UNCUYO
UNIVERSIDAD
NACIONAL DE CUYO

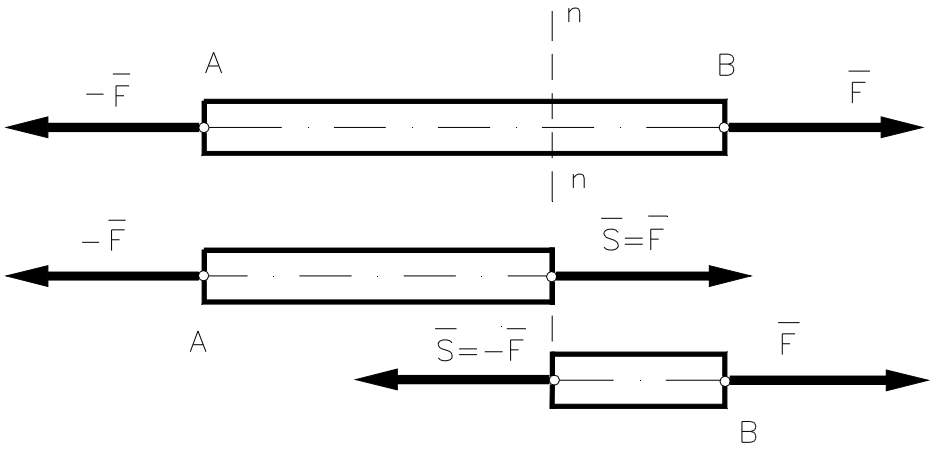
ESTÁTICA Y RESISTENCIA DE MATERIALES

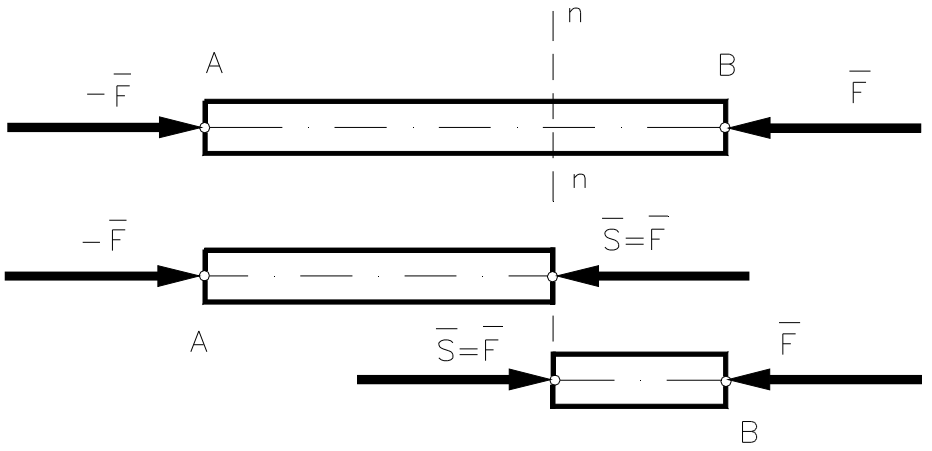
RETICULADOS

RETICULADOS

- ***¨Una estructura constituida por varias barras (de hierro, madera u hormigón) unidas por sus extremos en puntos llamados nudos, de manera tal que el conjunto así formado sea indeformable, se denomina armadura o reticulado rígido¨.-***
- Si a esta estructura le agregamos los vínculos que la fijan a tierra, hablamos de ***sistema reticulado.-***

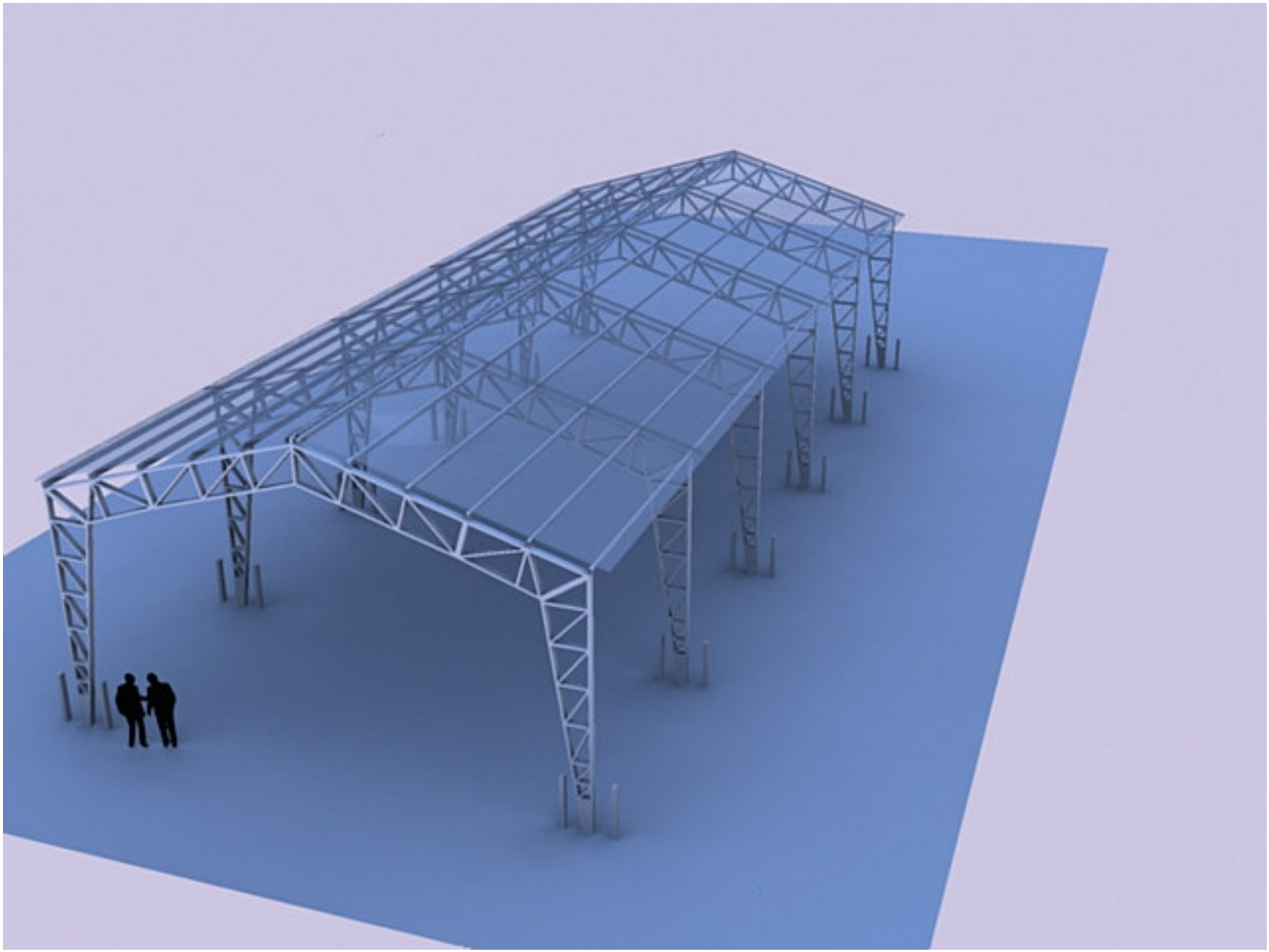
ESFUERZOS EN RETICULADOS
TRACCIÓN – COMPRESIÓN

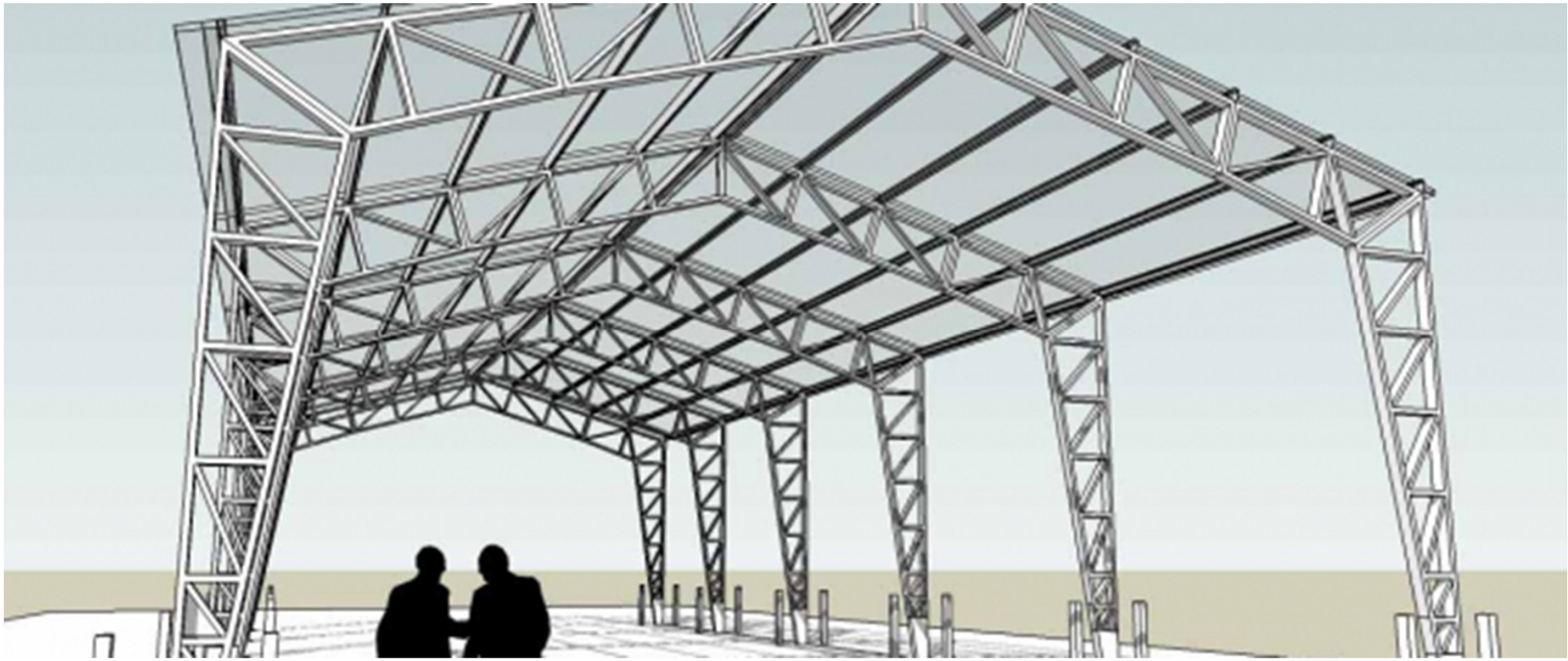




RETICULADOS PLANOS

RETICULADOS PLANOS



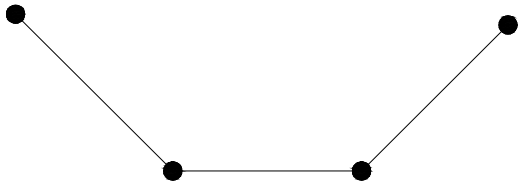


Reticulados para galpones

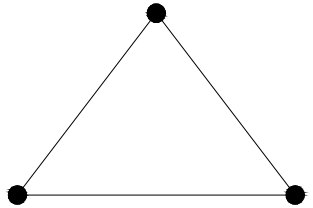
MENDOZA

Astoria-Megler Bridge (Astoria, EEUU)

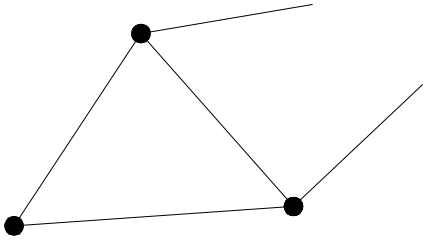
GENERACION DE RETICULADOS



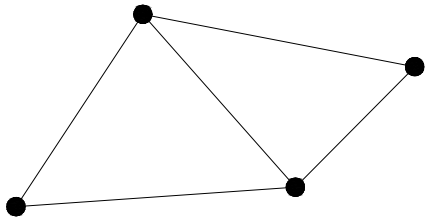
5 grados de libertad



3 grados de libertad



5 grados de libertad



3 grados de libertad

$$b=2\cdot v-3$$

Si llamamos “n” al número de pares de barras que se agregan al triángulo primitivo, el número total de barras será:

$$b = 2n + 3$$

Y como cada par de barras adicionales da origen a un nuevo vértice, el número de éstos será:

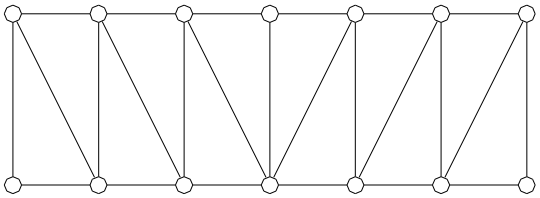
$$v = n + 3$$

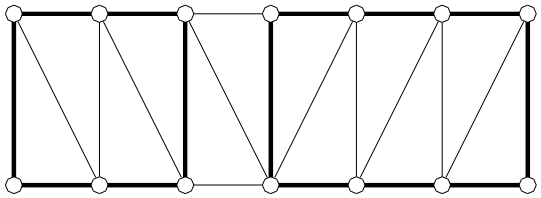
Despejando n de esta última y reemplazando en la primera se tiene:

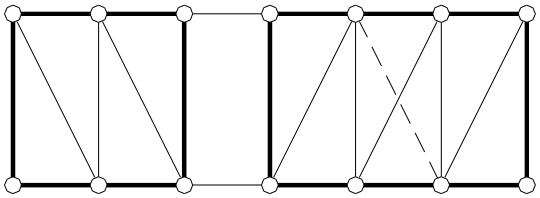
$$\mathbf{b = 2.v - 3}$$

DENOMINADA **CONDICIÓN DE RIGIDEZ**

DISEÑO

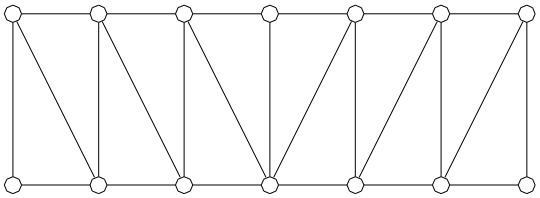


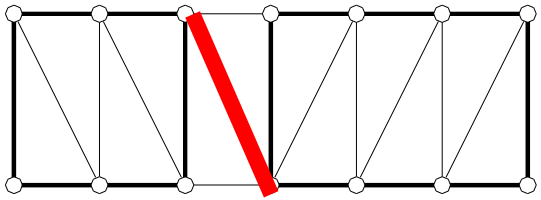


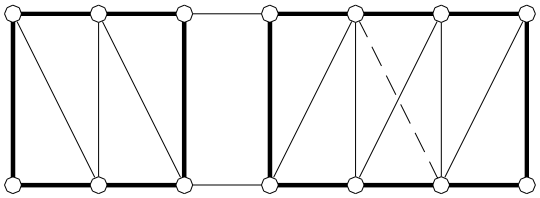


$$b=2\cdot v-3$$

DISEÑO

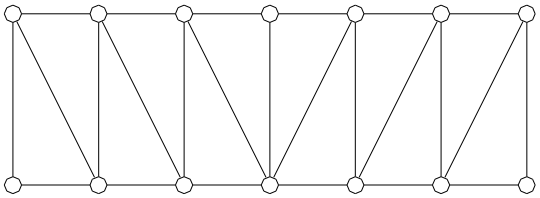


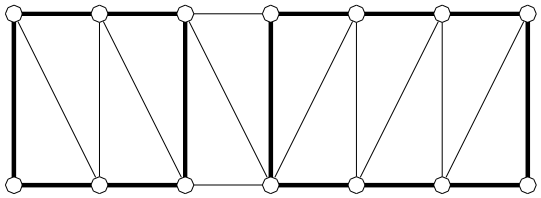


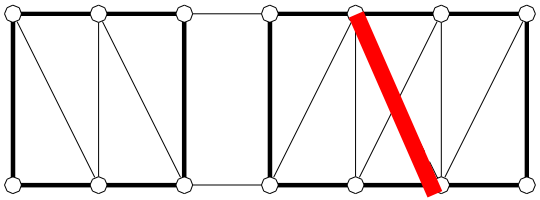


$$b=2\cdot v-3$$

DISEÑO





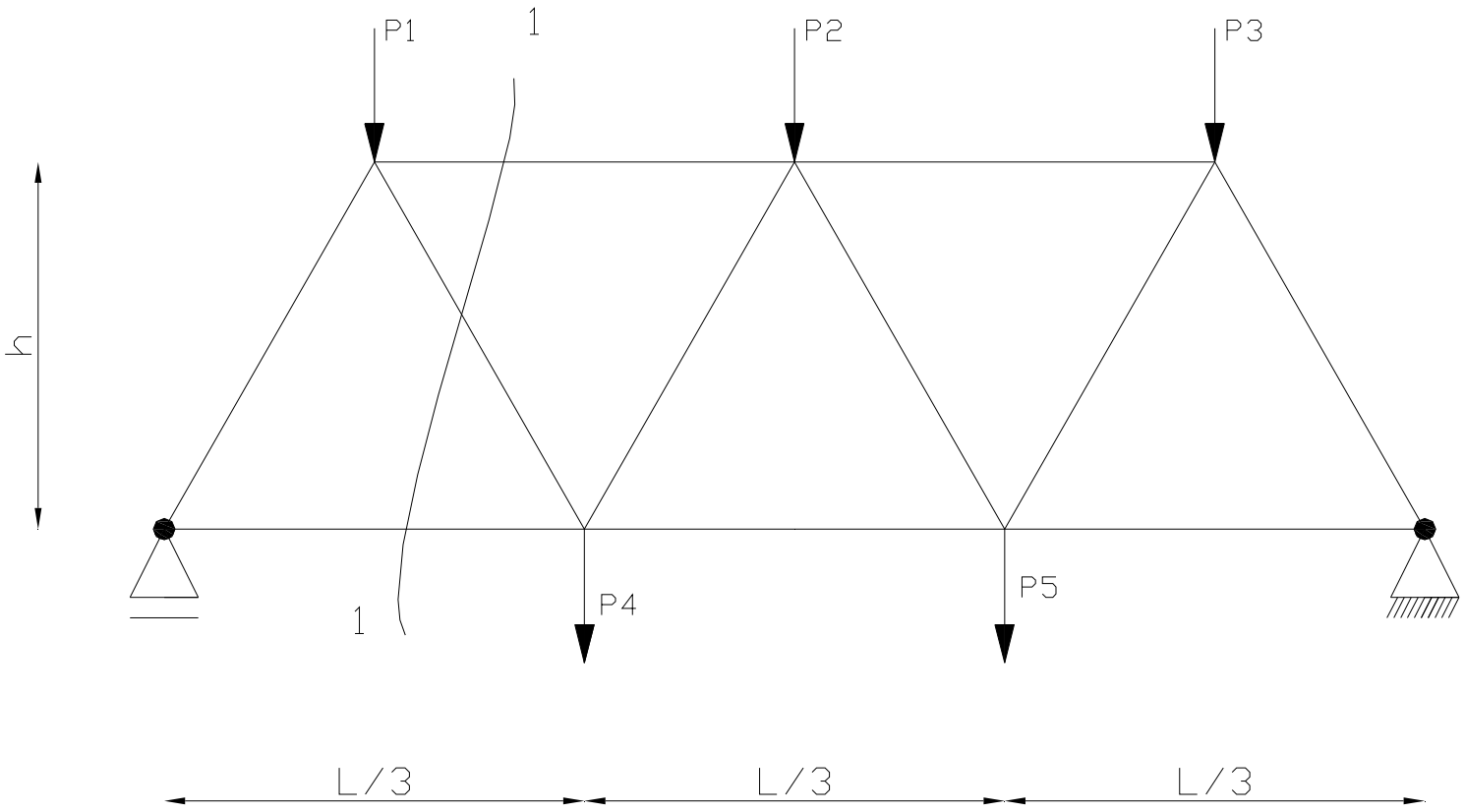


$$b=2\cdot v-3$$

RETICULADOS PLANOS

- **SIMPLES**
- **COMPUESTOS**
- **COMPLEJOS**

RETICULADO SIMPLE



$$b=2\cdot v-3$$

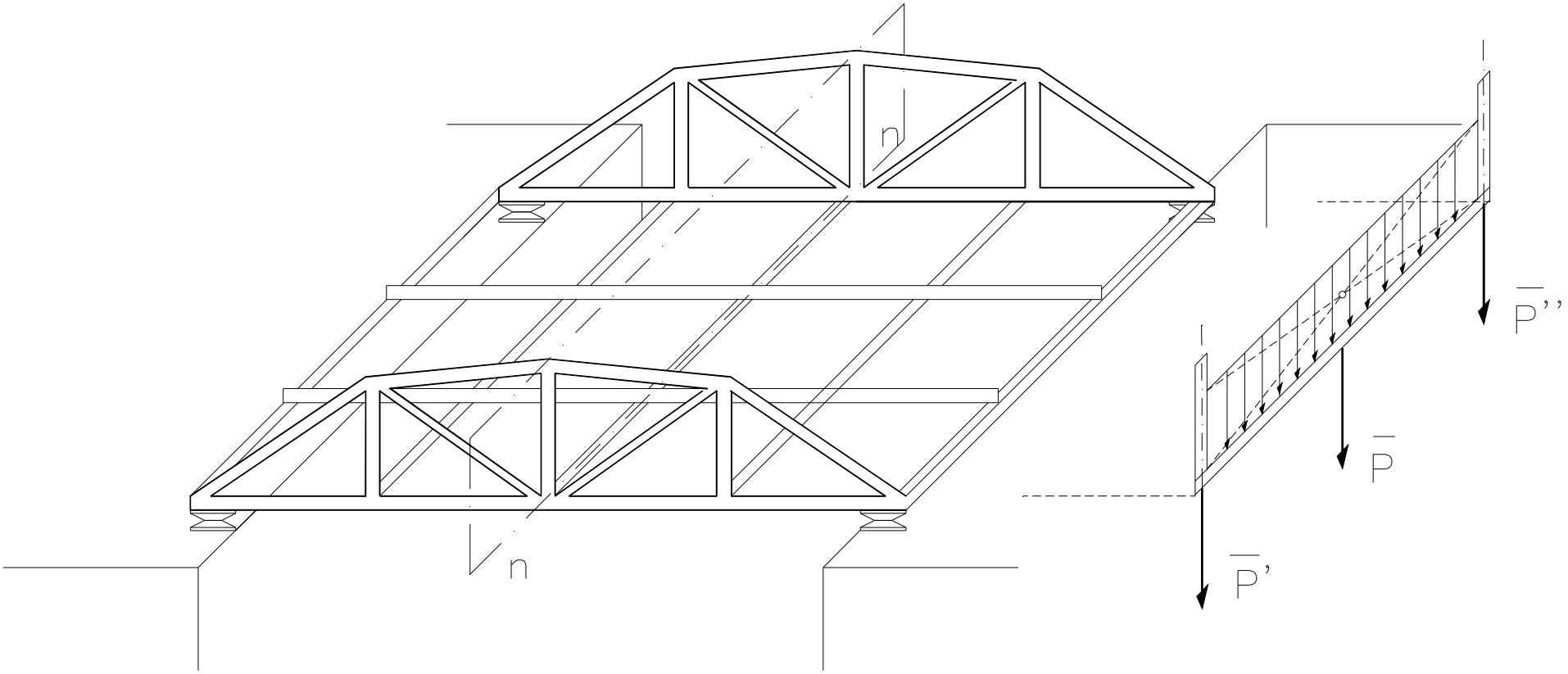
DETERMINACION DE ESFUERZOS EN BARRAS

HIPÓTESIS

RETICULADOS

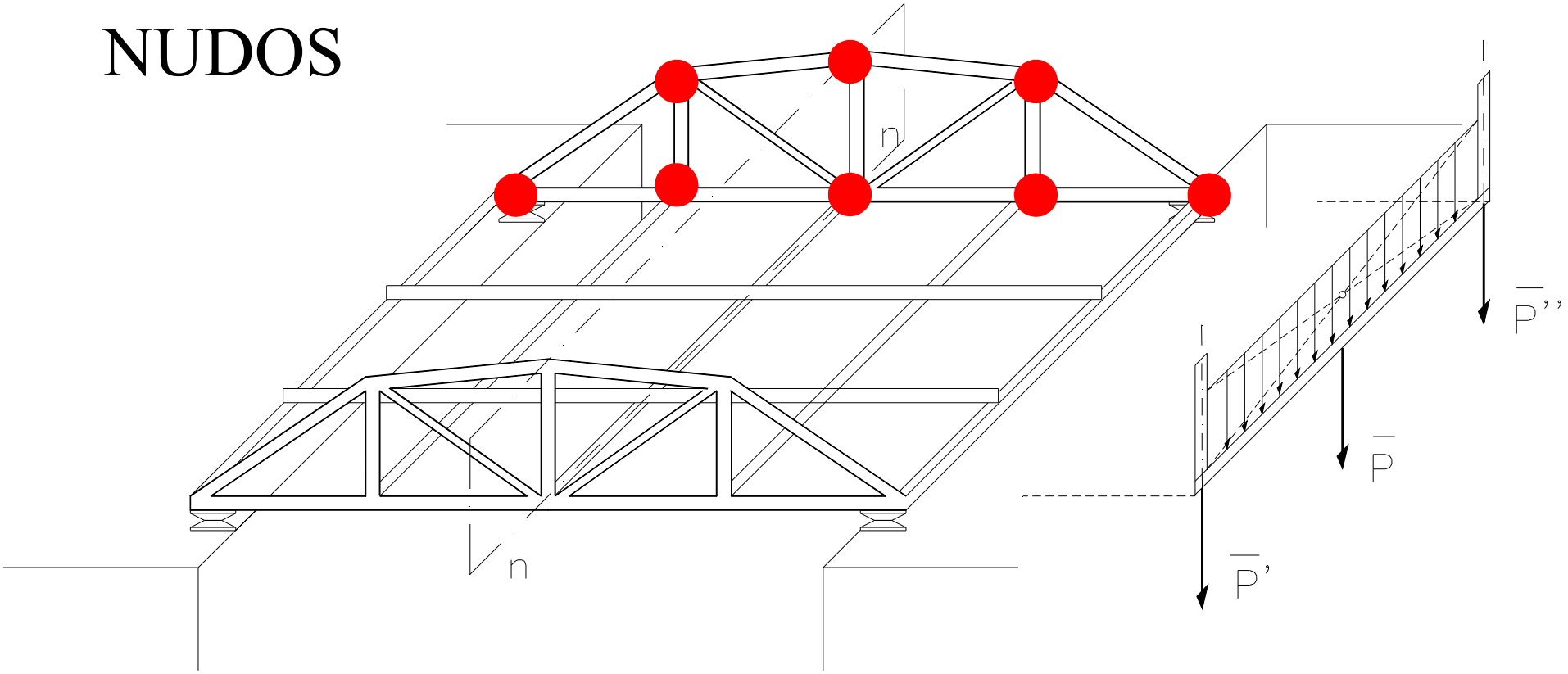
- Para determinar los esfuerzos que se originan en las barras se formulan dos hipótesis que, con la suficiente aproximación, permiten abordar el cálculo con sencillez.-
- Se supone primero ***que las barras se encuentran articuladas en los nudos*** y,
- en segundo término, ***que las fuerzas exteriores actúan solamente en ellos.-***

