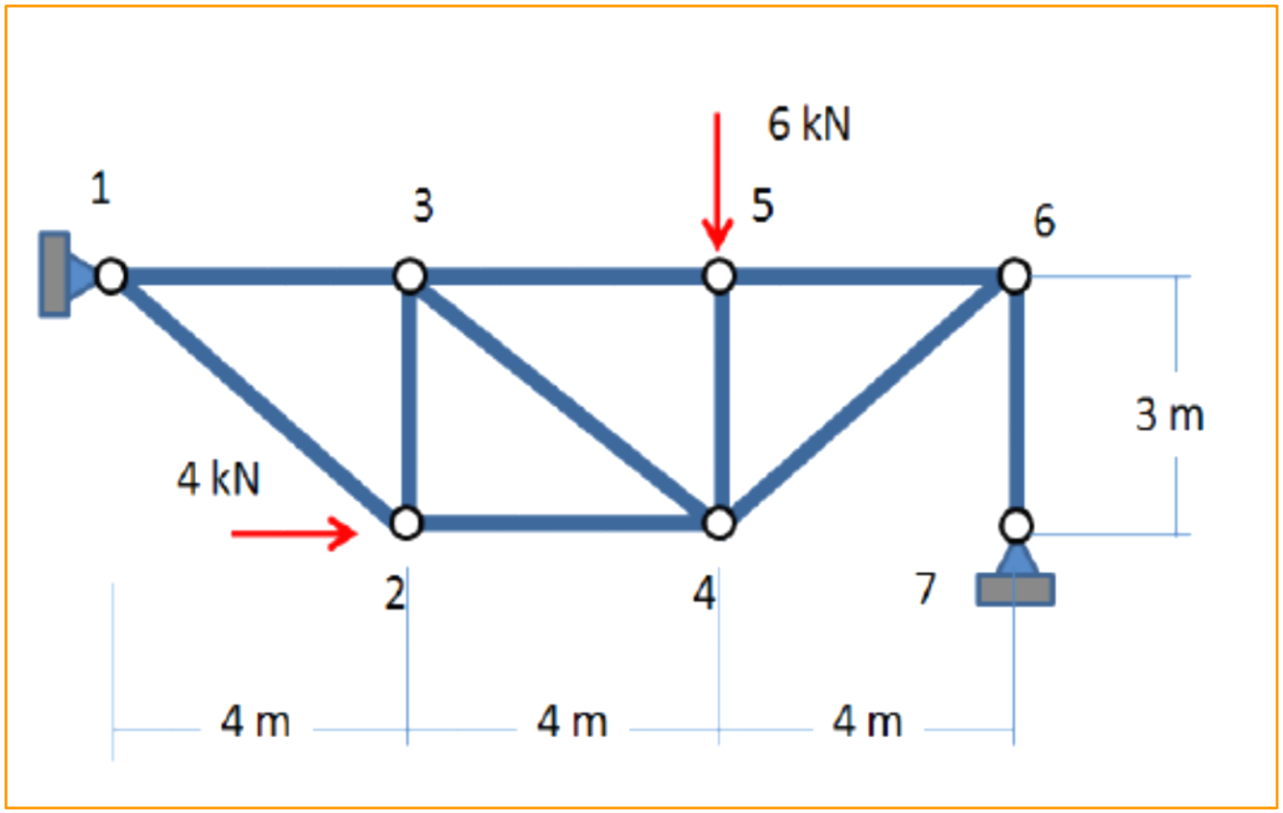
$$\sum_{Rincon}^{El} \sqrt[del]{Ingeniero}$$

