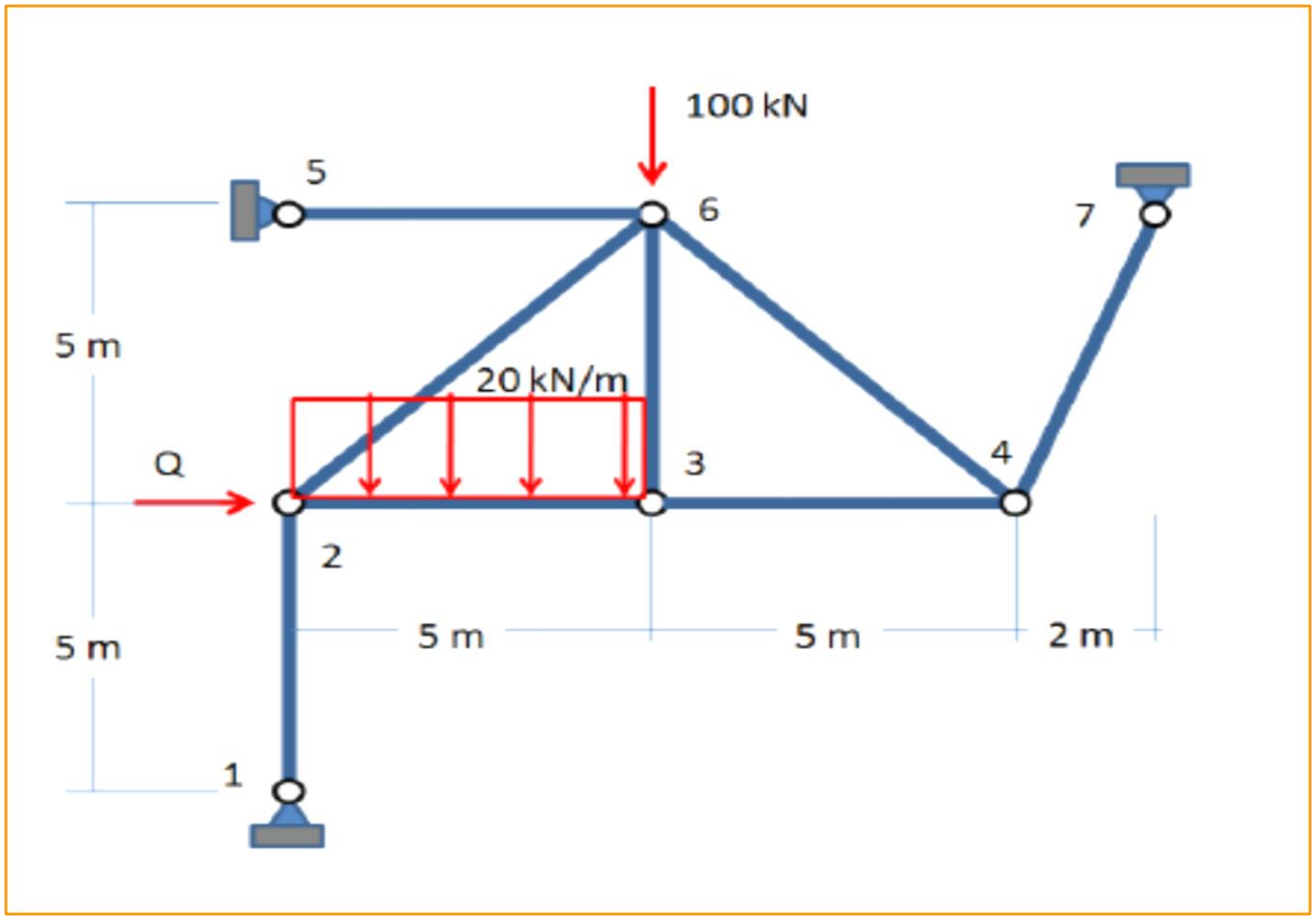
TRUSS EXERCISE



STATEMENT

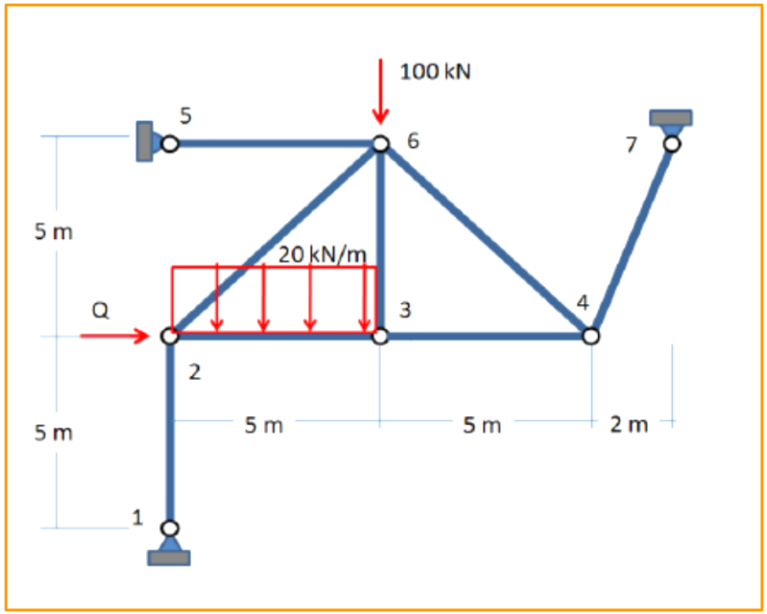
Determine for the truss shown in the figure:

a) Degree of static indeterminacy (DSI).

b) The value of the point load Q that produces zero horizontal reaction force in node 7. Reaction forces at the supports.

c) Internal forces using the method of the nodes.

