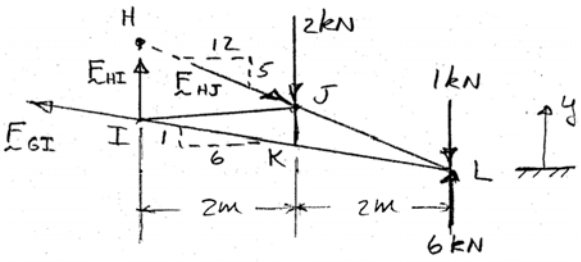
FBD Truss:



$\rightarrow \Sigma F_x = 0$: $\mathbf{A}_x = 0$

By symmetry: $\mathbf{A}_y = \mathbf{L}_y = 6$ kN ↑

FBD Section:



Notes: $y_I = \dfrac{2}{3}$ m

$$y_H = \frac{2}{3} \cdot \frac{5}{2} = \frac{5}{3} \text{ m}$$

so $y_H - y_I = 1$ m

PROBLEM 6.51 CONTINUED

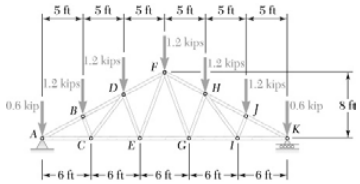
$$\circlearrowleft \Sigma M_I = 0: (4\text{ m})(6\text{ kN} - 1\text{ kN}) - (2\text{ m})(2\text{ kN}) - (1\text{ m})\left(\frac{12}{13}F_{HJ}\right) = 0$$

$$F_{HJ} = \frac{52}{3}\text{ kN} \qquad F_{HJ} = 17.33\text{ kN C} \blacktriangleleft$$

$$\circlearrowleft \Sigma M_H = 0: (4\text{ m})(6\text{ kN} - 1\text{ kN}) - (2\text{ m})(2\text{ kN}) - (1\text{ m})\left(\frac{6}{\sqrt{37}}F_{GI}\right) = 0$$

$$F_{GI} = \frac{8}{3}\sqrt{37}\text{ kN} \qquad F_{GI} = 16.22\text{ kN T} \blacktriangleleft$$

$$\circlearrowleft \Sigma M_L = 0: (2\text{ m})(2\text{ kN}) - (4\text{ m})F_{HI} = 0 \qquad F_{HI} = 1.000\text{ kN T} \blacktriangleleft$$

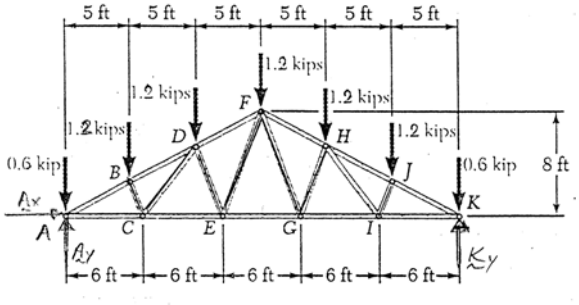


PROBLEM 6.52

A Fink roof truss is loaded as shown. Determine the force in members *BD*, *CD*, and *CE*.

SOLUTION

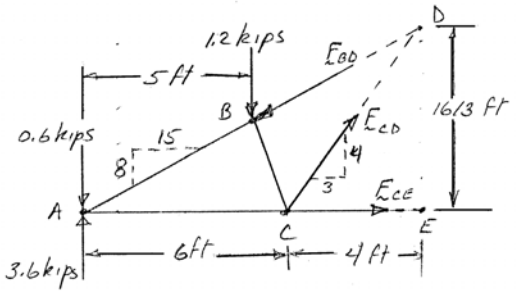
FBD Truss:



$$\rightarrow \Sigma F_x = 0: \quad \mathbf{A}_x = 0$$

By symmetry: $\mathbf{A}_y = \mathbf{K}_y = 3.6 \text{ kips} \uparrow$

FBD Section:



$$\circlearrowleft \Sigma M_D = 0: \left(\frac{16}{3} \text{ ft}\right) F_{CE} + (5 \text{ ft})(1.2 \text{ kips}) + (10 \text{ ft})(0.6 \text{ kips}) - (10 \text{ ft})(3.6 \text{ kips}) = 0$$