http://www.elrincondelingeniero.com/



$$\sin\alpha = \frac{3}{\sqrt{4^2+3^2}} = 0{,}6$$

$$\cos\alpha = \frac{4}{\sqrt{4^2+3^2}} = 0{,}8$$

A) Calculation of EDSI, IDSI and DSI

EDSI = 4 - 3 = 1

IDOF = 3(10-1) = 27

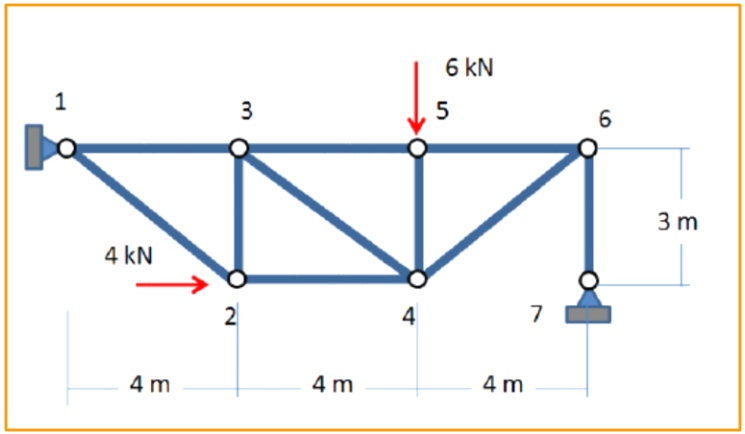
IL = 2(2-1) + 3[2(3-1)] + 2[2(4-1)] = 26

IDSI = 26-27 = -1

DSI=1-1=0

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

*DSI = 10 + 4 - 2*7 = 0*



* *10 beams*
* *7 hinge joints*
* *4 Reactions*

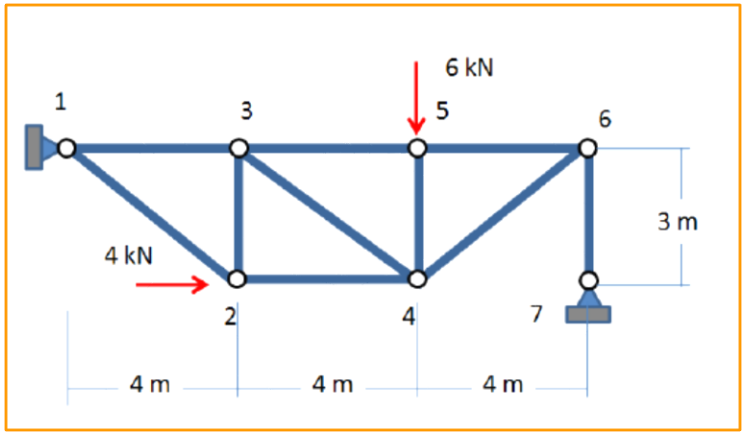
Thus the structure is stable and determinate