d) Check value of stretches 56, 23 and 26 using the method o the sections.



A) CALCULATION OF EDSI, IDSI AND DSI

EDSI = R-EDOF= 6 - 3 = 3

IDOF =3(m-1) = 3(8-1) = 21

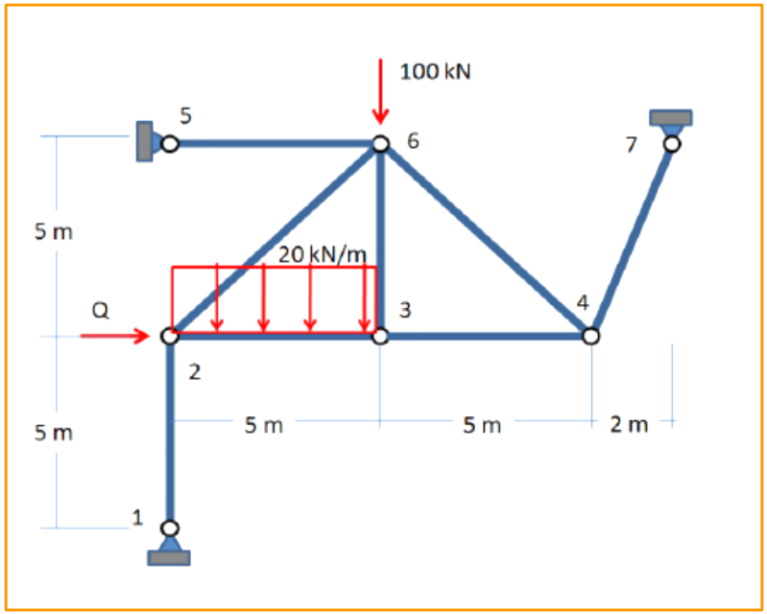
IL = sum 2(b-1)= 3[2(3-1)] + [2(4-1)] = 18

IDSI =IL-IDOF = 18-21 = -3

DSI = IDSI + EDIS= 3+(-3) = 0

DSI can be also calculated as it can be seen below:

DSI = m+r-2j =0= 8 + 6 - 2*7 = 0



* *8 beams*
* *7 hinge joints*
* *6 Reactions*

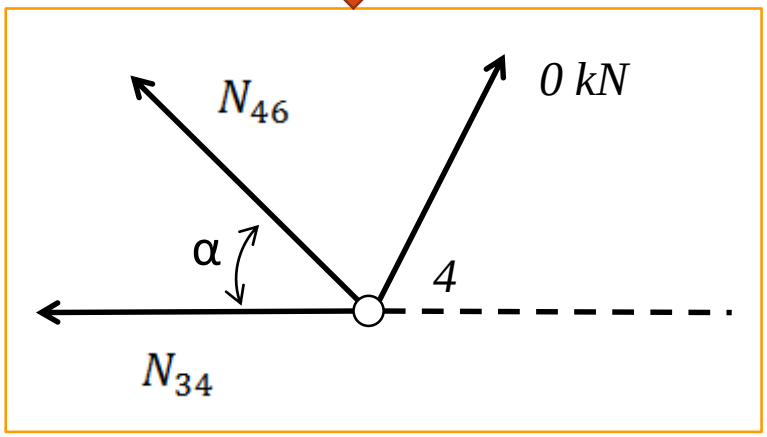
Thus the structure is stable and determined.

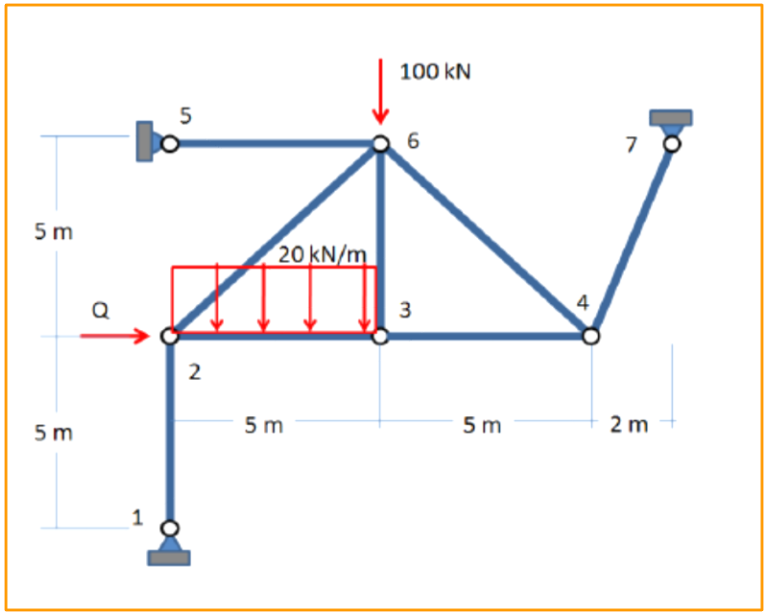
B) REACTION FORCES AND FORCE Q

The value of the point load Q produces zero horizontal reaction force in node 7

Vertical reaction will be also zero (a node with just two concurrent forces)

$$N_{47} = 0\ kN$$





$$\alpha = 45$$

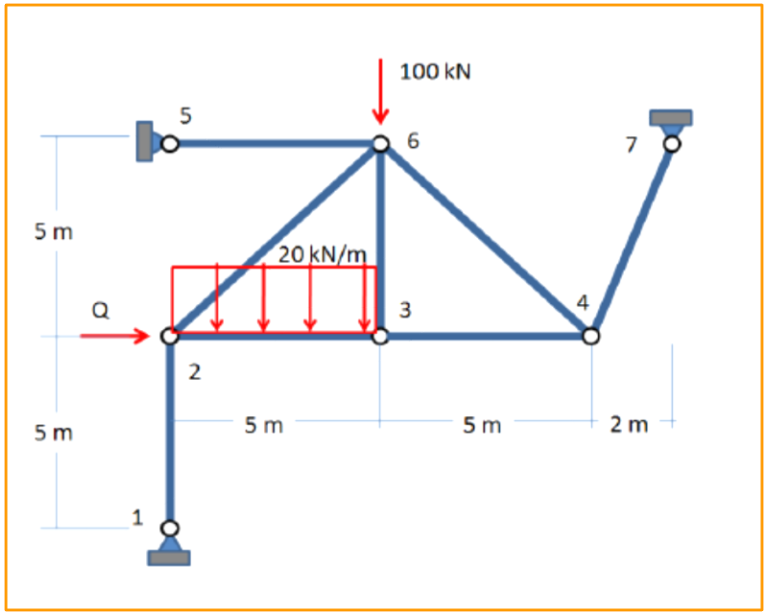
$$\rightarrow N_{46}\sin\alpha = 0 \rightarrow N_{46} = 0 \rightarrow N_{34} = 0$$