RETICULADOS



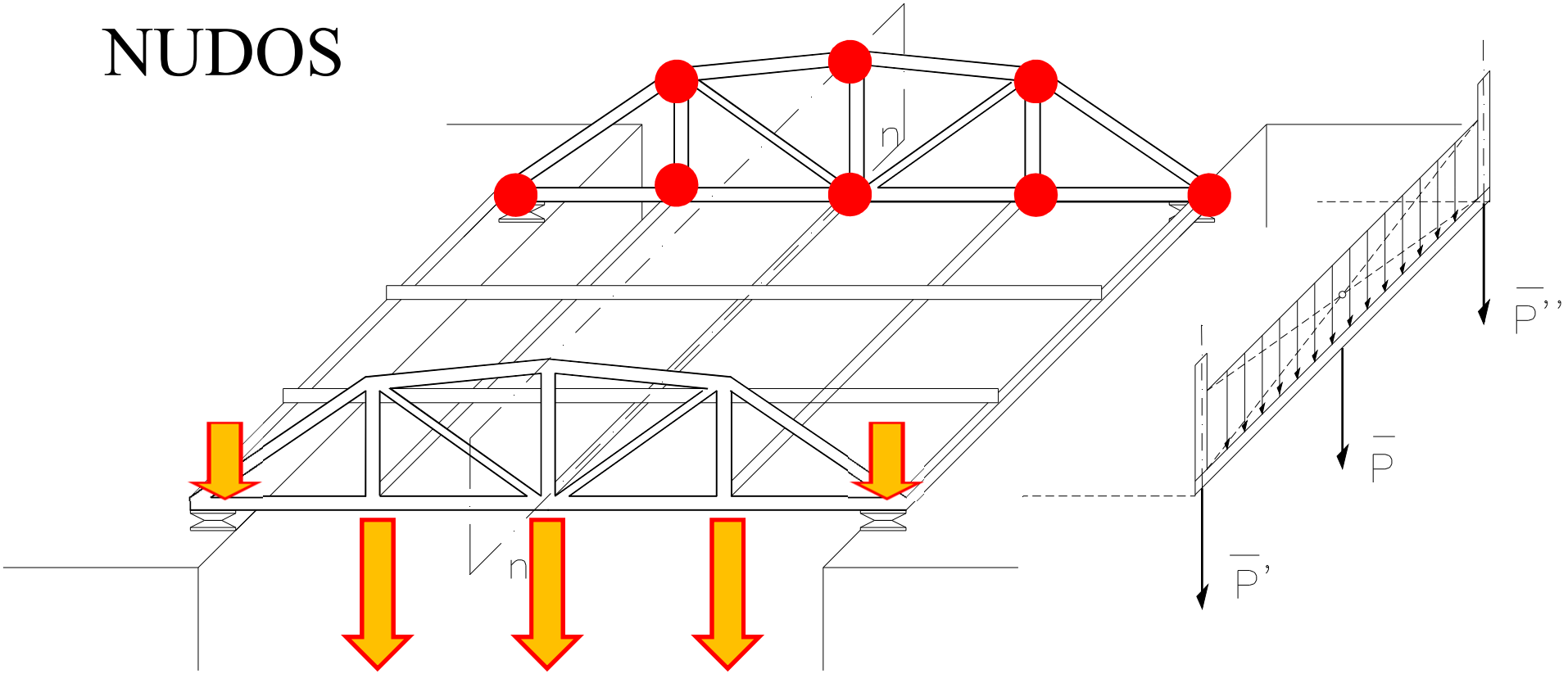
RETICULADOS

NUDOS



RETICULADOS

NUDOS

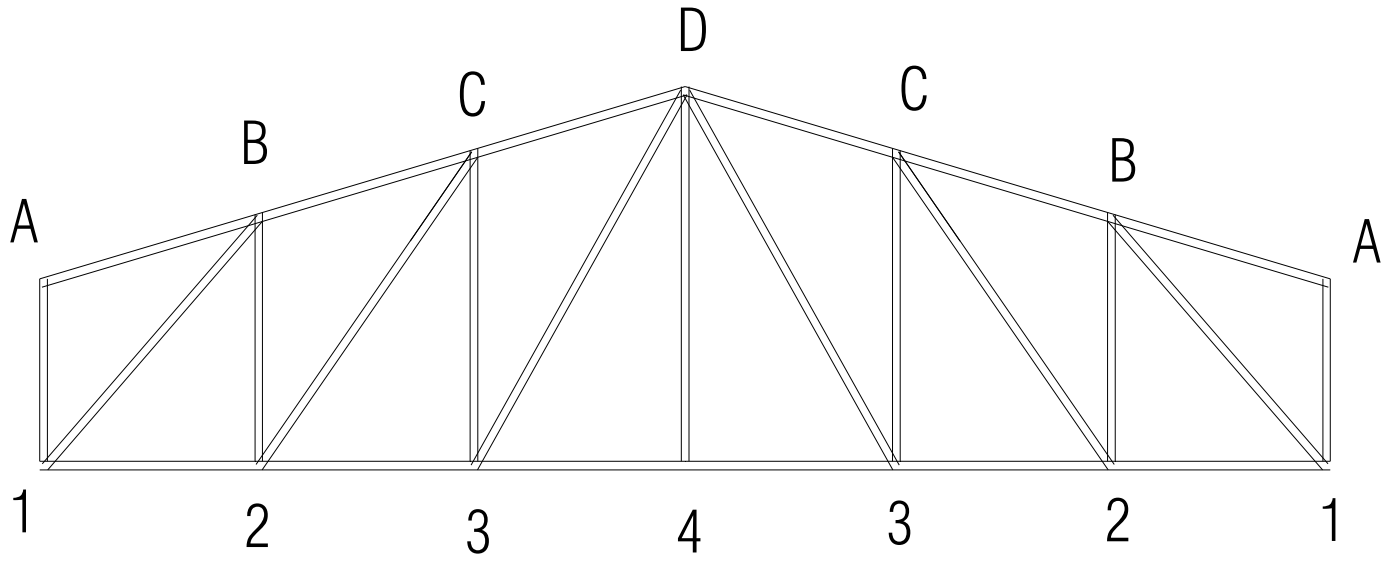


CARGAS

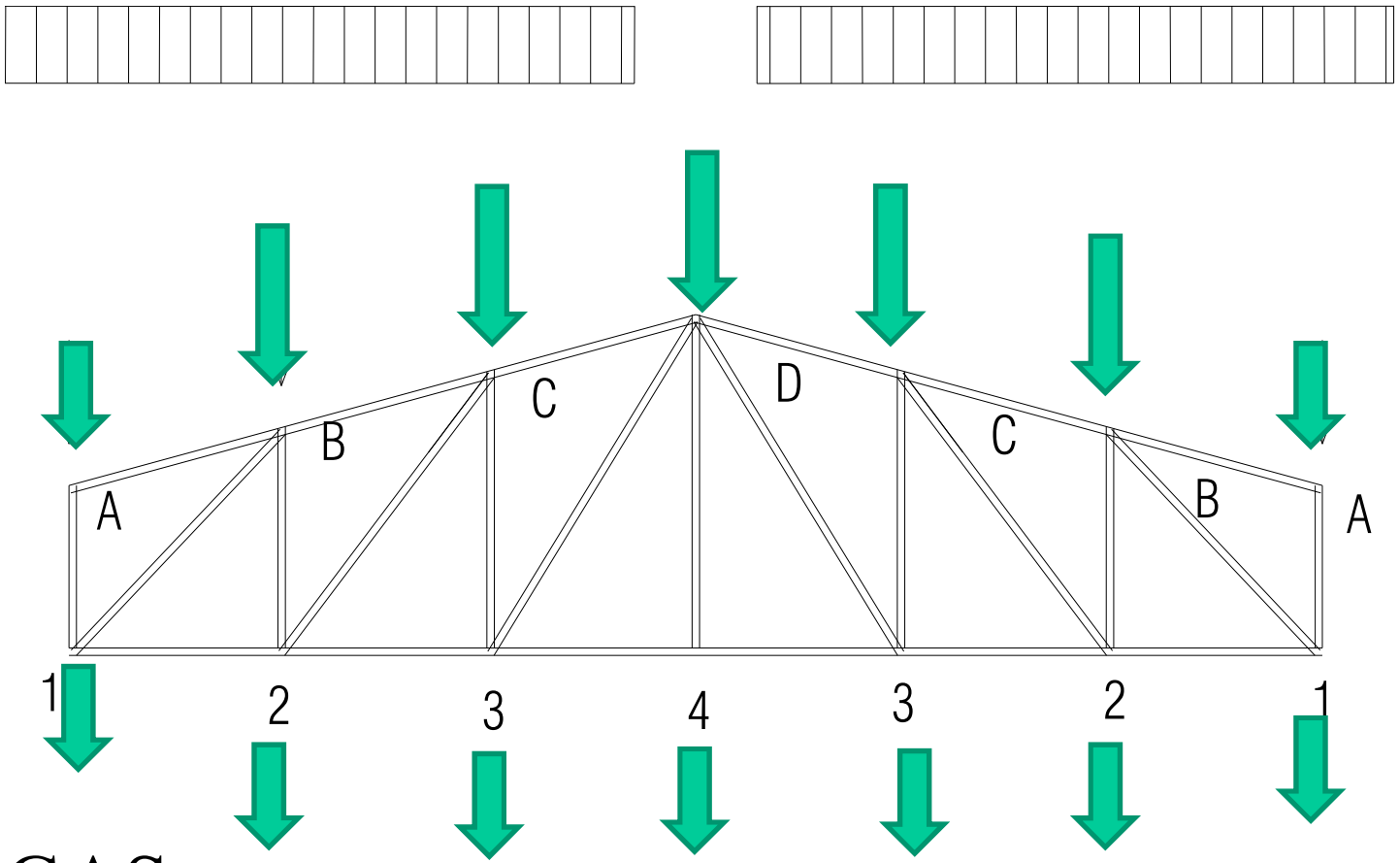
DETERMINACION DE ESFUERZOS EN BARRAS

MÉTODO DE LOS NUDOS
MÉTODO DE LAS SECCIONES

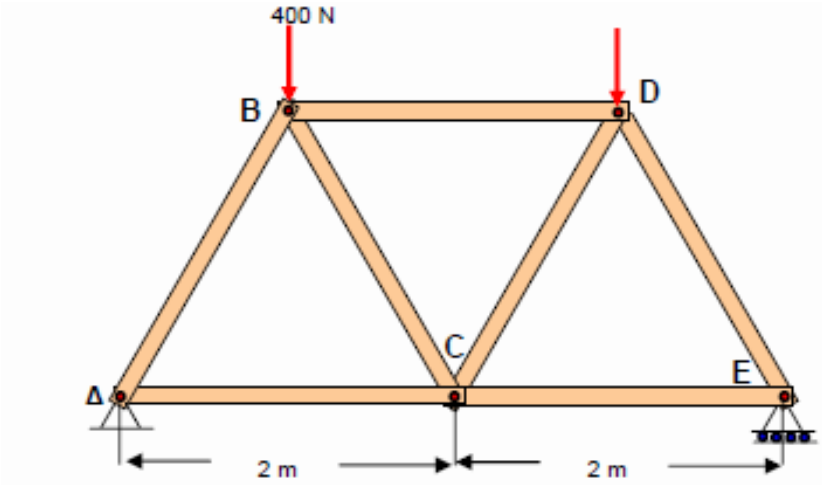
MÉTODO DE LOS NUDOS



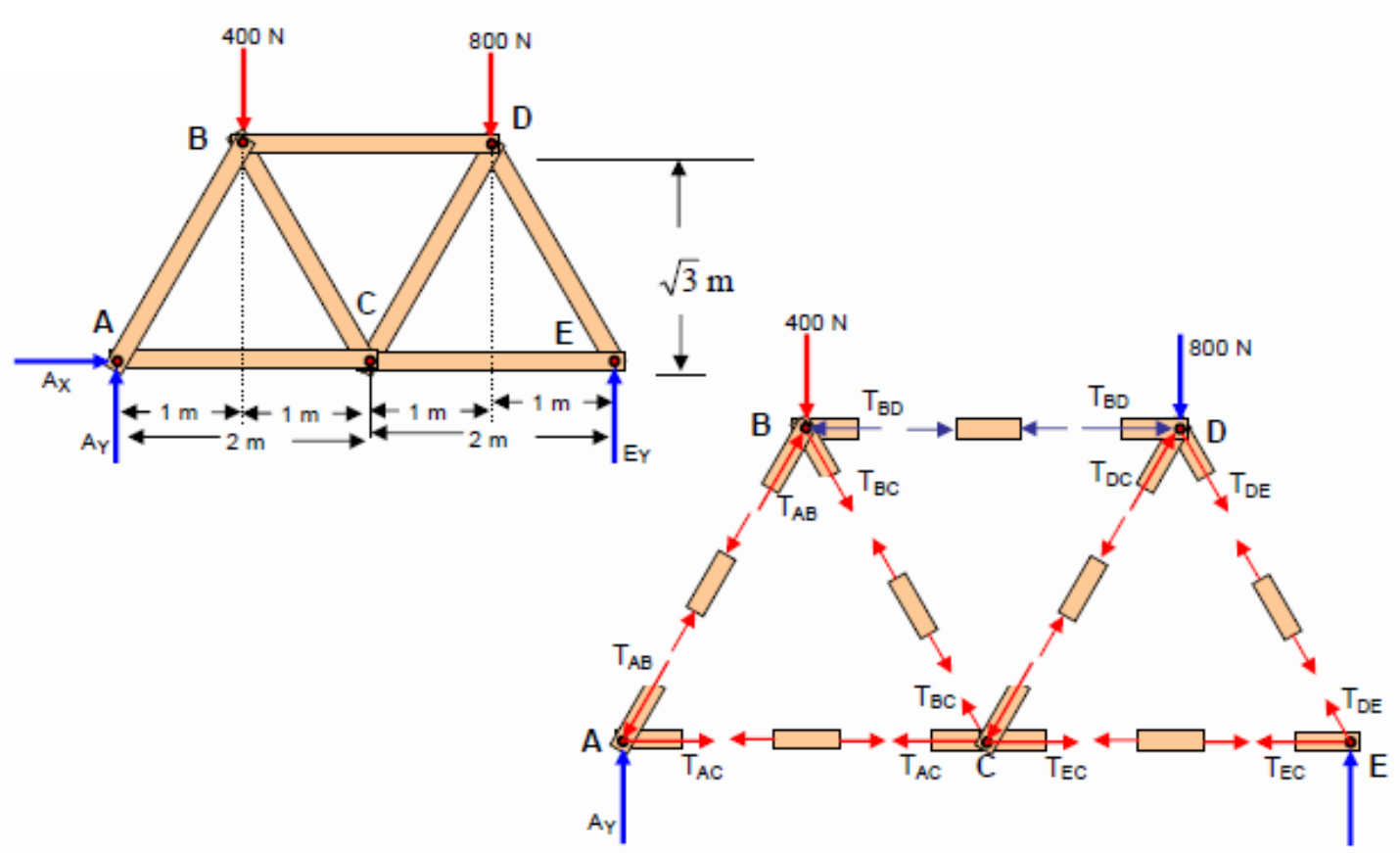
MÉTODO DE LOS NUDOS



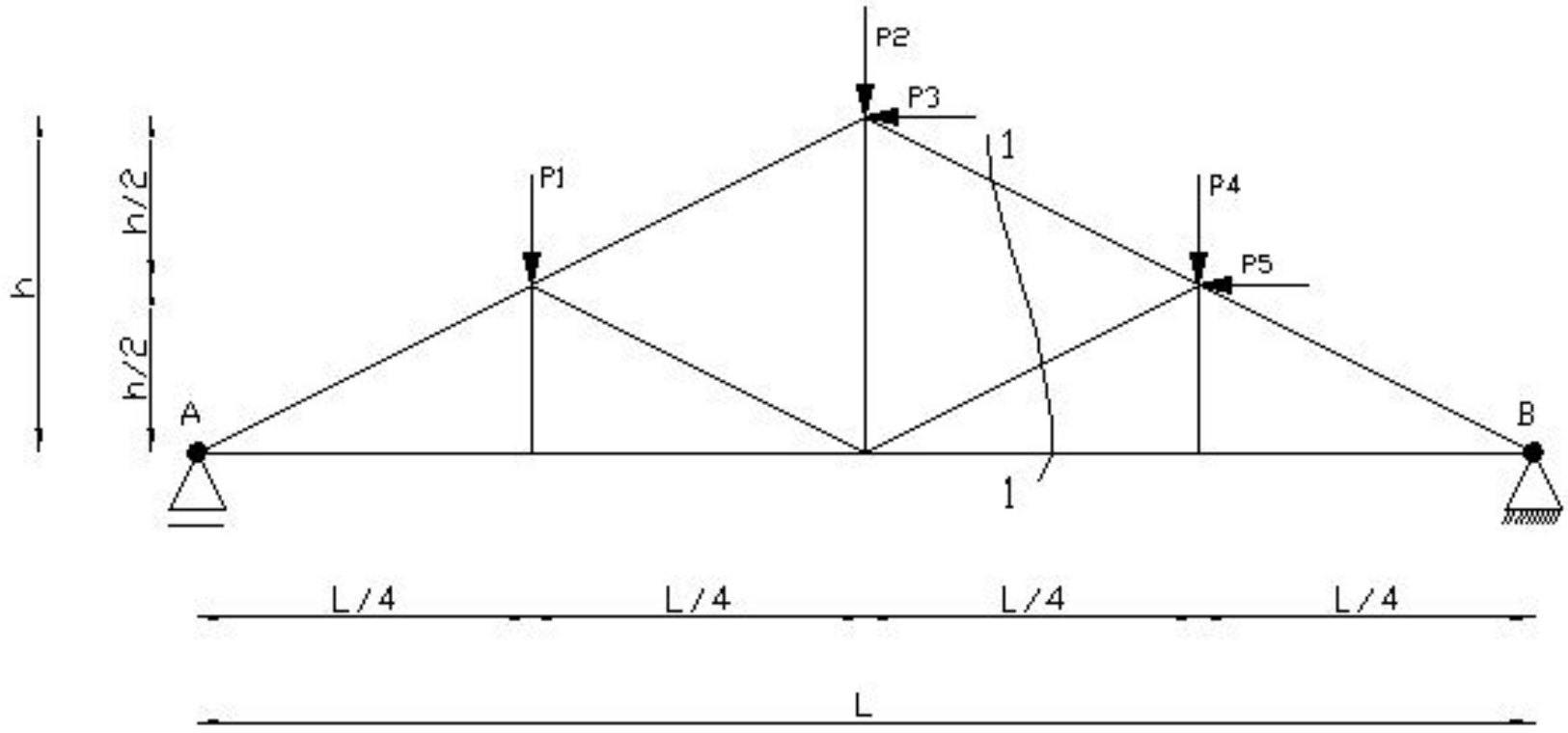
CARGAS



Armadura **WARREN** soportando dos cargas



EJERCICIO MODELO



P_1 a P_5=30KN

L=16m ; h= 4m

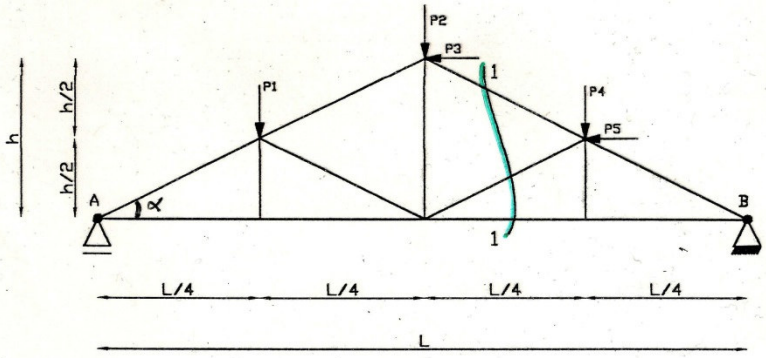
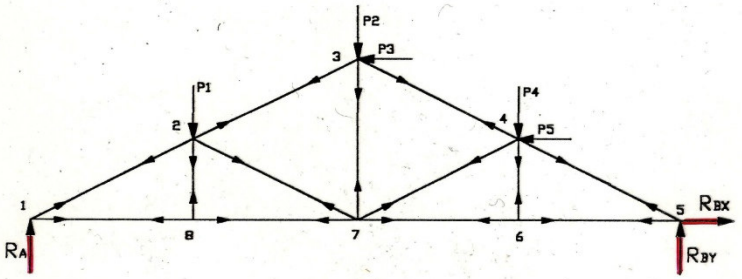