B) Calculation of the reactions

$$\sum F_x = 0 \Rightarrow H_1 = 4\ kN$$

$$\sum F_y = 0 \Rightarrow V_1 + V_2 = 6$$

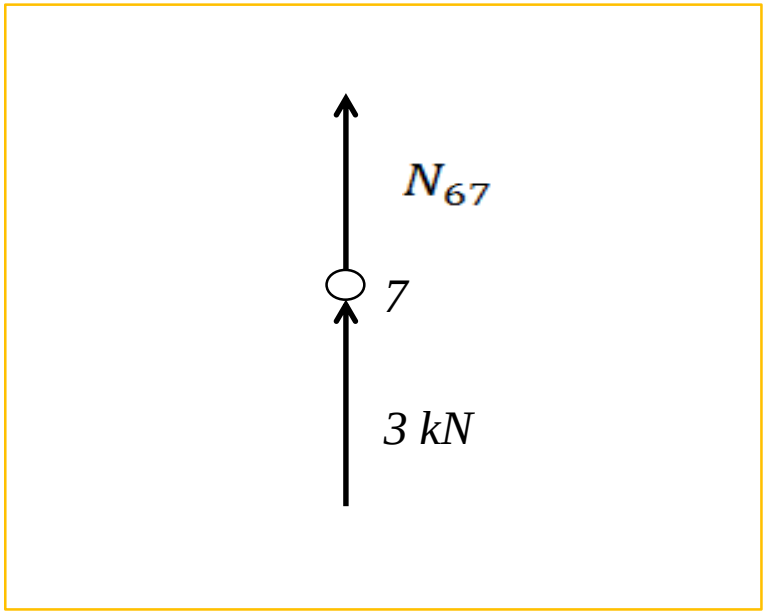
$$\sum M_1 = 12V_7 - 6.8 + 4.3 = 0$$

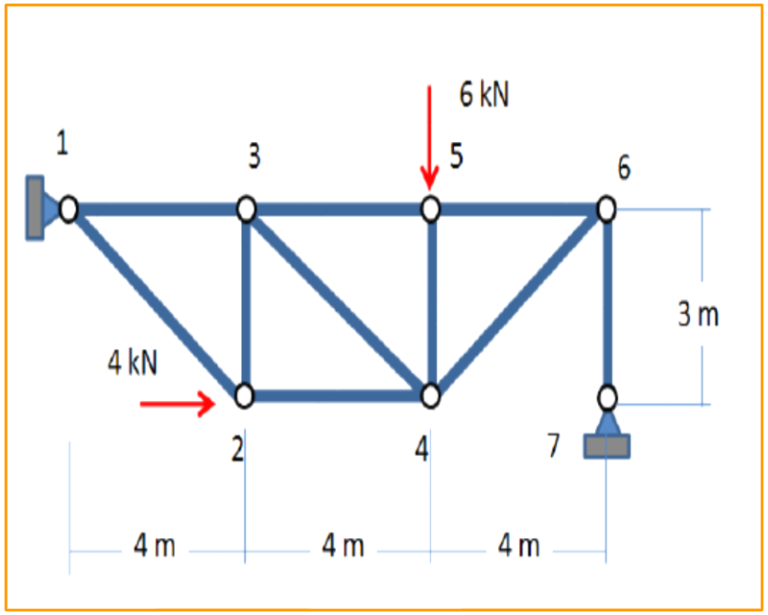


$$V_1 = 3\ kN$$

$$V_2 = 3\ kN$$

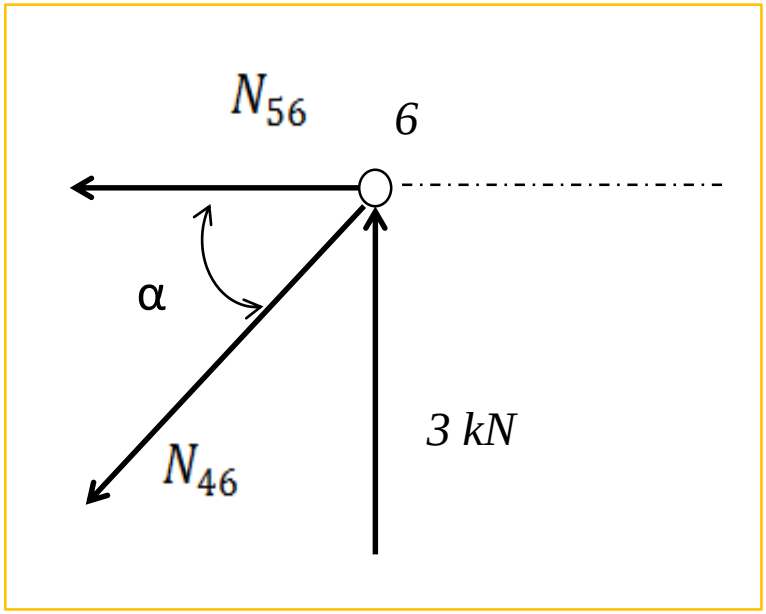
C) Force equilibrium in node 7

