University of Babylon
College of Engineering
Department of Environmental Engineering
Engineering Analysis I (ENAN 103)

Truss II

Undergraduate Level, 1st Stage

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1.0 Truss

A truss can be defined as a pin jointed frame that made of slender members (members with high ratio of length to cross sectional area) and capable of taking loads at its joints. Trusses are used in building roofs, steel structure frames, and bridges.

In making a perfect joint frame (truss), the number of members (m) shall have the following relationships with the number of joints (j):

$M = 2J - 3$

where:

M: number of members,

J: number of joints.

In analyzing a truss, the following assumption are necessary:

1- The external loads are applied only on the joints.

2- Members do not hold any bending.

3- The members' self-weight is negligible

4- Members' ends are pin joined.

Method of Sections

This method of analysis is used to determine the internal forces of a truss. It can be done as follows:

1- Determine the value of the reactions using the equilibrium equations

$\sum F_x = 0 \qquad \rightarrow (+ve.)$

$\sum F_y = 0 \qquad \uparrow (+ve.)$

$\sum M_z = 0 \qquad C.C.W\ (+ve.)$

2- Use the cutting section to cut the truss to two parst through three unknown members. Then take one of the cut sections and use the equilibrium equations in determining the internal forces of the cut members.

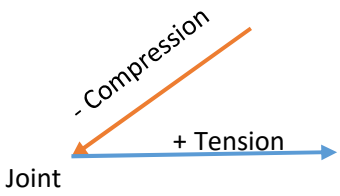
$\sum F_x = 0 \qquad \rightarrow (+ve.)$

$\sum F_y = 0 \qquad \uparrow (+ve.)$

$\sum M_z = 0 \qquad C.C.W\ (+ve.)$

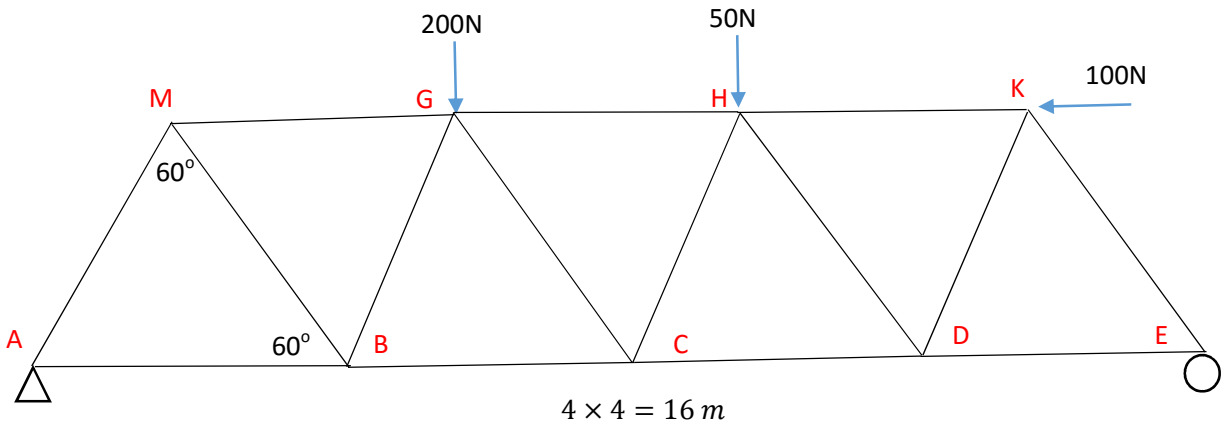
3- If the internal force of a member is moving toward the joint it calls compression force (-).

If the internal force is moving far from the joint, it is tension force (+).