Diagrama de cuerpo libre



b = 2v - 3

L=	16 m
h=	4 m
P1=	30 KN
P2=	30 KN
P3=	30 KN
P4=	30 KN
P5=	30 KN
α =	26.6 °

Resolución Ejercicio Modelo:

Σ Fx = 0 = - P3 - P5 + R_{BX} = 0

R_{BX} = P3 + P5 = **60.0 KN**

$\Sigma M_B = 0 = R_A.L - P1.3/4.L - P2.L/2 - P3.h - P5.h/2 - P4.L/4 = 0$

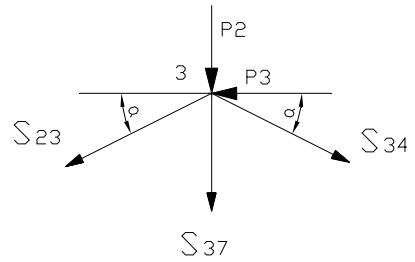
R_A = (P1.3/4.L + P2.L/2 + P3.h + P5.h/2 + P4.L/4) / L= **56.3 KN**

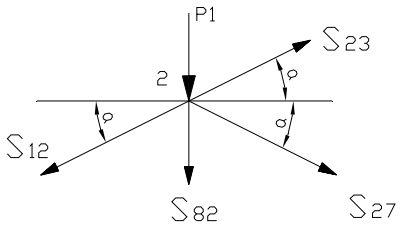
$\Sigma M_A = 0 = P1.L/4 + P2.L/2 - P3.h - P5.h/2 + P4.3/4.L - R_{BY}.L = 0$

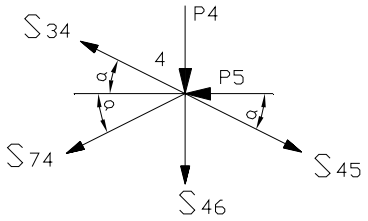
R_{BY} = (P1.L/4 + P2.L/2 - P3.h - P5.h/2 + P4.3/4.L) / L = **33.75 KN**

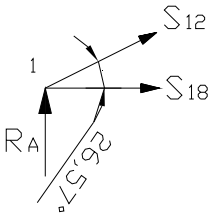
Verificación de reacciones:

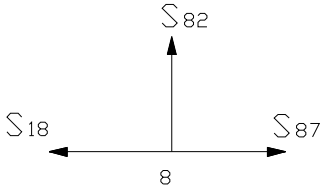
$\Sigma Fy = R_A + R_{BY} - P1 - P2 - P4$= 0.0 KN