B) REACTION FORCES AND FORCE Q

$$\sum F_y = 0 \quad V_1 = 200\ kN$$

$$\sum F_x = 0 \quad H_5 = Q\ kN$$

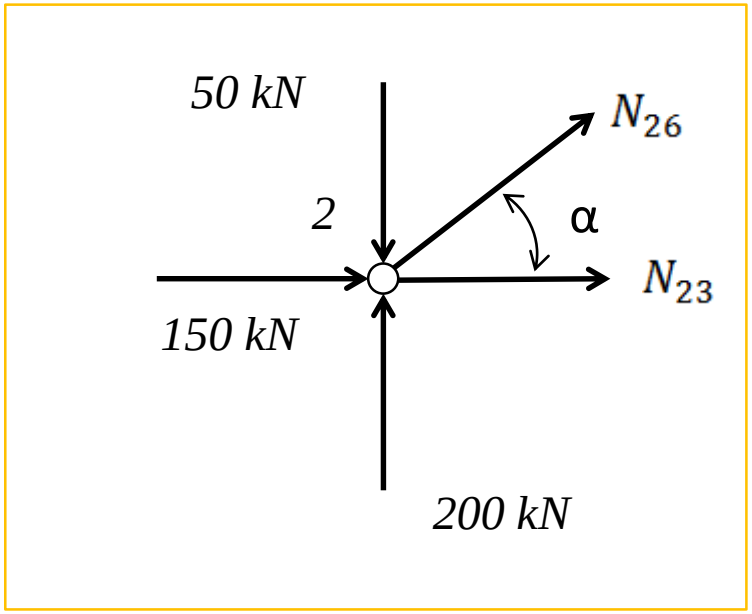
$$N_{12} = 200\ kN\ (C)$$

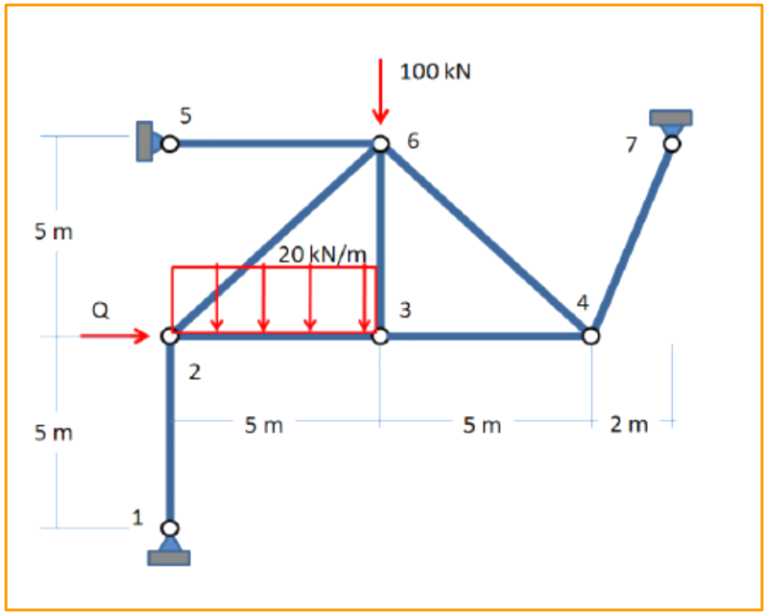


$$\sum M_1 = -10H_5 + 5H_5 + 5.100 + 5.50 = 0$$

$$H_5 = 150\ kN\ (T)$$