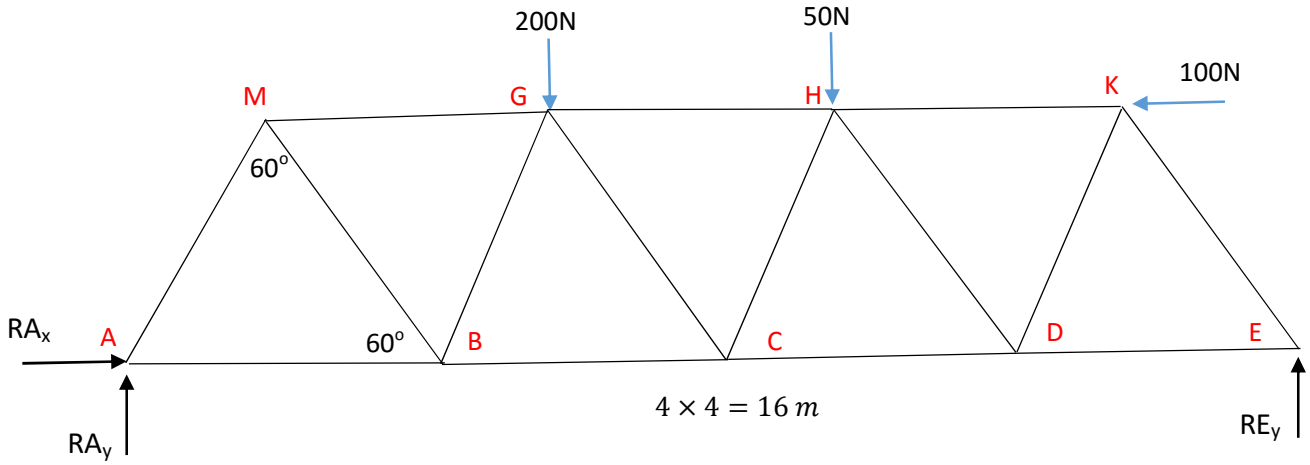
Example 1

Determine the external reactions as well as the internal force of CH and member CG of the following truss.



Solution

Draw free-body diagram for the truss.



For the whole truss:

Structure height:

$tan60 = h/2$

$h = tan60 \times 2 = 3.46m$

$\sum F_x = 0 \qquad \rightarrow (+ve.)$

$RA_x - 100 = 0$

$RA_x = 100N \quad \rightarrow$

$\sum M_z = 0$ at point A $C.C.W\ (+ve.)$

$RE_y \times 16 + 100 \times 3.46 - 50 \times 10 - 200 \times 6 = 0$

$RE_y \times 16 + 100 \times 3.46 - 50 \times 10 - 200 \times 6 = 0$

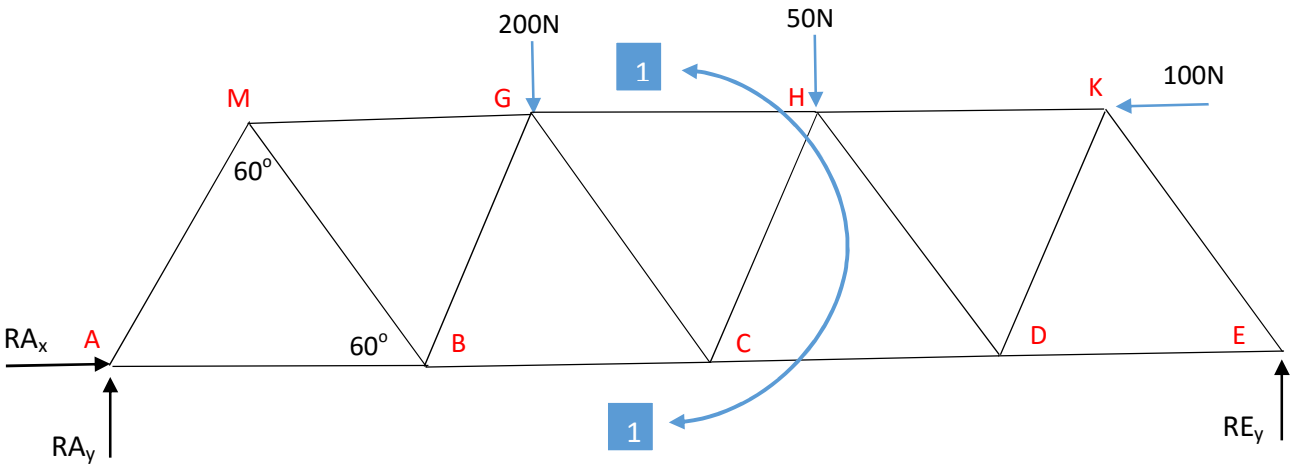
$RE_y = 84.63N \quad \uparrow$

$\sum F_y = 0 \qquad \uparrow (+ve.)$

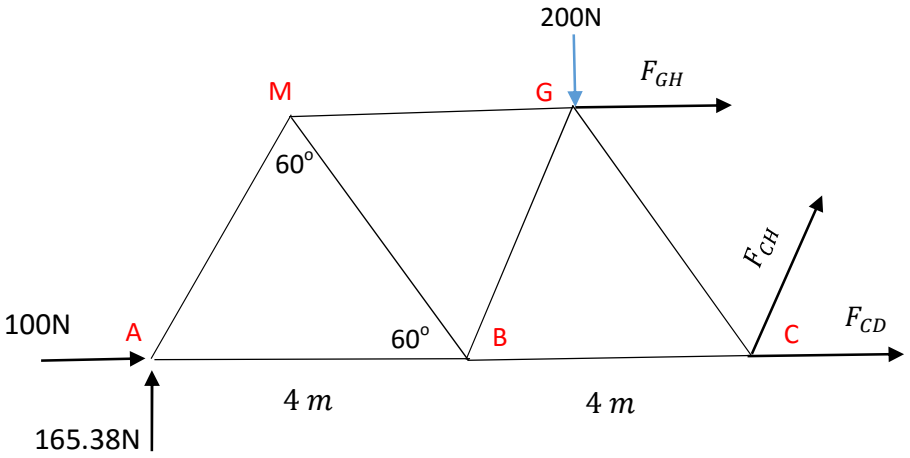
$RA_y - 200 - 50 + RE_y = 0$

$RC_y = 165.38N \quad \uparrow$

Section 1-1: Pass through member CD, CH, and GH



whole structure with section 1-1



Section 1-1