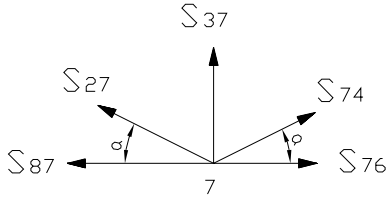


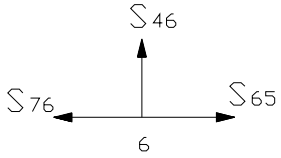


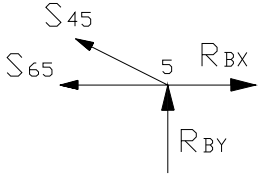










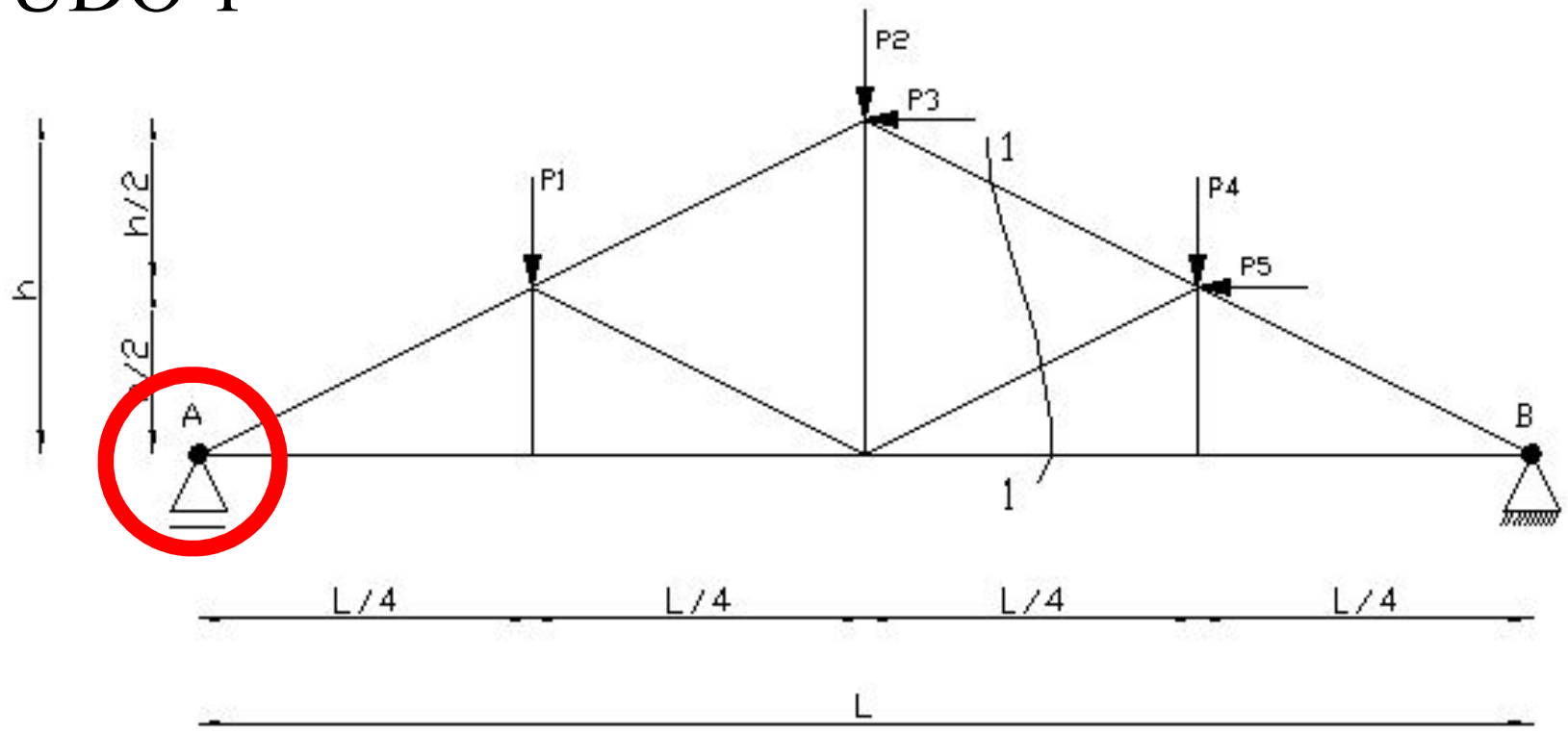


$$\Sigma X = 0$$

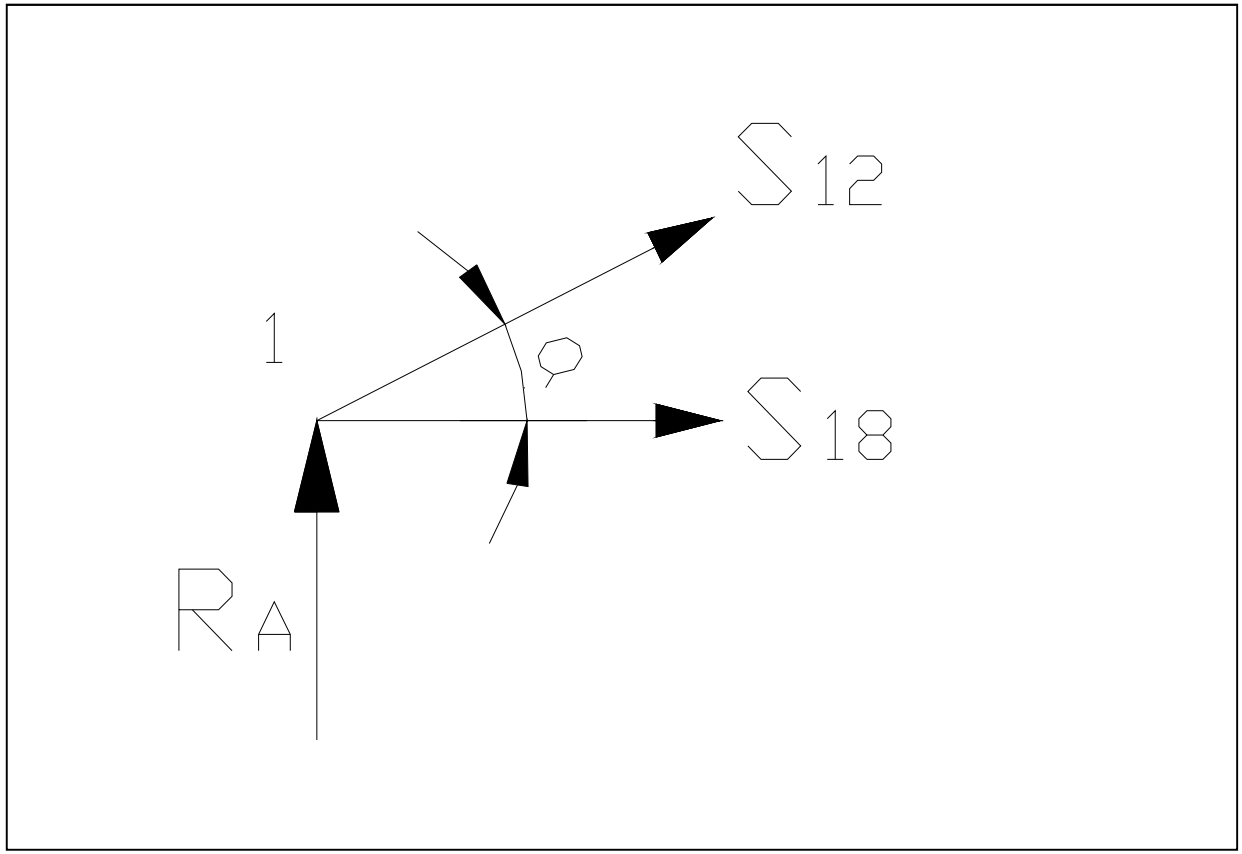
$$\Sigma Y = 0$$

EJERCICIO MODELO

NUDO 1



NUDO 1

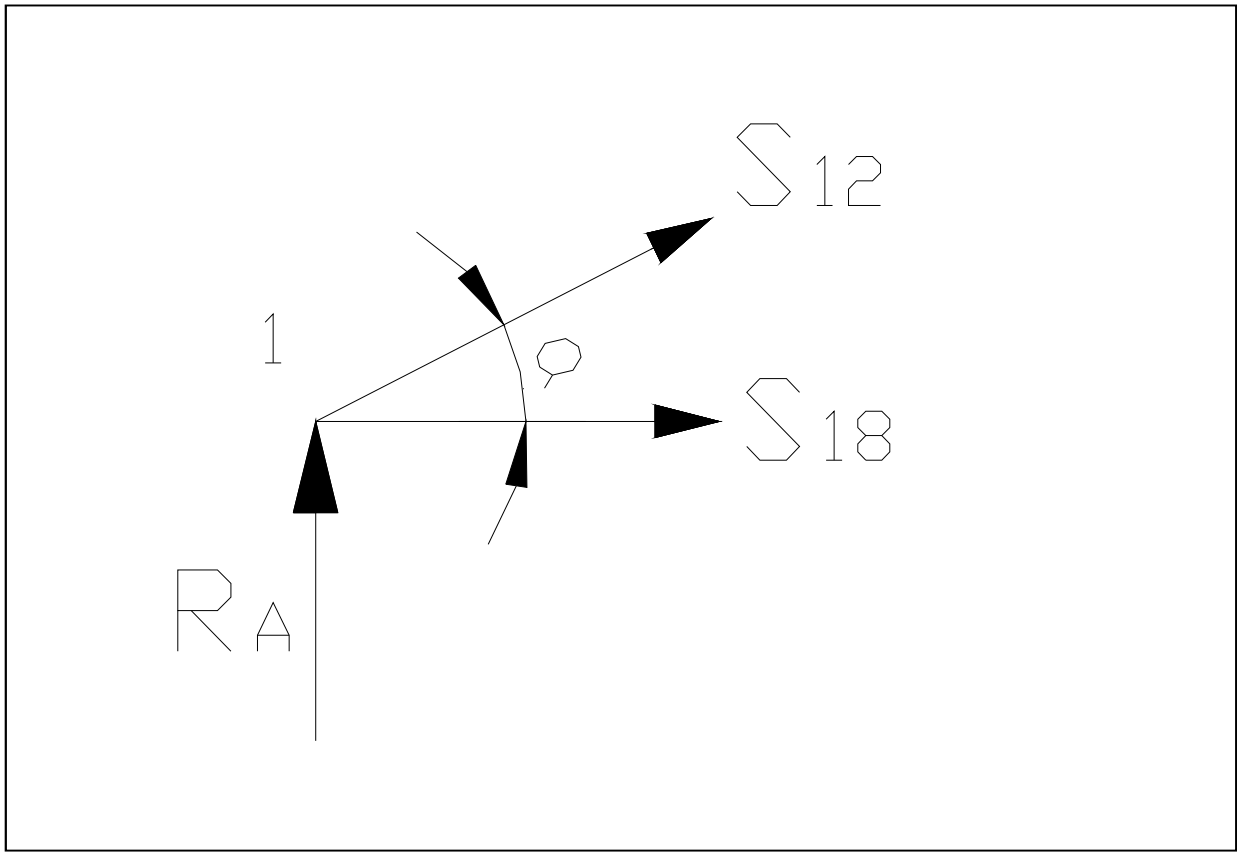


$$\Sigma X = 0$$
$$\Sigma Y = 0$$

NUDO 1

$R_A = 56{,}3$ KN

$$\Sigma X = 0$$
$$\Sigma Y = 0$$



$$\Sigma X = S_{12}.\cos a + S_{18} = 0$$

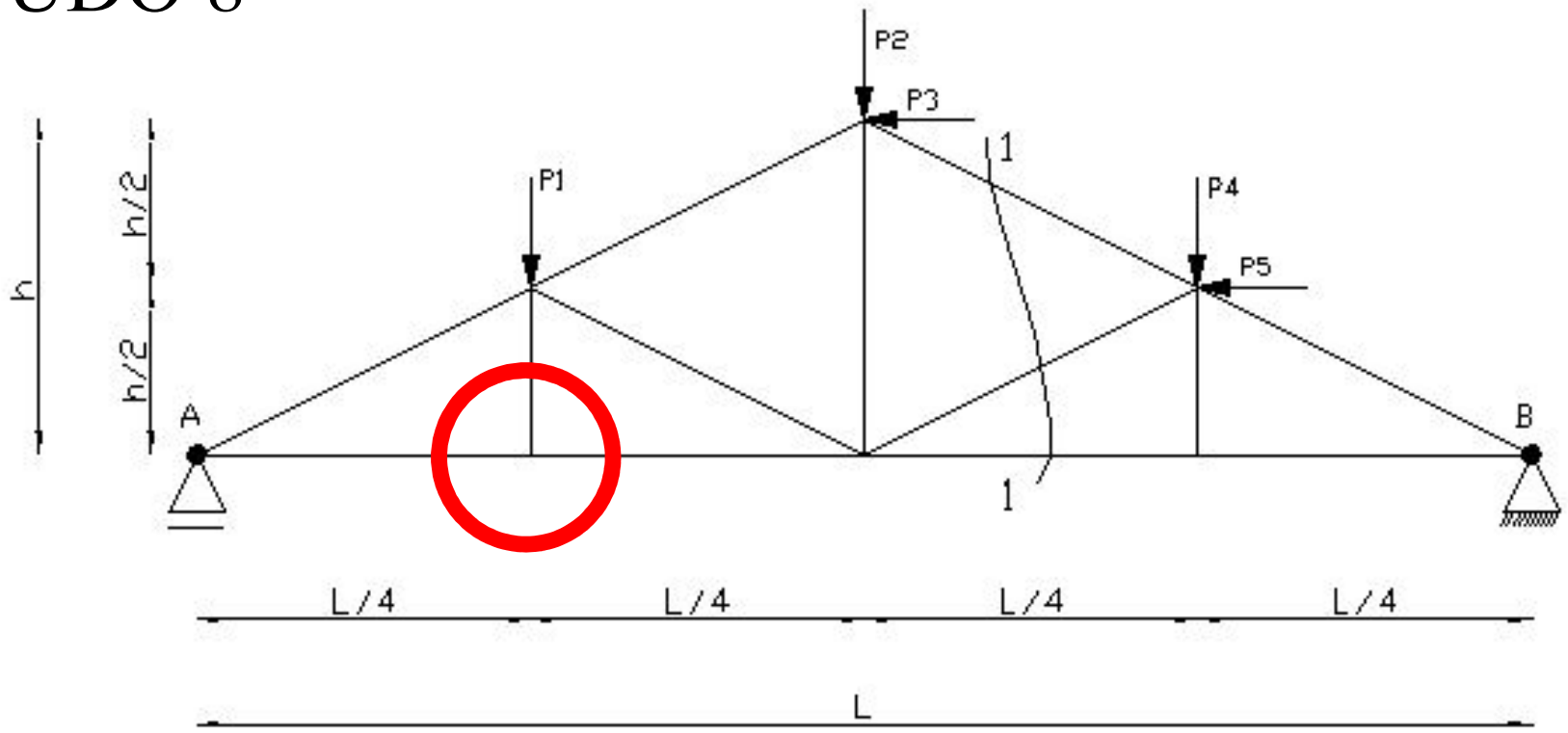
$$\Sigma Y = S_{12}.\text{sen } a + R_A = 0$$

$$S_{12} = - R_A / \text{sen } a = -125{,}8 \text{ KN}$$

$$S_{18} = - S_{12}.\cos a = 112, \text{ KN}$$

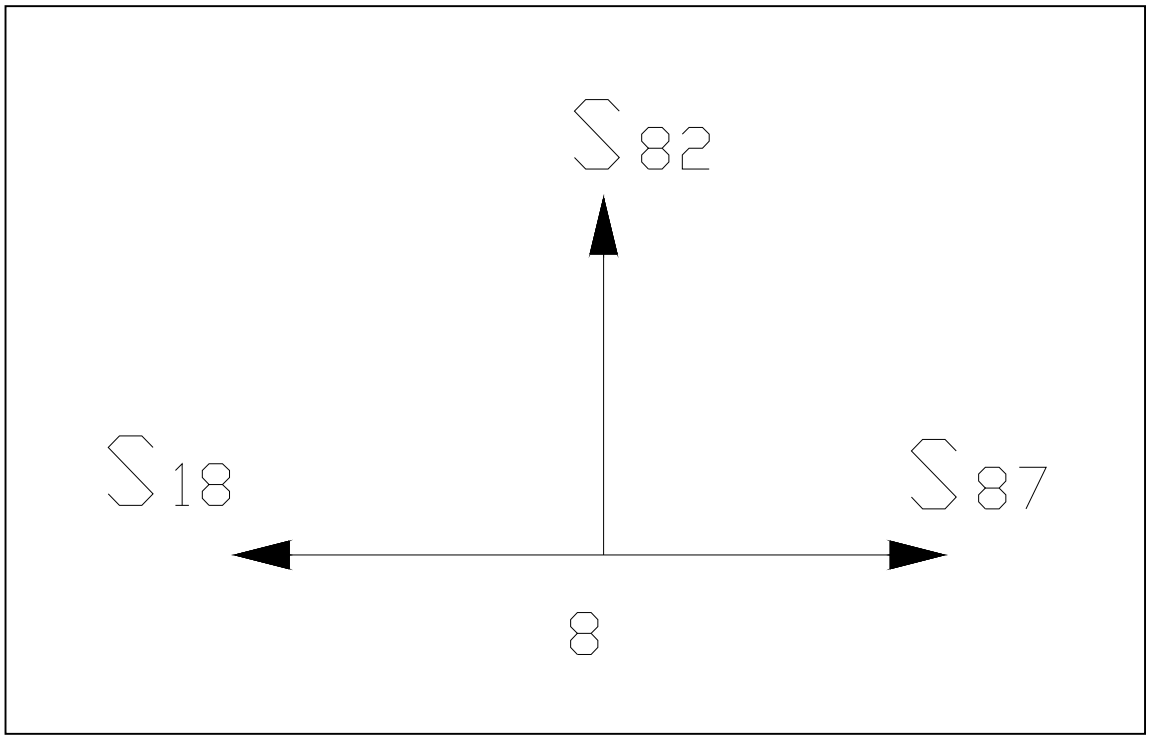
EJERCICIO MODELO

NUDO 8



NUDO 8

$$\Sigma X = 0$$
$$\Sigma Y = 0$$



$$\Sigma X = S_{87} - S_{18} = 0$$

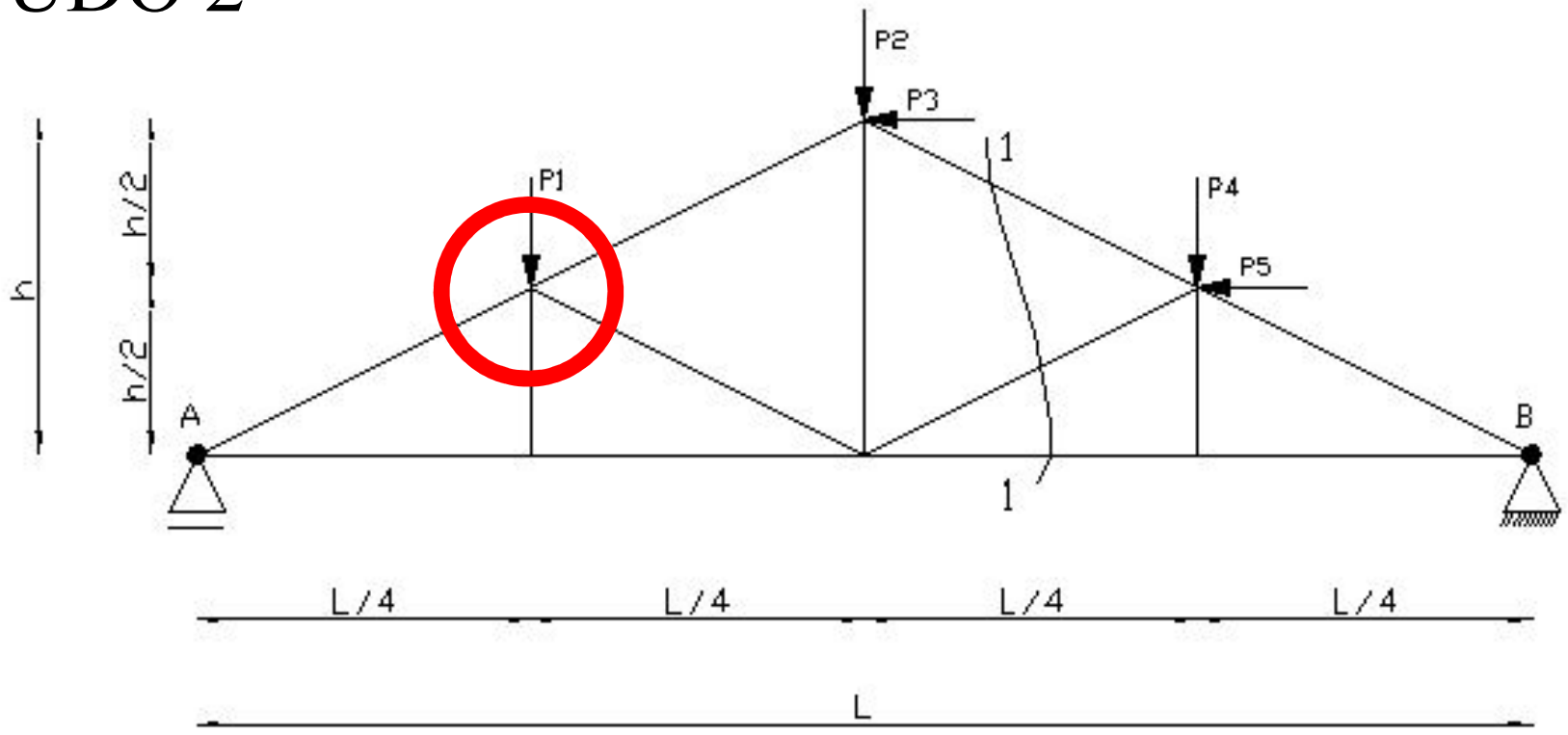
$$\Sigma Y = S_{82} = 0$$

$$S_{87} = S_{18} = 112{,}5 \text{ KN}$$

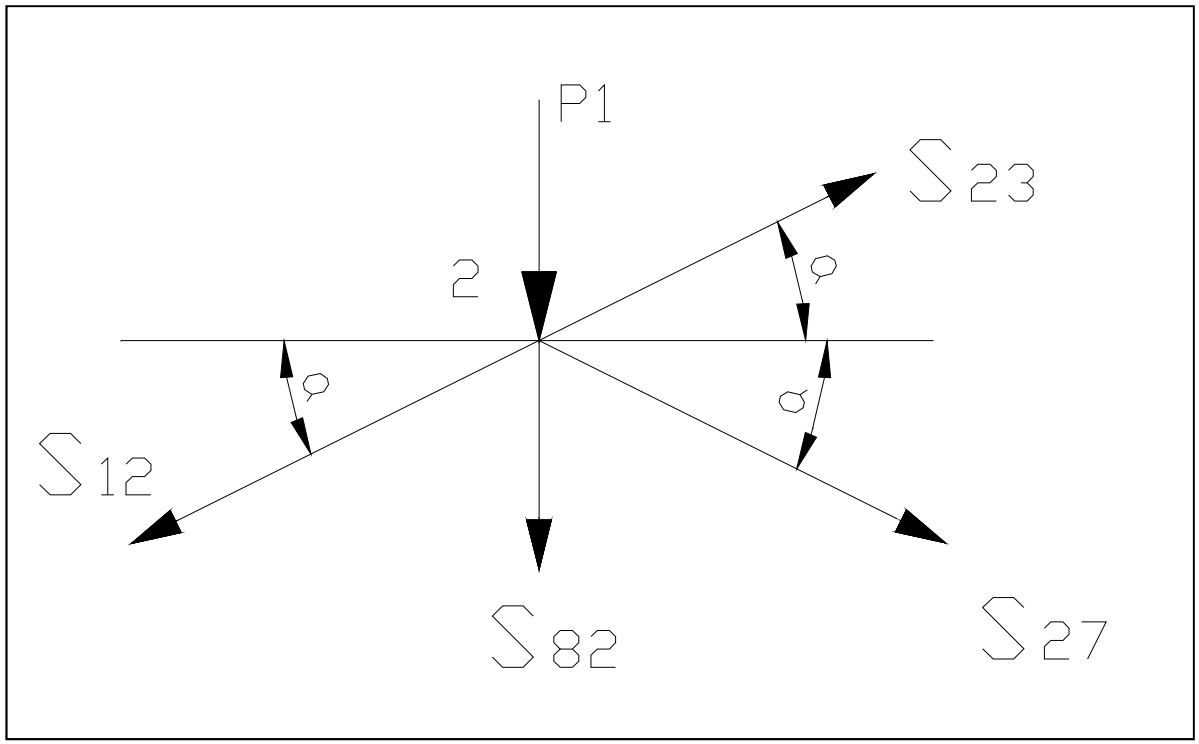
$$S_{82} = 0 \text{ KN}$$

EJERCICIO MODELO

NUDO 2



NUDO 2



$$\Sigma X = 0$$
$$\Sigma Y = 0$$

$$\Sigma X = S_{23}.\cos a + S_{27}.\cos a - S_{12}.\cos a = 0$$

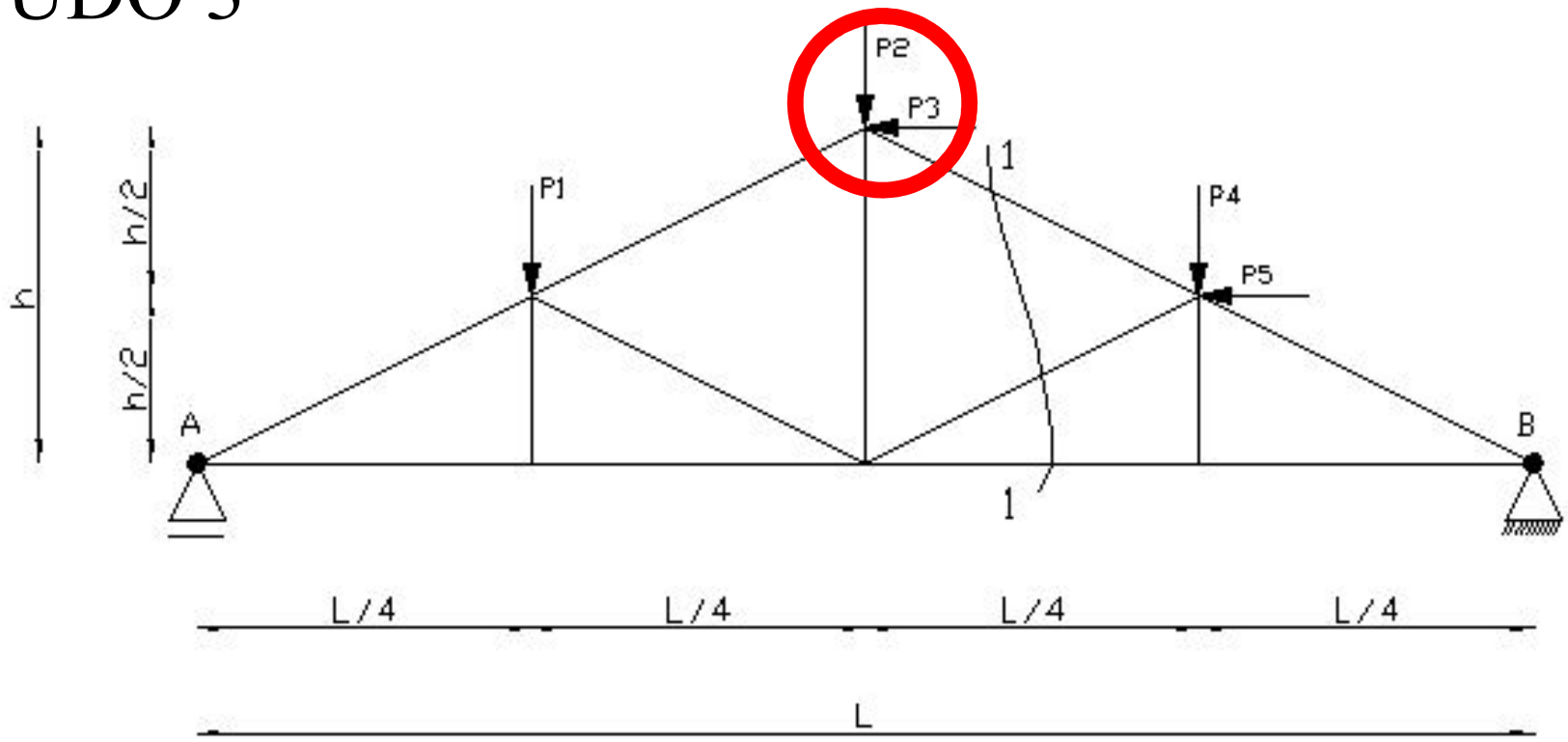
$$\Sigma Y = - P1 + S_{23}.\text{sen } a - S_{27}.\text{sen } a - S_{82} - S_{12}.\text{sen } a = 0$$

