Problem 6.130  The Pratt bridge truss supports loads at $F$, $G$, and $H$. Determine the axial forces in members $BC$, $BG$, and $FG$.

Solution:  The angles of the cross-members are $\alpha = 45^\circ$.

The complete structure as a free body:

The sum of the moments about $A$:

$$\sum M_A = -60(4) - 80(8) - 20(12) + 16E = 0,$$

from which $E = 70$ kN. The sum of the forces:

$$\sum F_x = A_x = 0,$$

$$\sum F_y = A_y - 60 - 80 - 20 + E = 0,$$

from which $A_y = 90$ kN

The method of joints: Joint $A$:

$$\sum F_y = A_y + AB \sin \alpha = 0,$$

from which $AB = -127.3$ kN (C),

$$\sum F_x = AB \cos \alpha + AF = 0,$$

from which $AF = 90$ kN (T). Joint $F$:

$$\sum F_y = -AF + FG = 0,$$

from which $FG = 90$ kN (T)

$$\sum F_x = BF - 60 = 0,$$

from which $BF = 60$ kN (C). Joint $B$:

$$\sum F_x = -AB \cos \alpha + BC + BG \cos \alpha = 0,$$

and $$\sum F_y = -AB \sin \alpha - BF - BG \sin \alpha = 0,$$

from which:

$$-AB \sin \alpha - BF - BG \sin \alpha = 0.$$

Solve: $BG = 42.43$ kN (T).

and $-AB \cos \alpha + BC + BG \cos \alpha = 0$.

from which $BC = -120$ kN (C)
Problem 6.131  Consider the truss in Problem 6.130. Determine the axial forces in members $CD$, $GD$, and $GH$.

Solution:  Use the results of the solution of Problem 6.130:

\[ BC = -120 \text{ kN (C).} \]
\[ BG = 42.43 \text{ kN (T).} \]

and $FG = 90 \text{ kN (T).}$

The angle of the cross-members with the horizontal is $\alpha = 45^\circ$.

**Joint C:**
\[ \sum F_x = -BC + CD = 0, \]
from which $CD = -120 \text{ kN (C)}$.

\[ \sum F_y = -CG = 0, \]
from which $CG = 0$.

**Joint G:**
\[ \sum F_x = BG \sin \alpha + GD \sin \alpha + CG - 80 = 0, \]
from which $GD = 70.71 \text{ kN (T)}$.

\[ \sum F_y = -BG \cos \alpha + GD \cos \alpha - FG + GH = 0, \]
from which $GH = 70 \text{ kN (T)}$. 
Problem 6.132  The truss supports loads at F and H. Determine the axial forces in members AB, AC, BC, BD, CD, and CE.

Solution:  The complete structure as a free body: The sum of the moments about I:

\[ \sum M_A = 100(6) + 200(12) - 24y = 0, \]

from which \( Ay = 125 \) lb. The sum of forces:

\[ \sum F_y = A_y = 0. \]

The method of joints: The angles of the inclined members with the horizontal are

\[ \alpha = \tan^{-1}(0.6667) = 33.69^\circ \]

Joint A:

\[ \sum F_x = AC \cos \alpha = 0. \]

from which \( AC = 0. \)

\[ \sum F_y = A_y + AB + AC \sin \alpha = 0, \]

from which \( AB = -125 \) lb (C)

Joint B:

\[ \sum F_x = -AB + BD \sin \alpha = 0. \]

from which \( BD = -225.3 \) lb (C)

\[ \sum F_y = BD \cos \alpha + BC = 0, \]

from which \( BC = 187.5 \) lb (T)

Joint C:

\[ \sum F_x = -BC - AC \cos \alpha + CE \cos \alpha = 0, \]

from which \( CE = 225.3 \) lb (T)

\[ \sum F_y = -AC \sin \alpha + CD + CE \sin \alpha = 0, \]

from which \( CD = -125 \) lb (C)
Problem 6.134  Determine the axial forces in members $BD$, $CD$, and $CE$.

Solution: Use the method of sections

$$\tan \theta = \frac{2}{1.5}$$
$$\theta = 53.13^\circ$$

$$\sum F_x: \quad F_{CE} \cos \theta - F_{CD} \cos \theta + 24 = 0$$

$$\sum F_y: \quad -F_{BD} - F_{CD} \sin \theta - F_{CE} \sin \theta = 0$$

$$\sum M_B: \quad -2(10) - 1.5F_{CD} \sin \theta - 1.5F_{CE} \sin \theta = 0$$

3 eqns-3 unknowns.

Solving $F_{BD} = 13.3$ kN,

$F_{CD} = 11.7$ kN,

$F_{CE} = -28.3$ kN