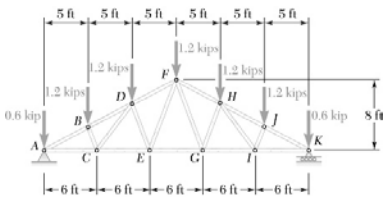
$$F_{CE} = 4.50 \text{ kips T} \blacktriangleleft$$

$$\circlearrowleft \Sigma M_A = 0: (6 \text{ ft})\left(\frac{4}{5} F_{CD}\right) - (5 \text{ ft})(1.2 \text{ kips}) = 0$$

$$F_{CD} = 1.250 \text{ kips T} \blacktriangleleft$$

$$\circlearrowleft \Sigma F_y = 0: (3.6 - 0.6) \text{ kips} - 1.2 \text{ kips} + \frac{4}{5}(1.25 \text{ kips}) - \frac{8}{17} F_{BD} = 0$$

$$F_{BD} = 5.95 \text{ kips} \qquad F_{BD} = 5.95 \text{ kips C} \blacktriangleleft$$

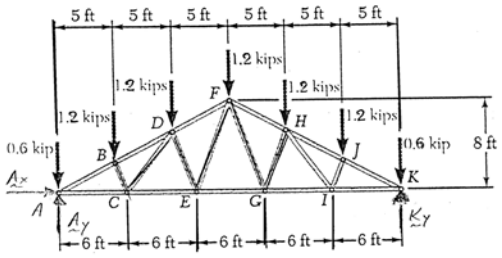


PROBLEM 6.53

A Fink roof truss is loaded as shown. Determine the force in members *FH*, *FG*, and *EG*.

SOLUTION

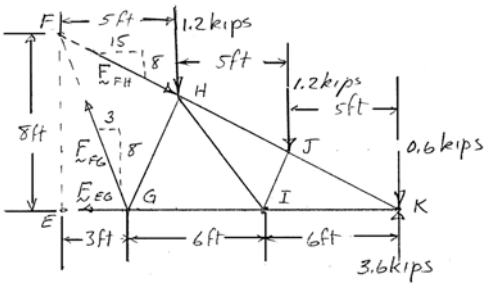
FBD Truss:



$$\rightarrow \Sigma F_x = 0: \quad \mathbf{A}_x = 0$$

By symmetry: $\mathbf{A}_y = \mathbf{K}_y = 3.6 \text{ kips} \uparrow$

FBD Section:



$$\circlearrowleft \Sigma M_F = 0: (15 \text{ ft})(3.6 - .6) \text{ kips} - (10 \text{ ft})(1.2 \text{ kips}) - (5 \text{ ft})(1.2 \text{ kips}) - (8\text{ft}) F_{EG} = 0$$

$$F_{EG} = 3.375 \text{ kips} \qquad F_{EG} = 3.38 \text{ kips T} \blacktriangleleft$$

$$\circlearrowleft \Sigma M_K = 0: (5 \text{ ft})(1.2 \text{ kips}) + (10 \text{ ft})(1.2 \text{ kips}) - (12 \text{ ft})\left(\frac{8}{\sqrt{73}} F_{FG}\right) = 0$$

$$F_{FG} = \frac{3}{16}\sqrt{73} \text{ kips} \qquad F_{FG} = 1.602 \text{ kips T} \blacktriangleleft$$

$$\uparrow \Sigma F_y = 0 \qquad \frac{8}{\sqrt{73}}\left(\frac{3}{16}\sqrt{73} \text{ kips}\right) - \frac{8}{17} F_{FH} - 1.2 \text{ kips} - 1.2 \text{ kips} - 0.6 \text{ kip} + 3.6 \text{ kips} = 0$$

$$F_{FH} = 4.4625 \text{ kips} \qquad F_{FH} = 4.46 \text{ kips C} \blacktriangleleft$$