$$S_{23} = -92{,}2 \text{ KN}$$

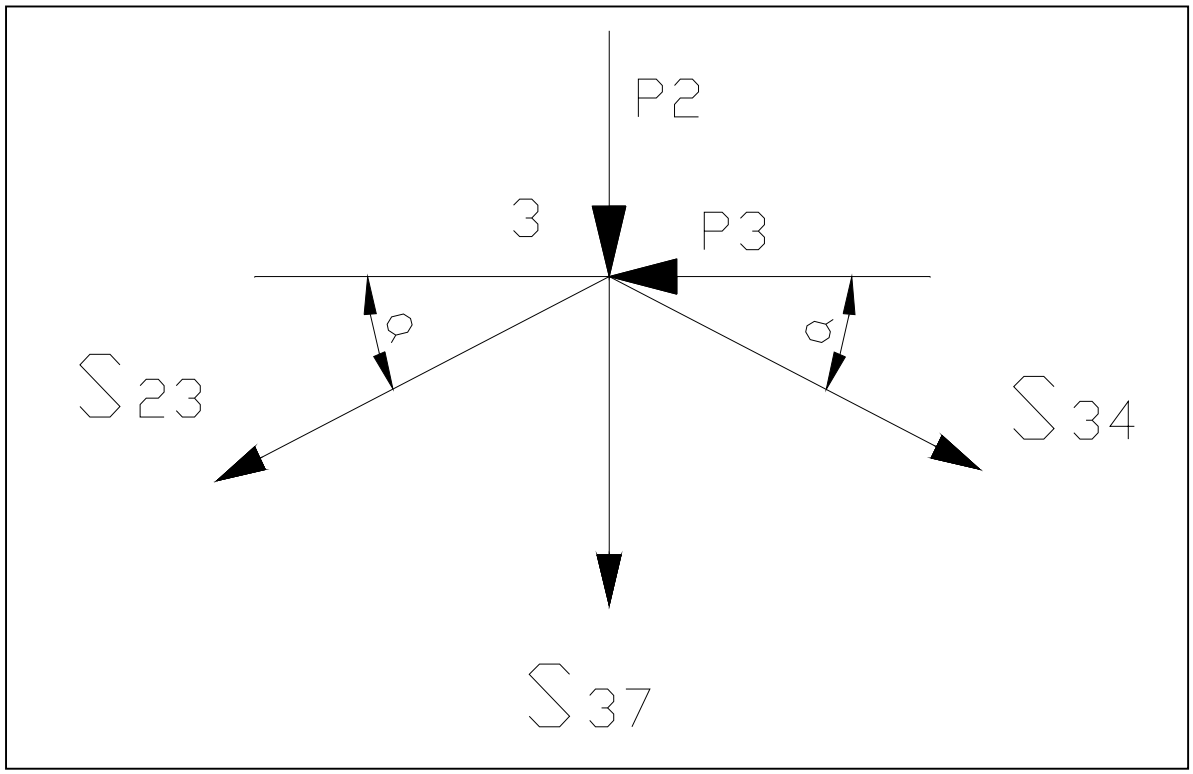
$$S_{27} = - 33{,}5 \text{ KN}$$

EJERCICIO MODELO

NUDO 3



NUDO 3



$$\Sigma X = 0$$
$$\Sigma Y = 0$$

$$\Sigma X = -P3 + S_{34}.\cos a - S_{23}.\cos a = 0$$

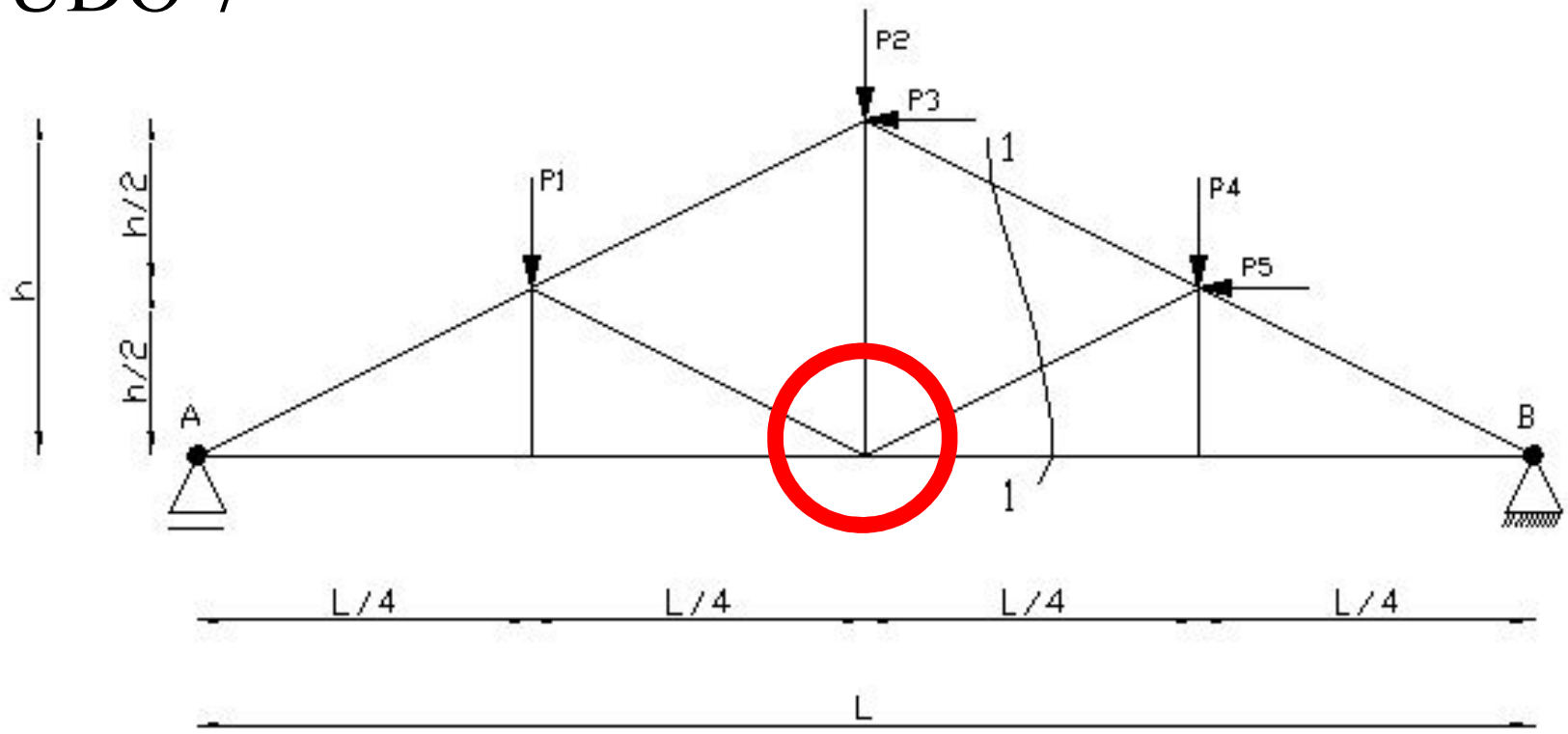
$$\Sigma Y = - P2 - S_{34}.\text{sen } a - S_{37} - S_{23}.\text{sen } a = 0$$

$$S_{34} = -58{,}7 \text{ KN}$$

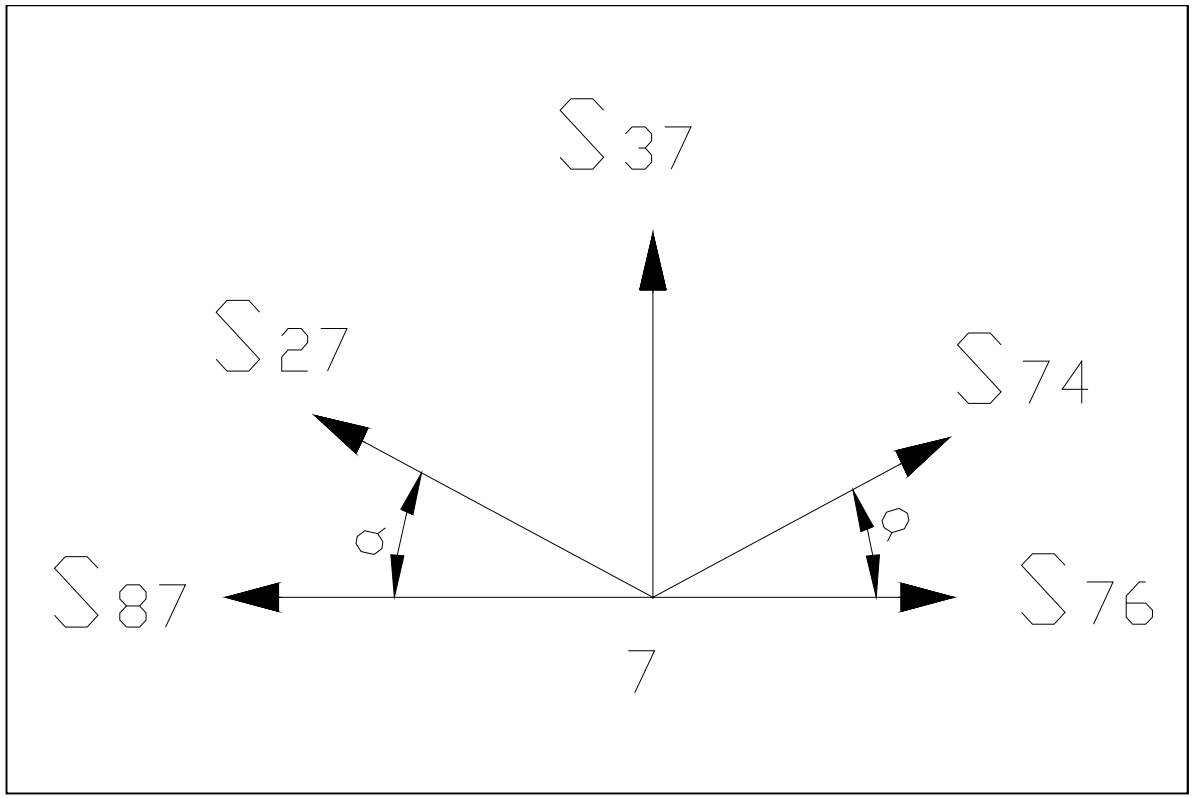
$$S_{37} = 37{,}5 \text{ KN}$$

EJERCICIO MODELO

NUDO 7



NUDO 7



$$\Sigma X = 0$$
$$\Sigma Y = 0$$

$$\Sigma X = S_{74}.\cos a + S_{76} - S_{87} - S_{27}.\cos a = 0$$

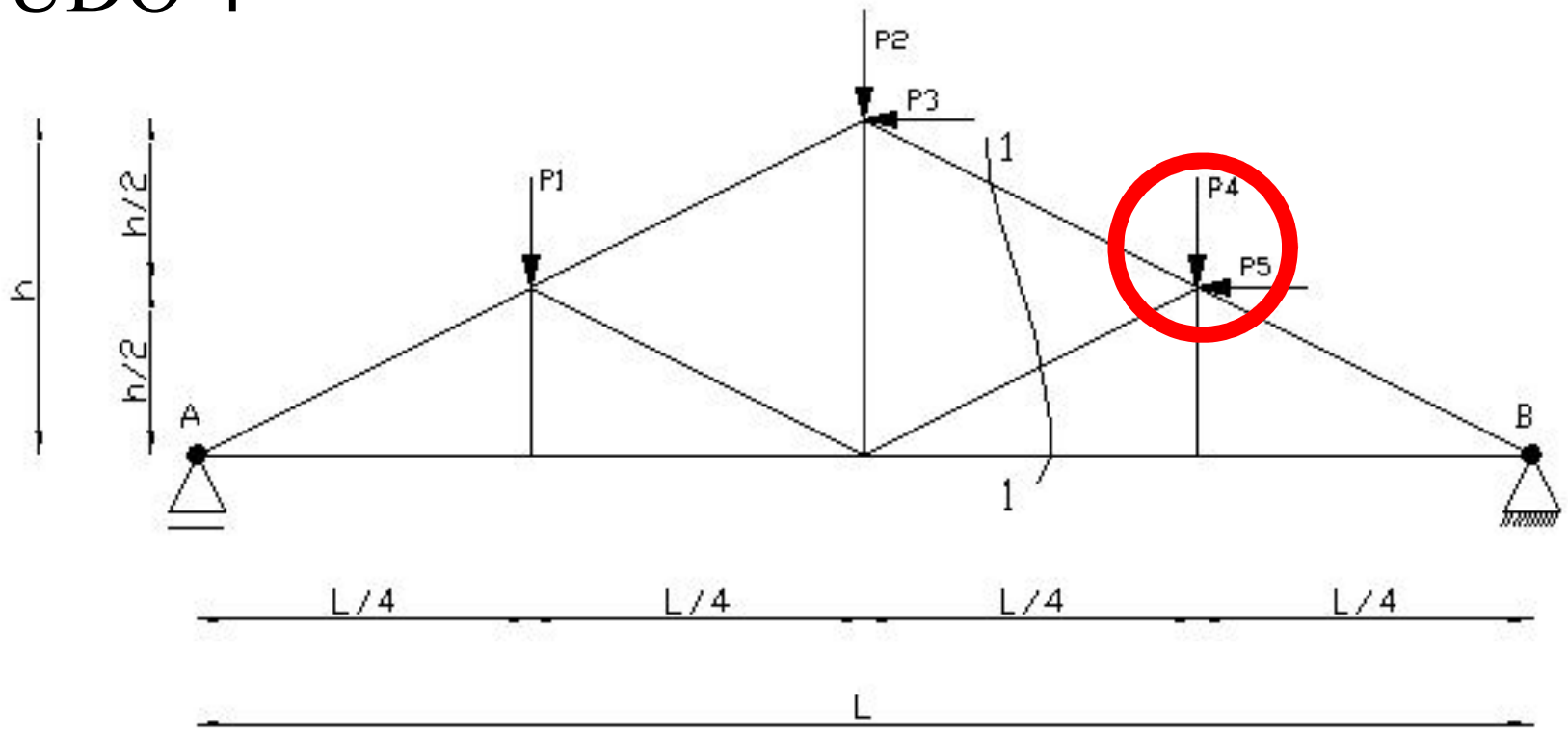
$$\Sigma Y = S_{37} + S_{74}.\text{sen } a + S_{27}.\text{sen } a = 0$$