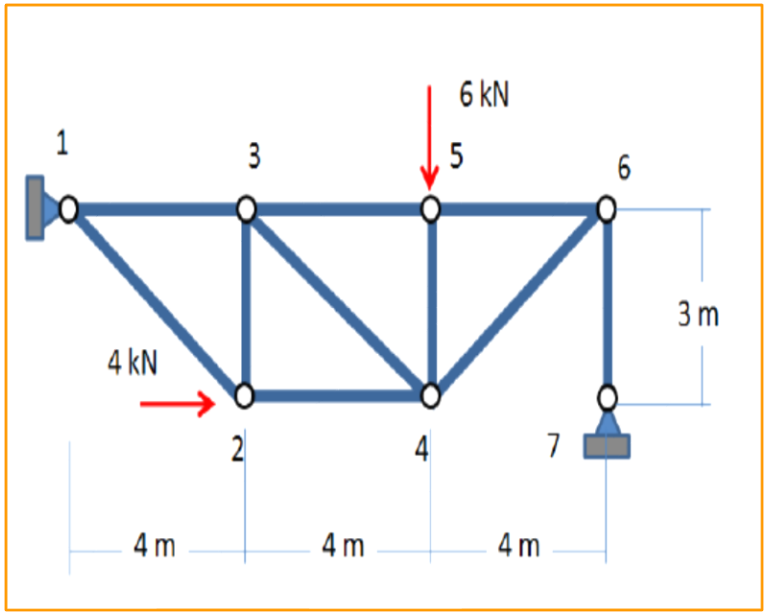




$$N_{67} = 3\ kN\ (C)$$

C) Force equilibrium in node 6





$$\sum F_x = 0 \quad N_{56} + N_{46}\cos\alpha = 0$$

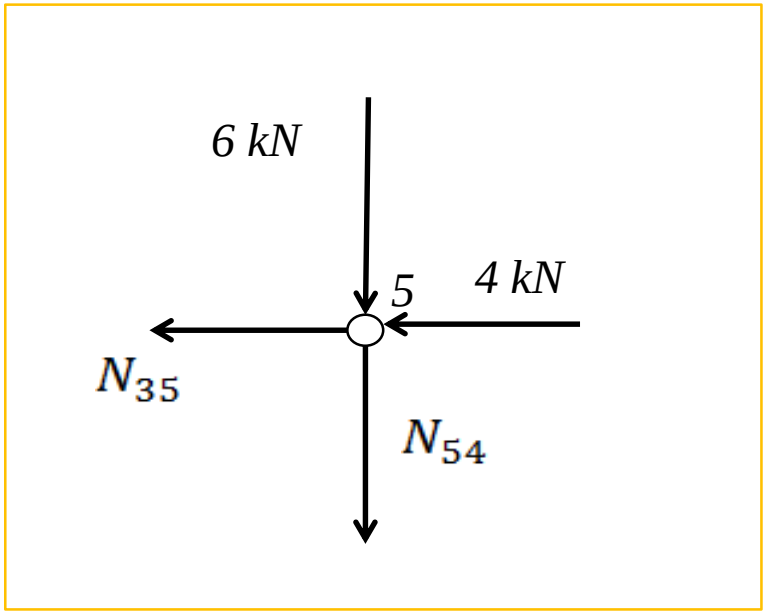
$$\sum F_y = 0 \quad N_{46}\sin\alpha - 3 = 0$$

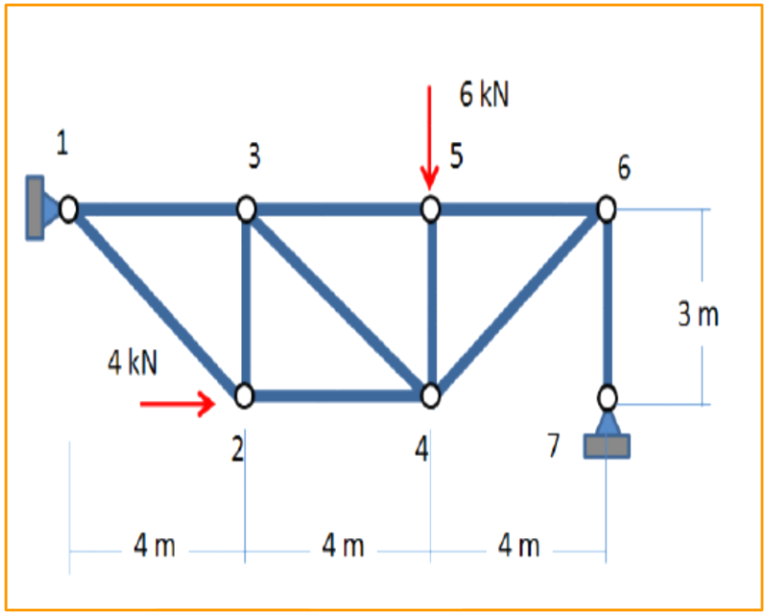
Using these expressions the following results are obtained:

$$N_{56} = 4\ kN\ (C)$$

$$N_{64} = 5\ kN\ (T)$$

C) Force equilibrium in node 5

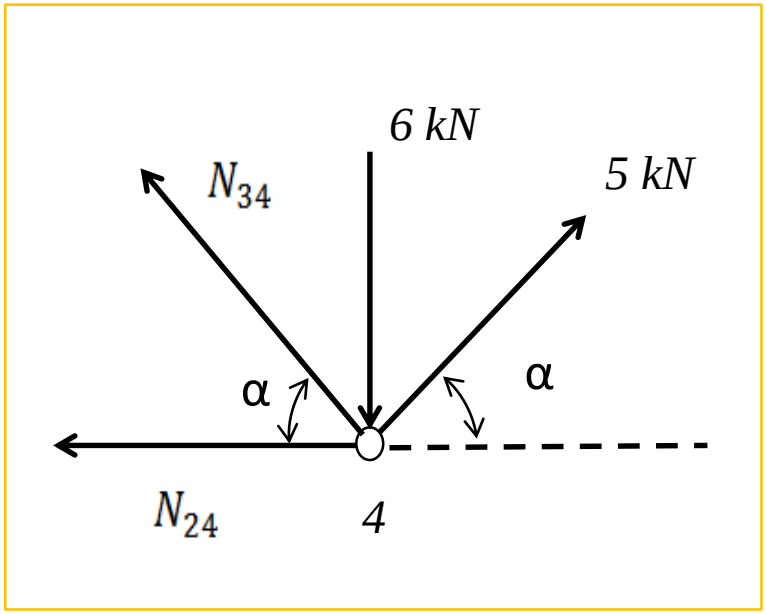


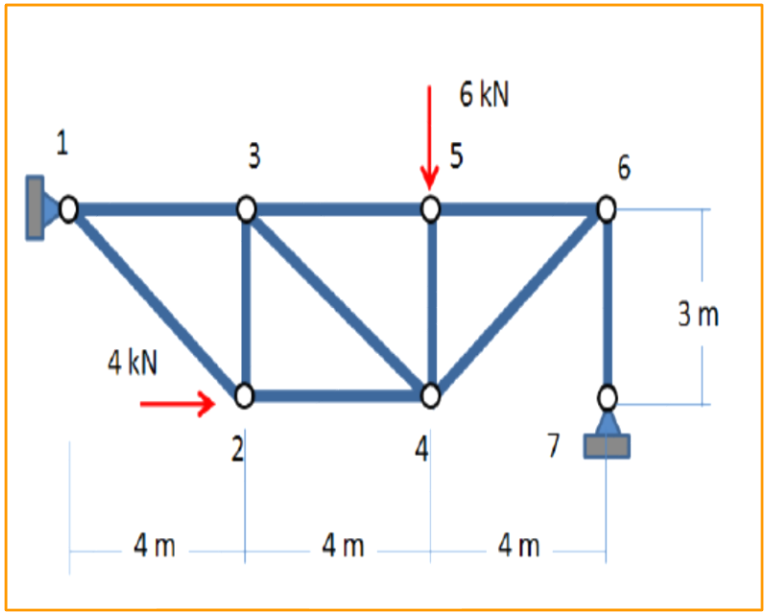


$$\sum F_x = 0 \qquad N_{35} = 4\ kN\ (C)$$

$$\sum F_y = 0 \qquad N_{54} = 6\ kN\ (C)$$

C) Force equilibrium in node 4