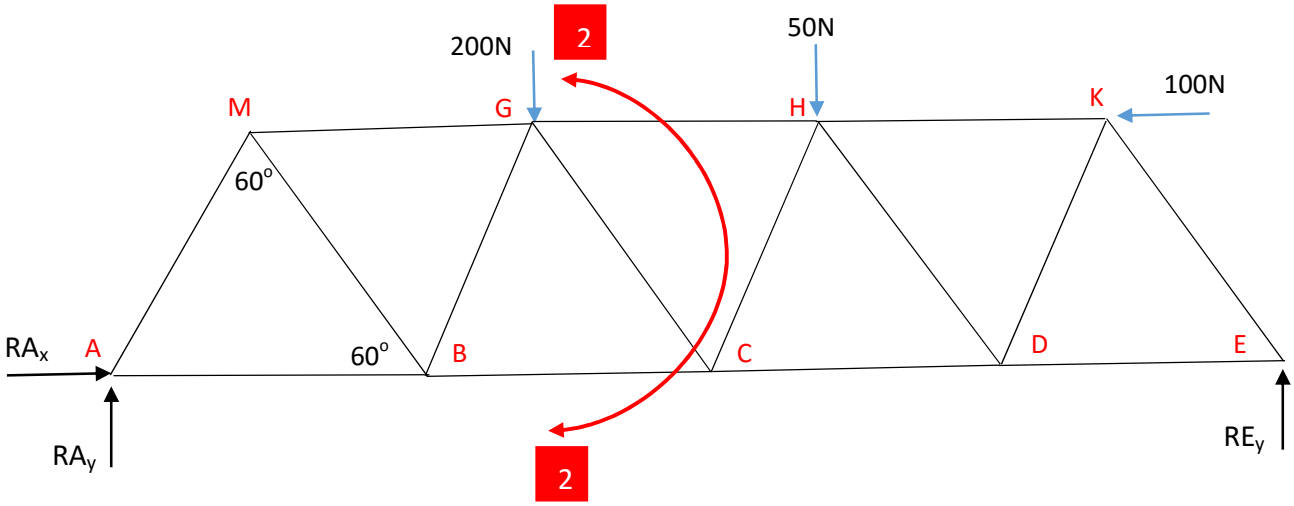
$\sum F_y = 0 \qquad \uparrow (+ve.)$

$F_{CH} \times \sin 60 + 165.38 - 200 = 0$

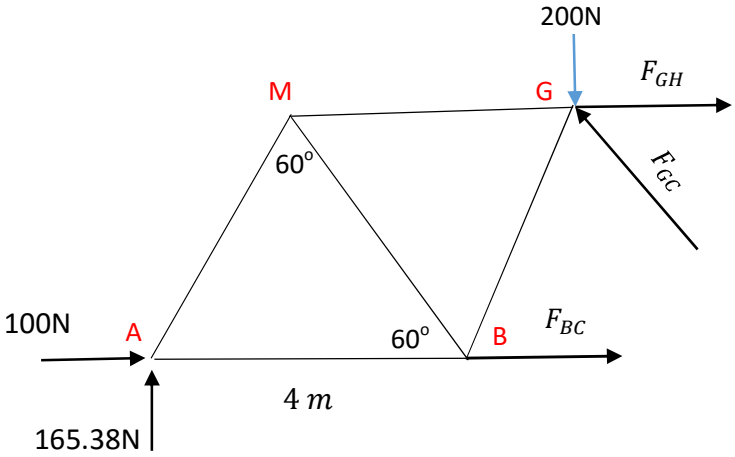
$F_{CH} \times \sin 60 + 165.38 - 200 = 0$

$F_{CH} = 40N \quad (Tension)$

Section 2-2: Pass through member GC, GH, and BC



whole structure with section 1-1



Section 1-1

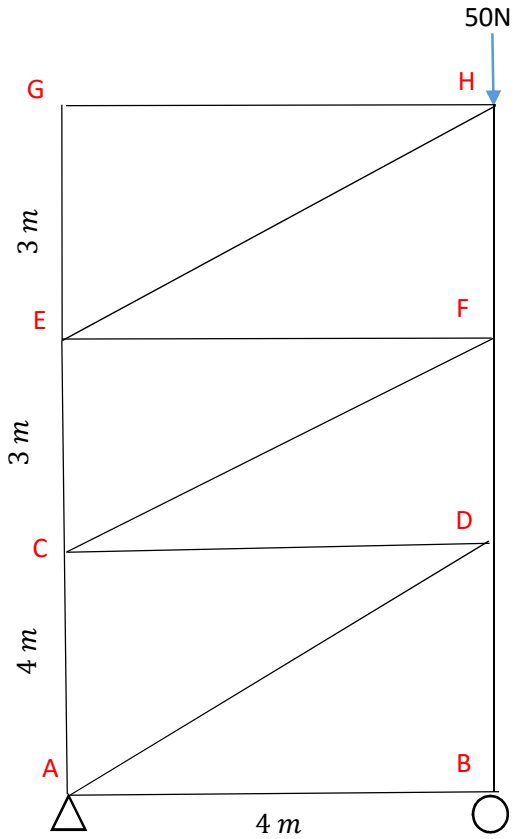
$\sum F_y = 0 \qquad \uparrow (+ve.)$

$F_{GH} \times \sin 60 + 165.38 - 200 = 0$

$F_{GH} = 40N \quad (Compression)$

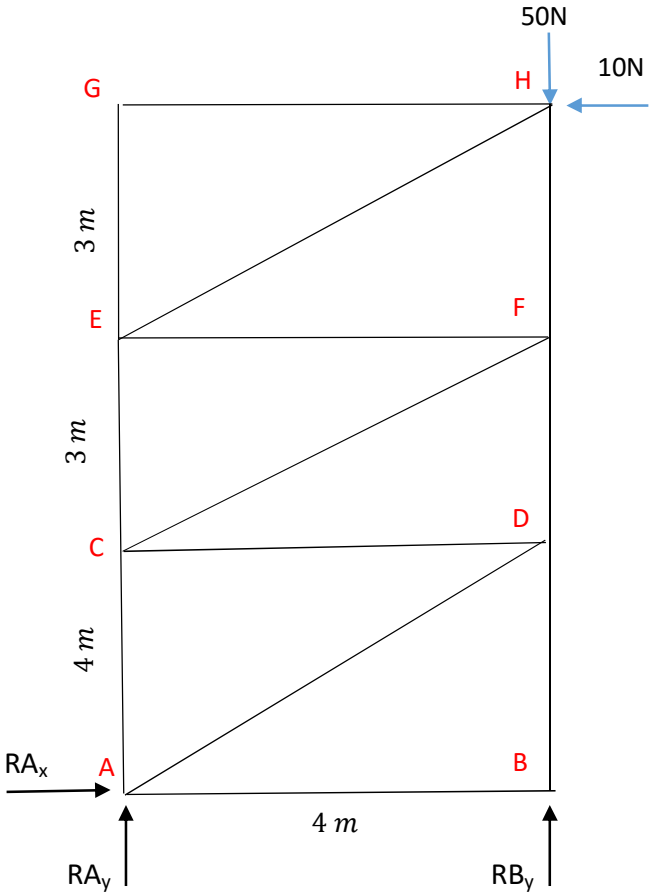
Example 2

Determine the external reactions as well as the internal force of CF the following truss.