$$S_{76} = 127{,}5 \text{ KN}$$

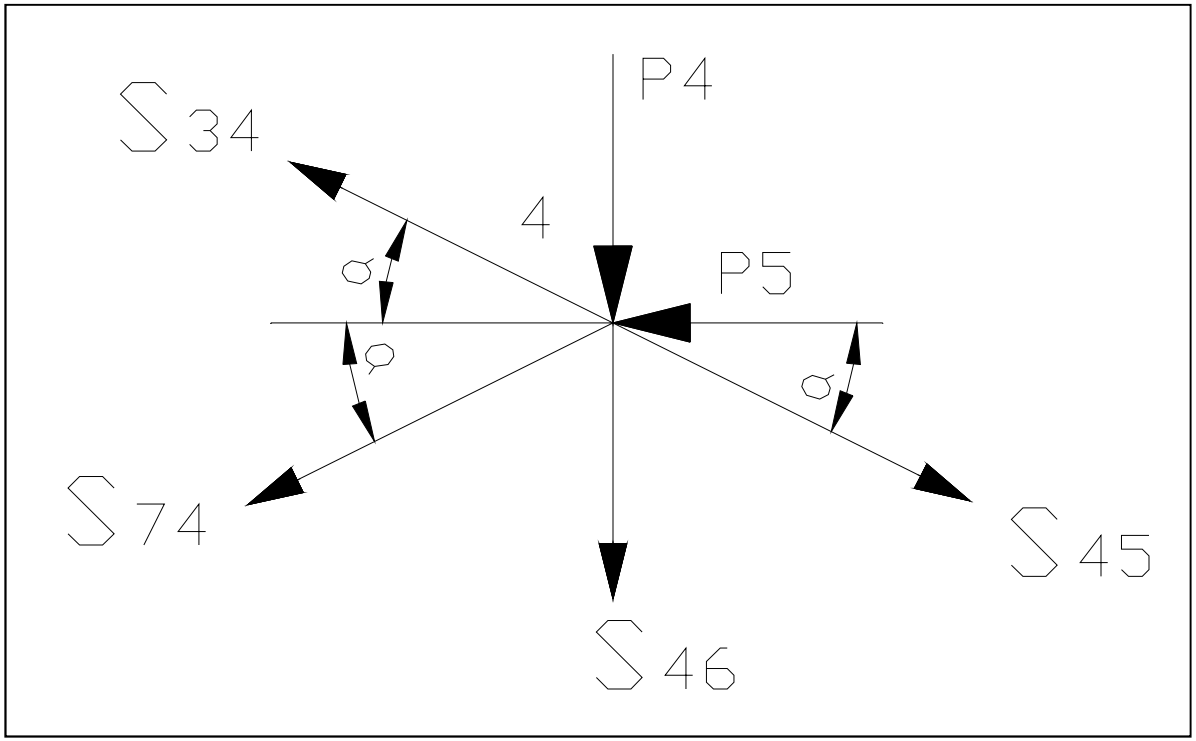
$$S_{74} = -50{,}3 \text{ KN}$$

EJERCICIO MODELO

NUDO 4



NUDO 4



$$\Sigma X = 0$$
$$\Sigma Y = 0$$

$$\Sigma X = -P5 + S_{45}.\cos a - S_{74}.\cos a - S_{34}.\cos a = 0$$

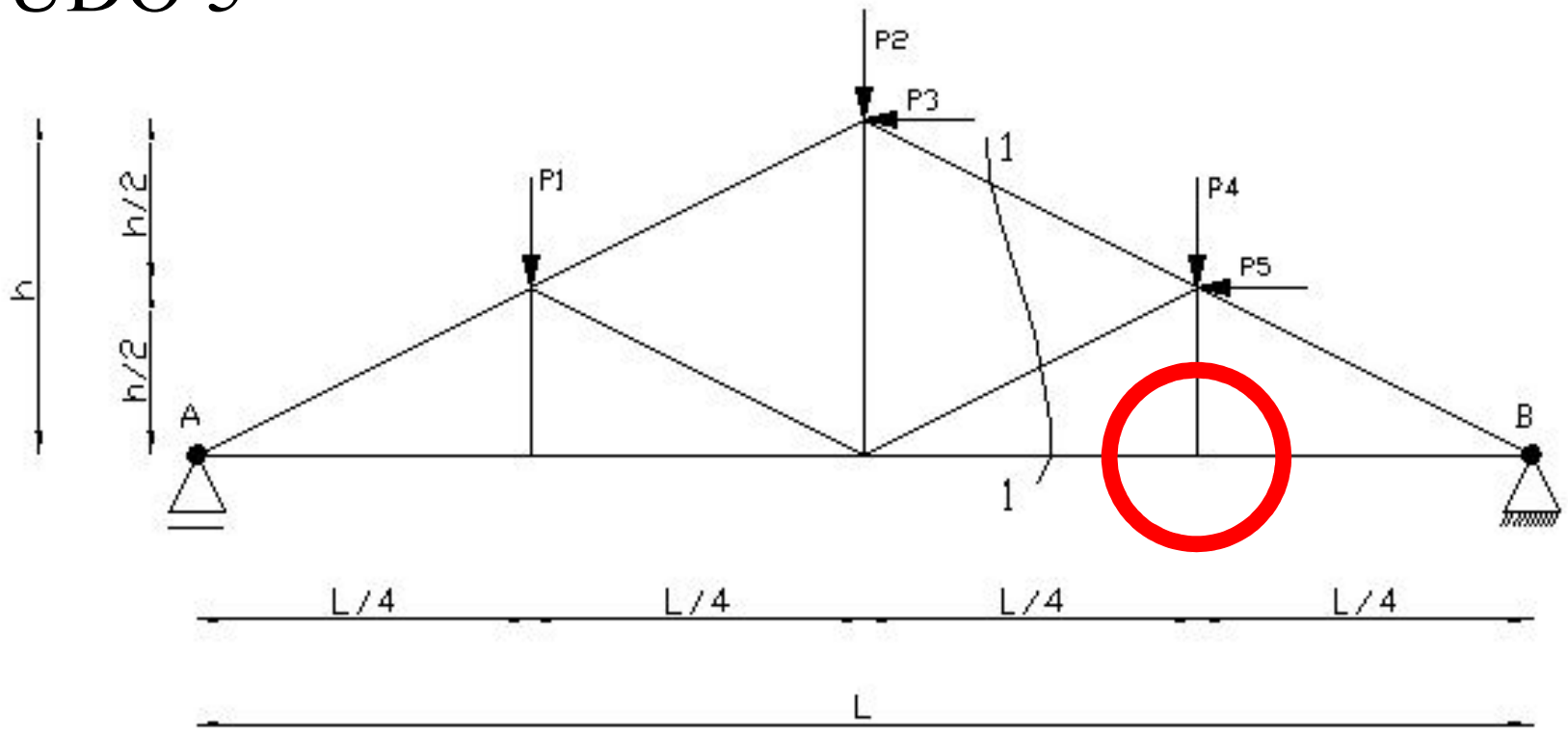
$$\Sigma Y = -P4 - S_{45}.\text{sen } a - S_{46} - S_{74}.\text{sen } a + S_{34}.\text{sen } a = 0$$