$$\sum F_x = 0 \quad N_{34}\cos\alpha + N_{24} - 5\cos\alpha = 0$$

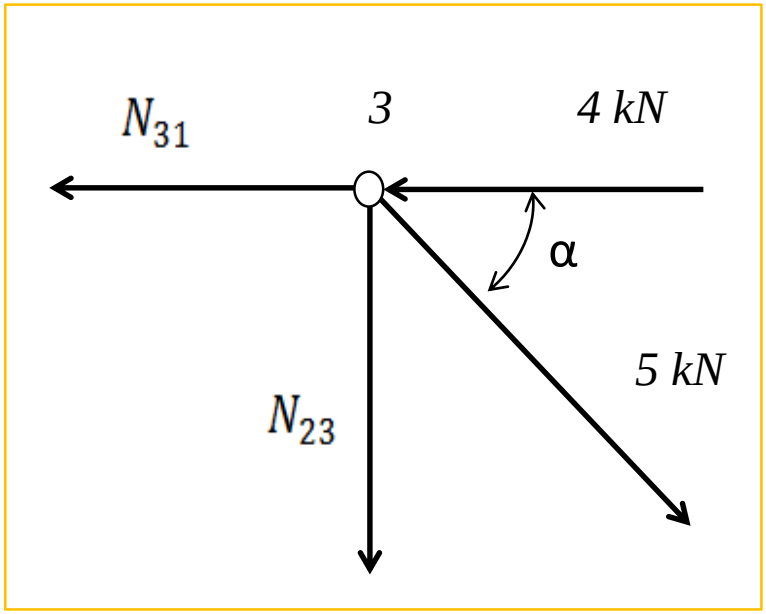
$$\sum F_y = 0 \quad N_{34}\sin\alpha - 6 + 5\sin\alpha = 0$$

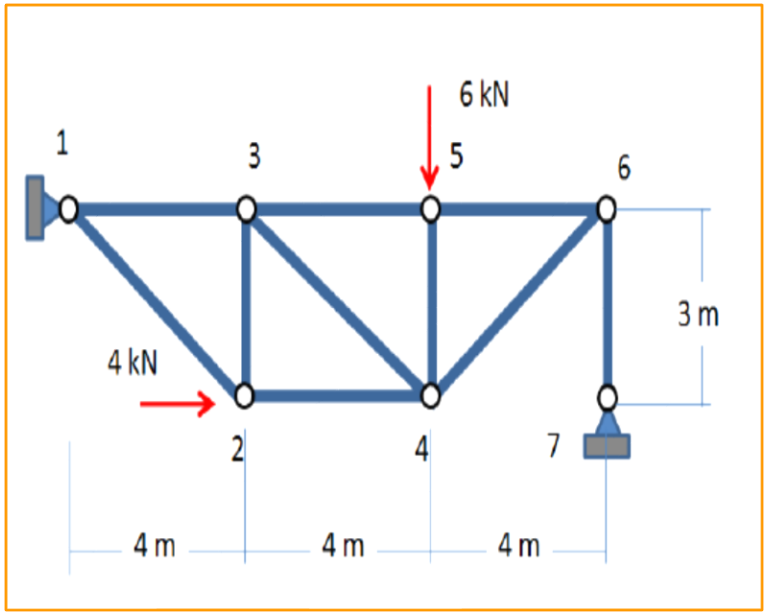
Using these expressions the following results are obtained:

$$N_{34} = 5\ kN\ (T)$$

$$N_{24} = 0\ kN$$

C) Force equilibrium in node 3





$$\sum F_x = 0 \quad N_{31} + 4 - 5\cos\alpha = 0$$

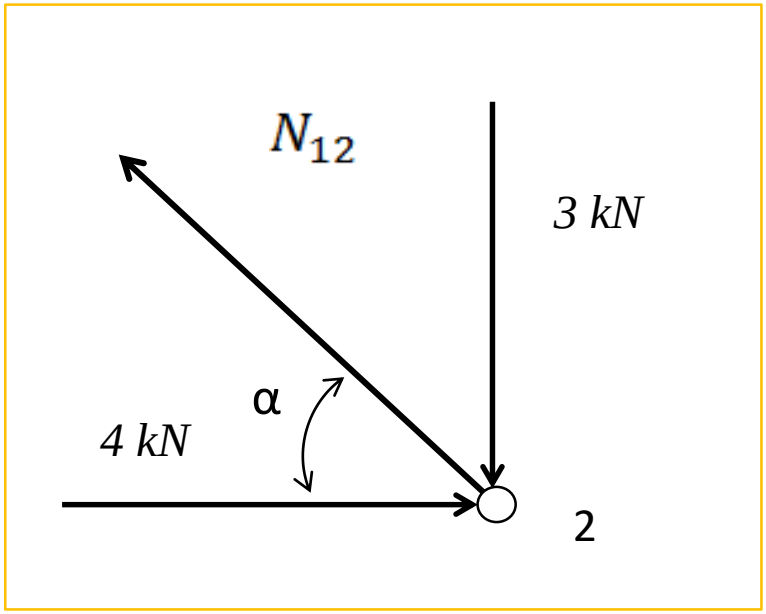
$$\sum F_y = 0 \quad N_{23} + 5\sin\alpha = 0$$

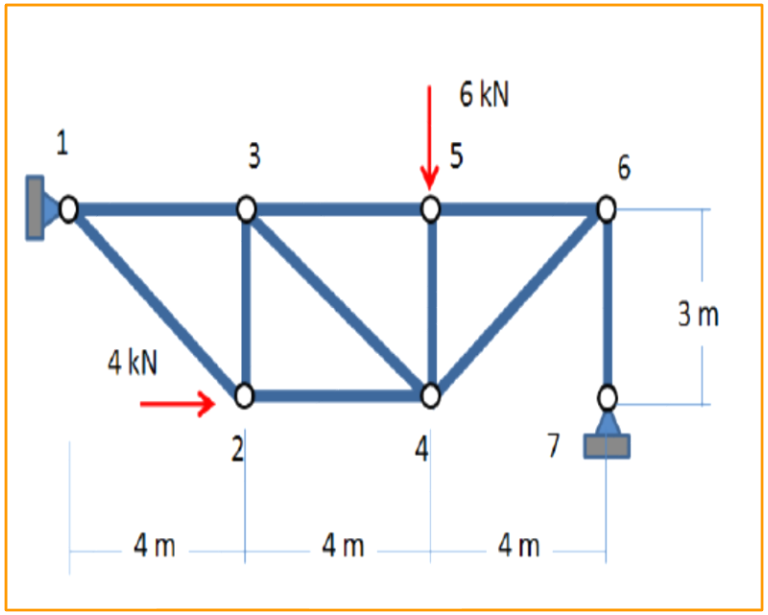
Using these expressions the following results are obtained:

$$N_{31} = 0\ kN$$

$$N_{23} = 3\ kN\ (C)$$

C) Force equilibrium in node 2



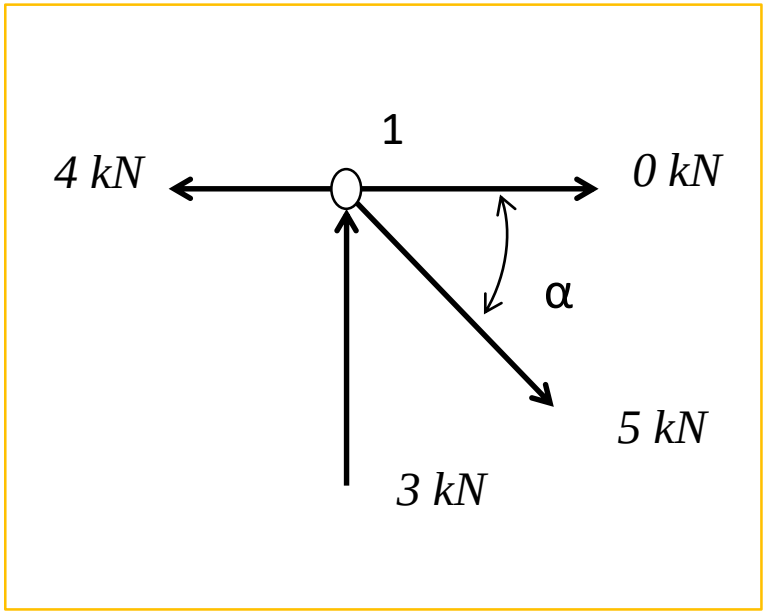


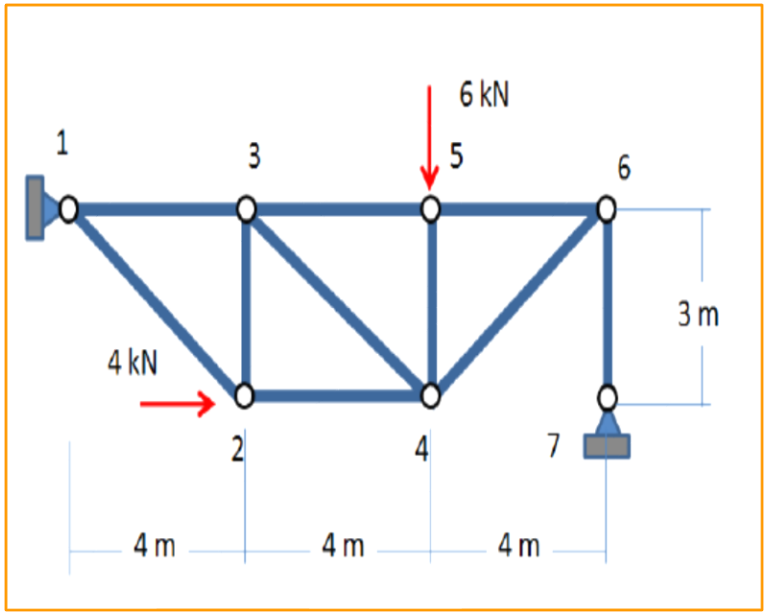
Using this expression the following result is obtained:

$$\sum F_x = 0 \qquad N_{12}\cos\alpha - 4 = 0$$

$$N_{12} = 5\ kN\ (T)$$

C) Force equilibrium in node 1





(only to be used to check the results)

$$\sum F_x = 0 \qquad 5\cos\alpha \equiv 4$$

$$\sum F_y = 0 \qquad 5\sin\alpha \equiv 3$$

Calculations are well performed

Computer Based Analysis

Estado 1 Deformada x 2129

Problema_21.dat

```
TITULO Problema 21. Método de los nudos

PARAMETROS
$  par val
   E   210.0e6   $ kPa
   A   10.0e-4   $ m2
   P   1.0       $ Tm

PUNTOS
$  pun X     Y
   1   0.0   0.0
   3   4.0   0.0
   5   8.0   0.0
   6   12.0  0.0
   2   4.0  -3.0
   4   8.0  -3.0
   7   12.0 -3.0

LINEAS
$  lin tipo  pun
   1   POL   1 3
   2   POL   3 5
   3   POL   5 6
   4   POL   1 2
   5   POL   2 4
   6   POL   4 6
   7   POL   6 7
   8   POL   2 3
   9   POL   3 4
  10   POL   5 4
  11   POL   4 6


MATERIALES
$  mat pro
   1   YOU E

PROPIEDADES
$  pro are
   1   A

ELEMENTOS_LINEAS
$  lin   tipo  mat pro
   TOD   ART   1   1

DESPLAZAMIENTOS_GLOBALES_PUNTOS
$  pun est DX    DY
   1   1   0.0   0.0
   7   1   0.0   0.0

CARGAS_GLOBALES_PUNTOS
$  pun est FX  FY
   2   1   4.0   0.0
   5   1   0.0 -6.0
```

Problema 21. Método de los nudos (estado 1)

Esfuerzos axiales