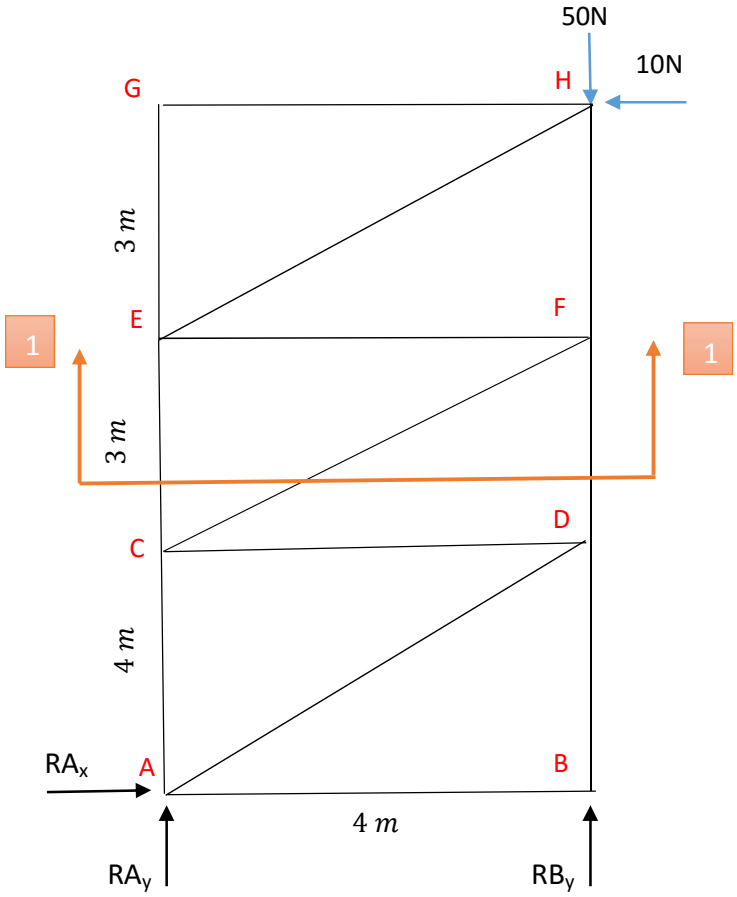
Solution

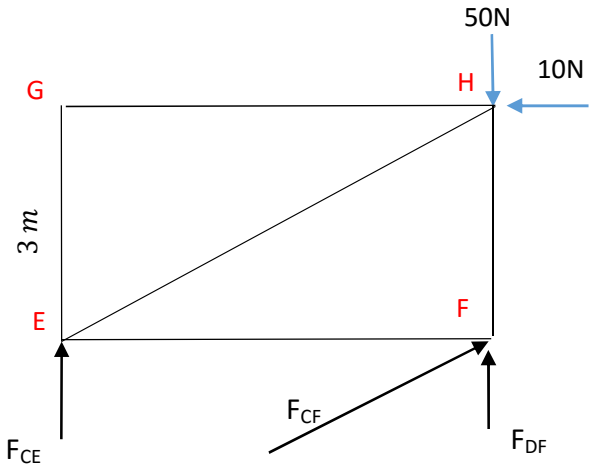
Draw free-body diagram for the truss.



Section 1-1: Pass through member CE, CF, and CD.

The angle of member CF with x-axis: $\emptyset = \tan^{-1}\frac{3}{4} = 37$





$\sum F_x = 0 \qquad \rightarrow (+ve.)$

$F_{CF} \times \cos 37 - 10 = 0$

$F_{CF} = 12.5N \qquad (Compression)$