C) INTERNAL FORCES METHOD OF THE NODES





$$\sum F_x = 0 \qquad 150 + N_{26}\cos\alpha + N_{23} = 0$$

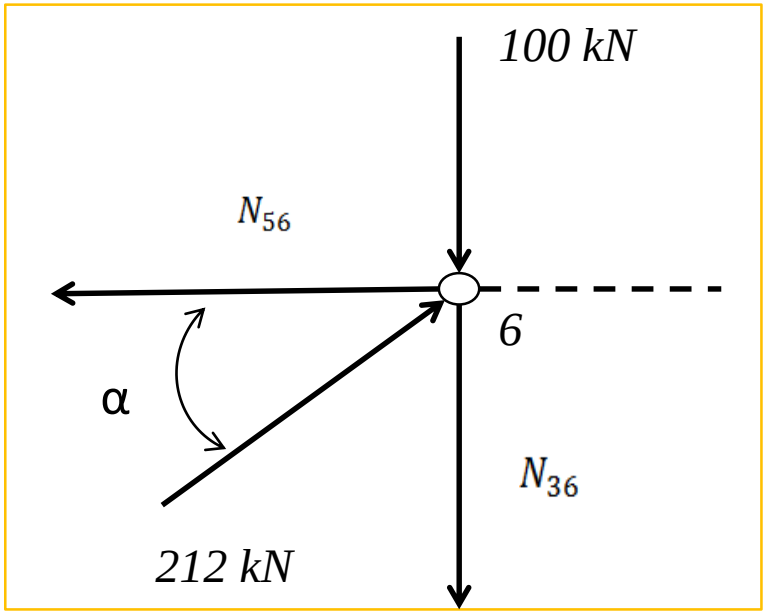
$$\sum F_y = 0 \qquad N_{26}\sin\alpha + 200 - 50 = 0$$

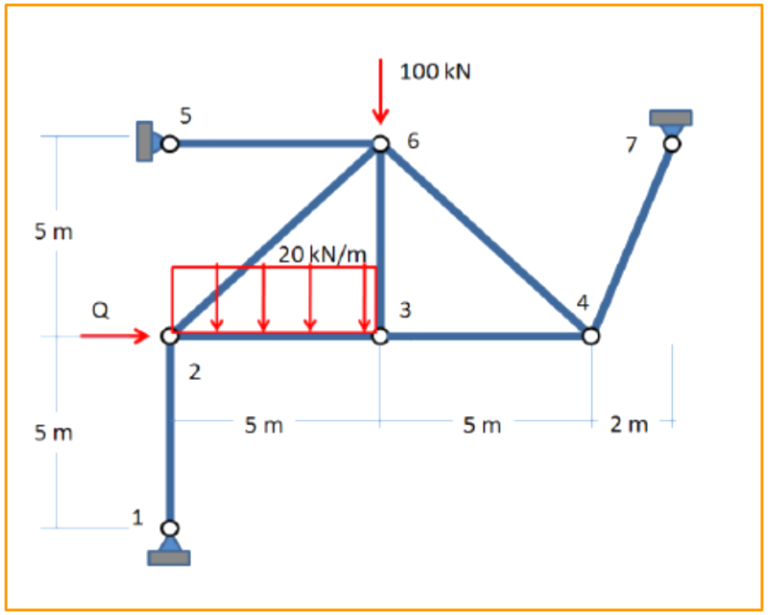
Using these expressions the following results are obtained:

$$N_{26} = 212\ kN\ (C)$$

$$N_{23} = 0$$

C) INTERNAL FORCES METHOD OF THE NODES





$$\sum F_y = 0 \quad 100 + N_{36} - \frac{212\sqrt{2}}{2} = 0$$

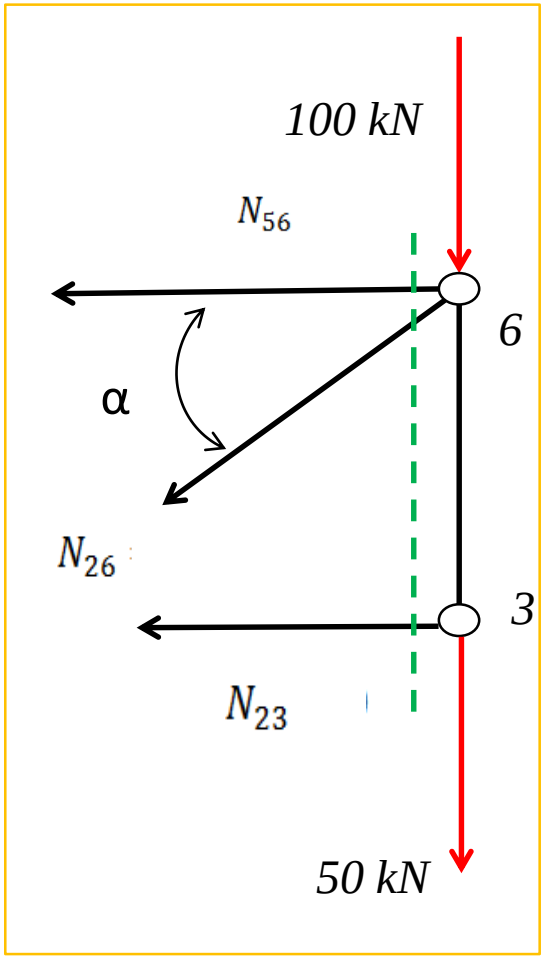
$$\sum F_x = 0 \quad N_{56} - \frac{212\sqrt{2}}{2} = 0$$

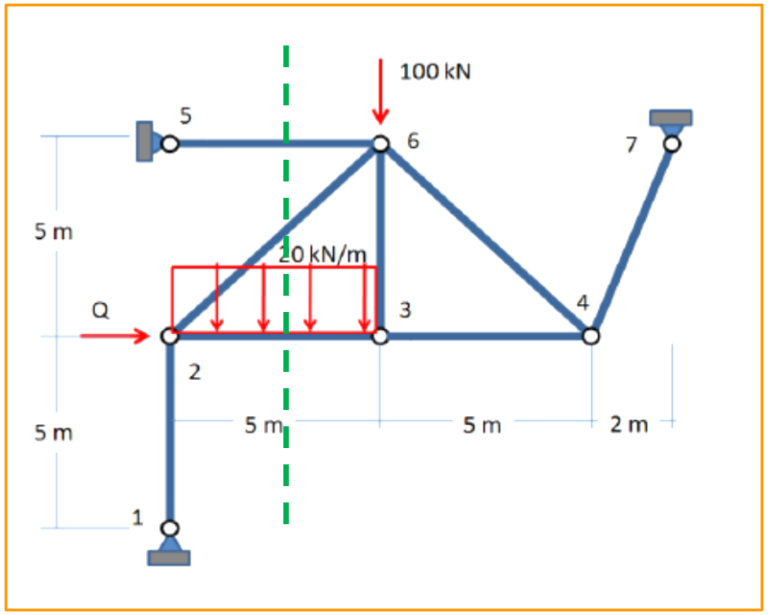
Using these expressions the following results are obtained:

$$N_{36} = 50\ kN\ (T)$$

$$N_{56} = 150\ kN\ (T)$$

D) INTERNAL FORCES METHOD OF THE SECTIONS





$$\sum M_6 = 0 \rightarrow \boxed{N_{23} = 0}$$

$$\sum F_y = 0 \rightarrow N_{26}\sin\alpha + 100 + 50 = 0 \rightarrow \boxed{N_{26} = 212\ kN\ (C)}$$

$$\sum F_x = 0 \rightarrow N_{26}\cos\alpha - N_{56} - N_{23} = 0 \rightarrow \boxed{N_{56} = 150\ kN\ (T)}$$

Same results as with prior method.