$$S_{45} = -75{,}5 \text{ KN}$$

$$S_{46} = 0 \text{ KN}$$

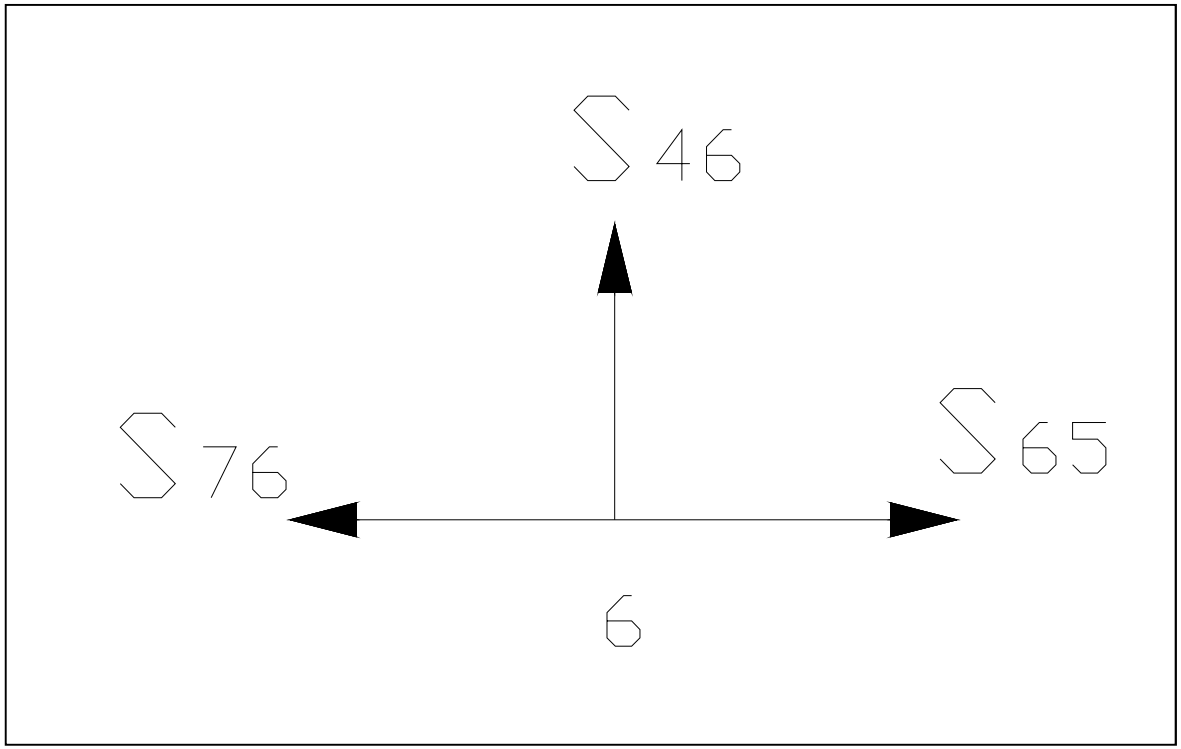
EJERCICIO MODELO

NUDO 5



NUDO 6

$$\Sigma X = 0$$
$$\Sigma Y = 0$$



$\Sigma X = S_{65} - S_{76} = 0$

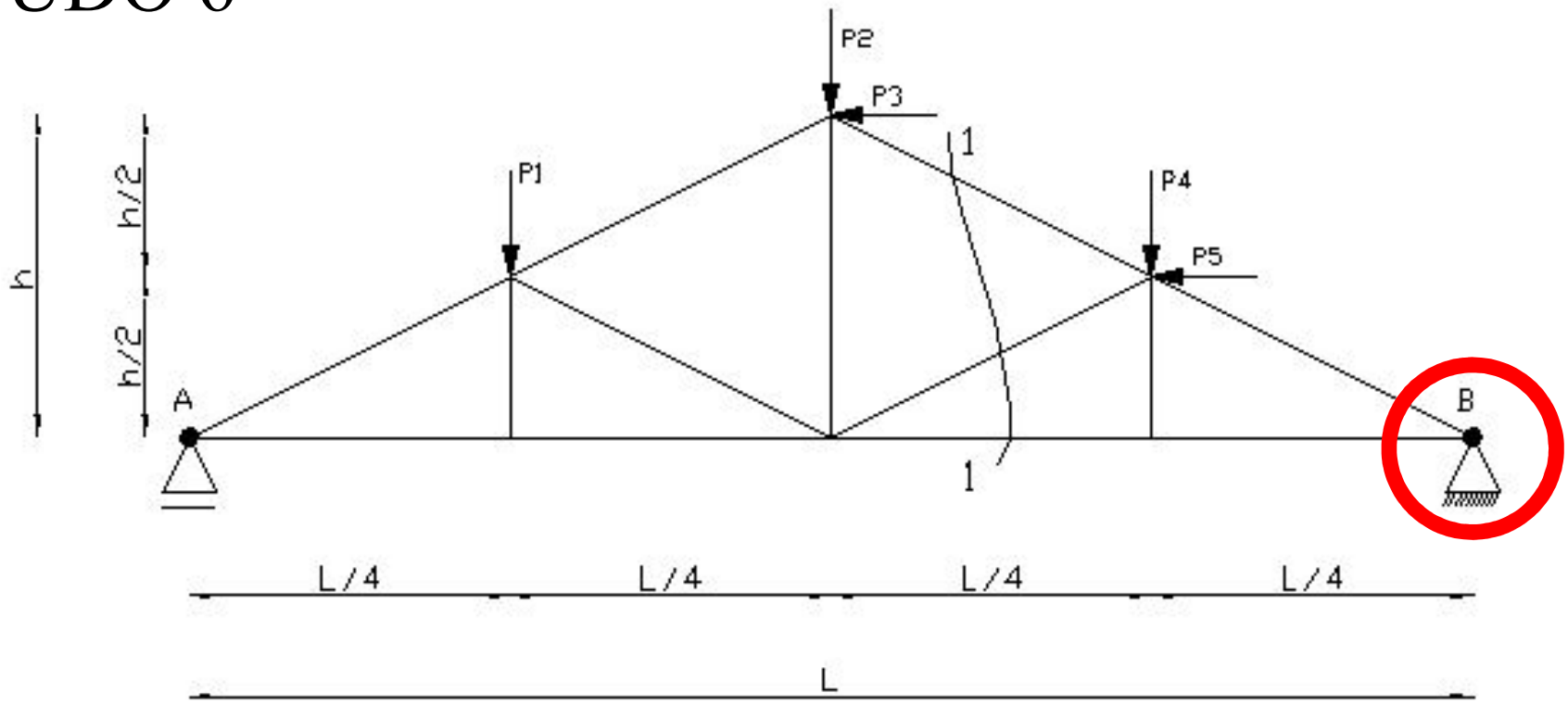
$\Sigma Y = S_{46} = 0$

$S_{65} = 127{,}5$ KN

$S_{46} = 0$ KN

EJERCICIO MODELO

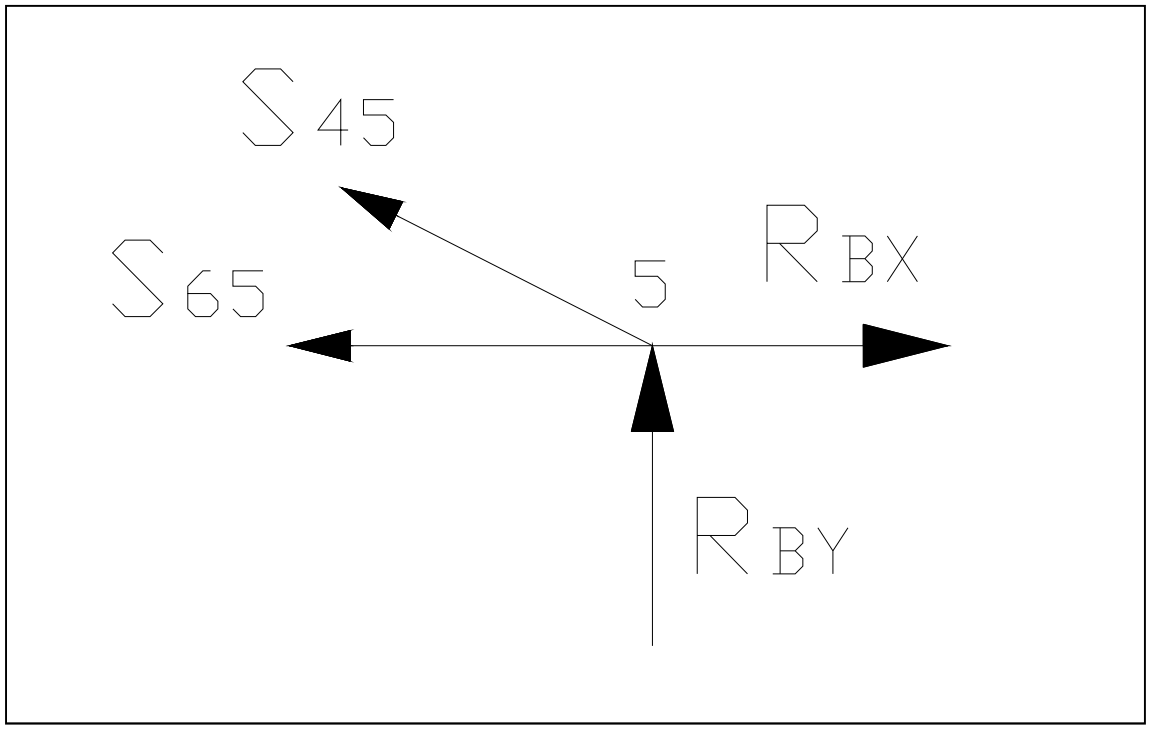
NUDO 6



NUDO 5

R_{BY}= 33,7 KN

$$\Sigma X = 0$$
$$\Sigma Y = 0$$



$\Sigma X = R_{BX} - S_{65} - S_{45}.\cos a = 0$

$\Sigma Y = S_{45}.\text{sen } a + R_{BY} = 0$

RETICULADOS PLANOS

METODO DE LAS SECCIONES
METODO DE RITTER

MÉTODO DE LAS SECCIONES Ó DE RITTER

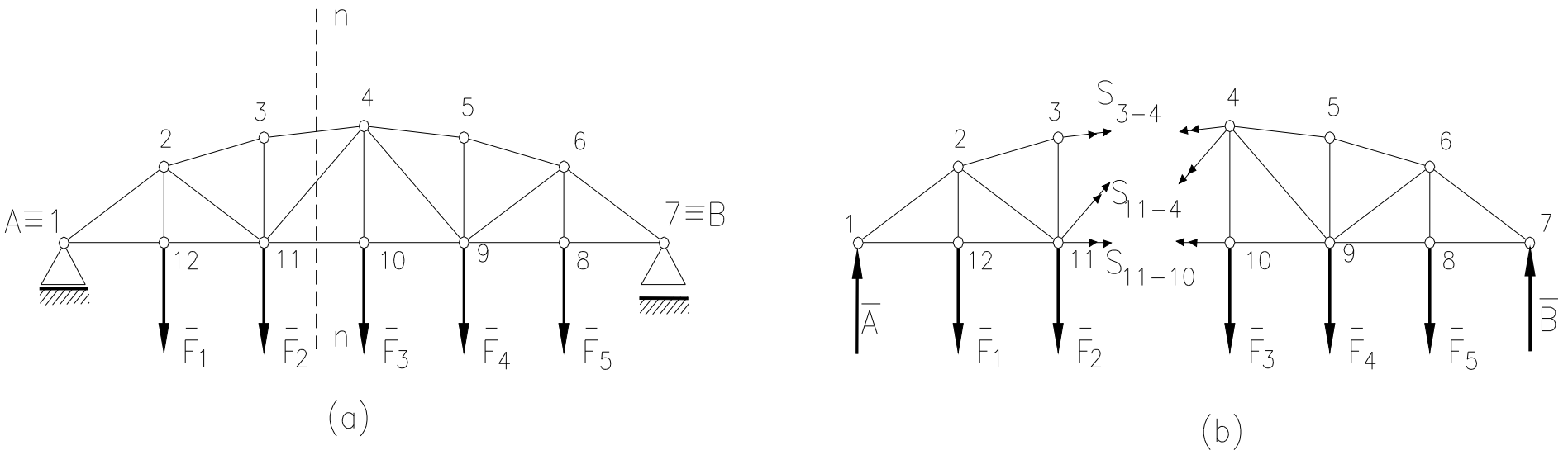
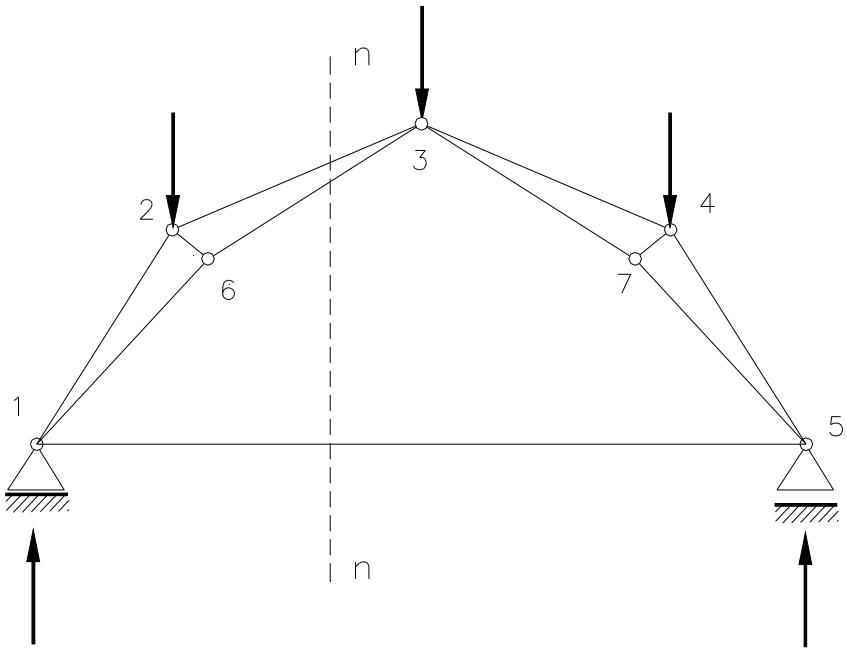
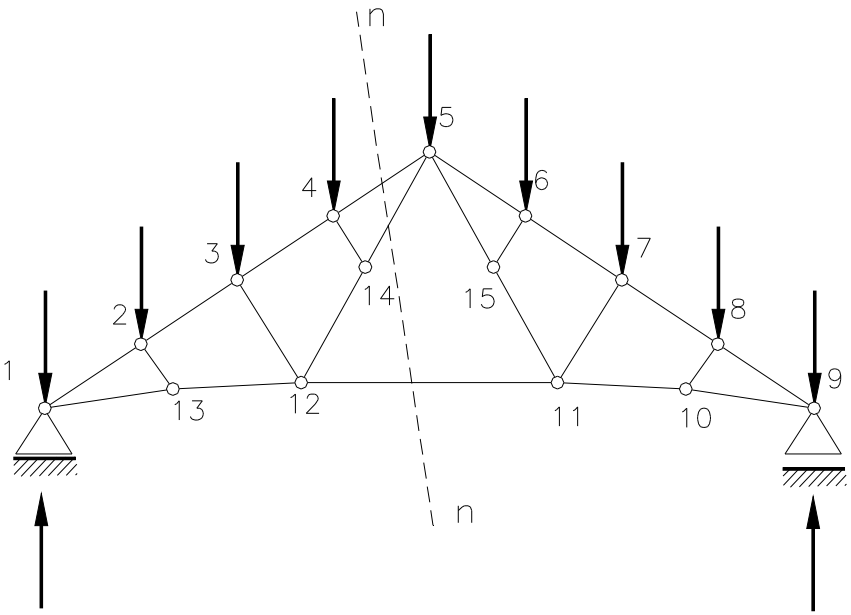


Fig. 5.16

MÉTODO DE LAS SECCIONES Ó DE RITTER





MÉTODO DE LAS SECCIONES Ó DE RITTER

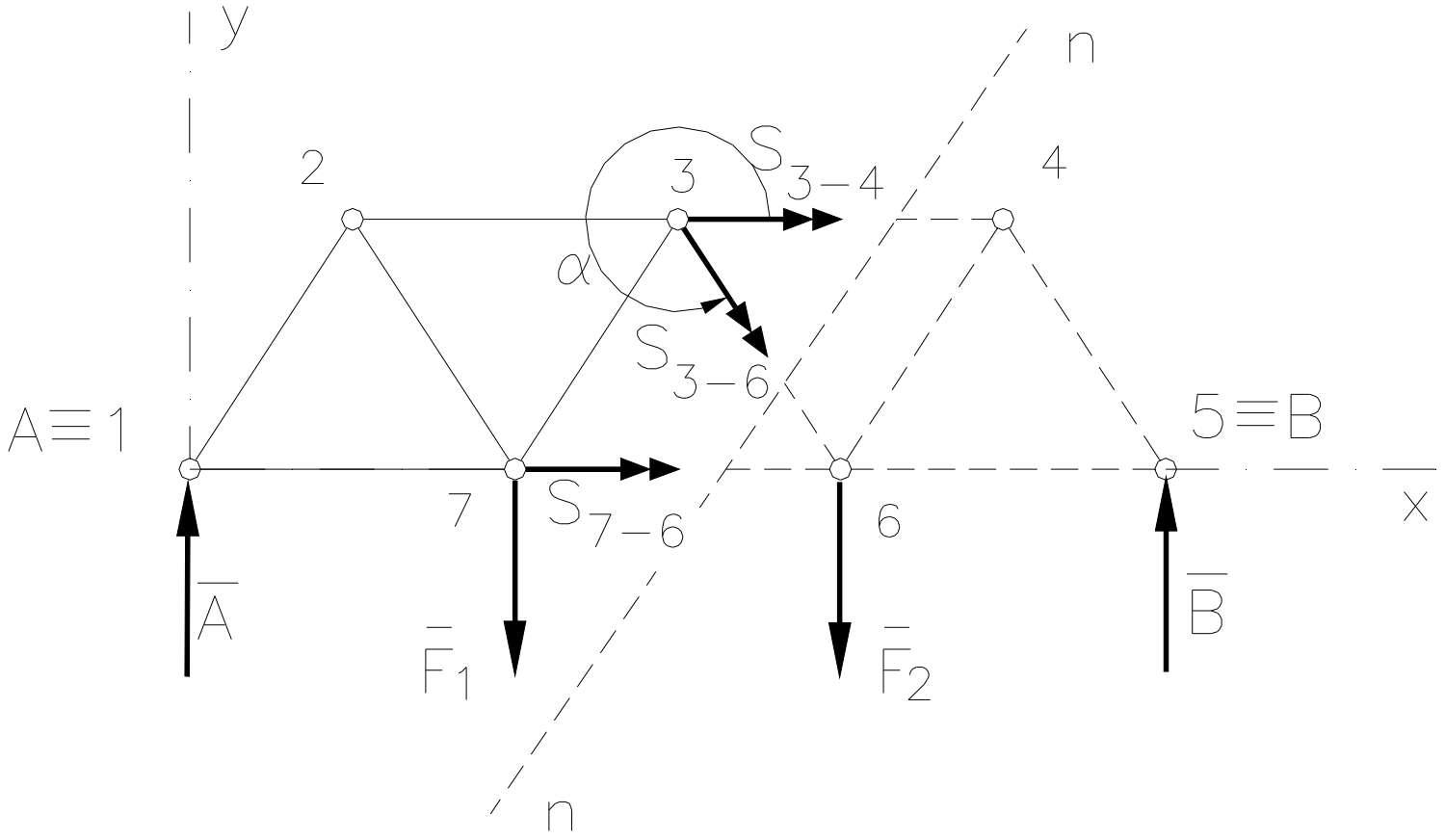
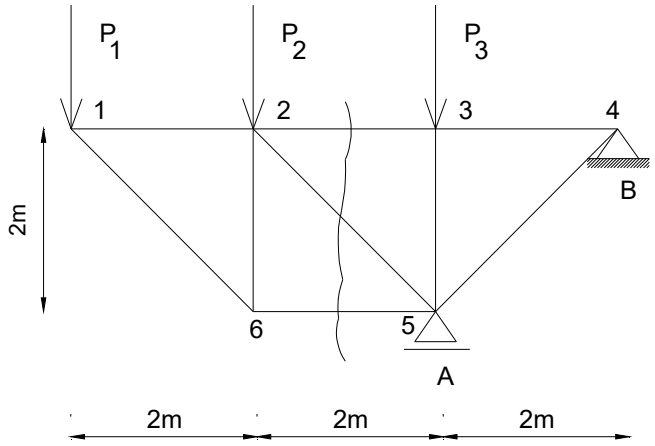
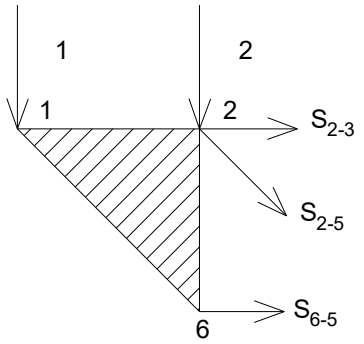


Fig. 5.19

$$P_1 = P_2 = P_3 = 1{,}0t$$

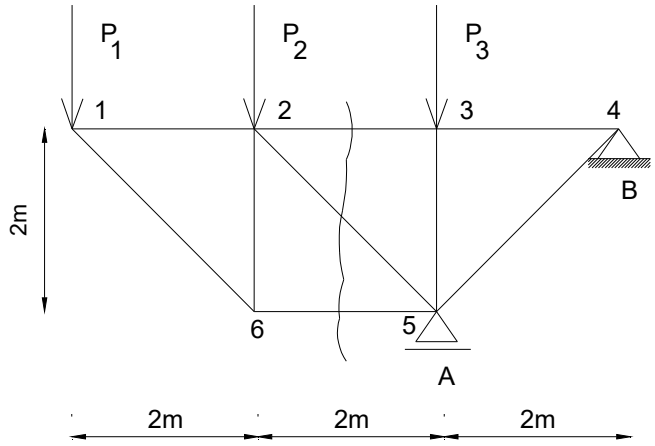


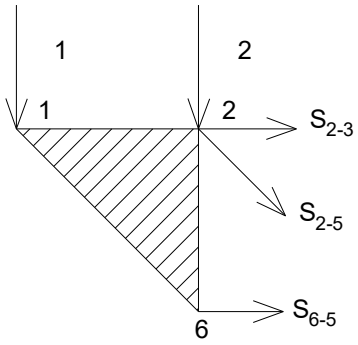


$$\sum F_x = 0$$

$$\sum F_y = 0$$

$$\sum M_0 = 0$$



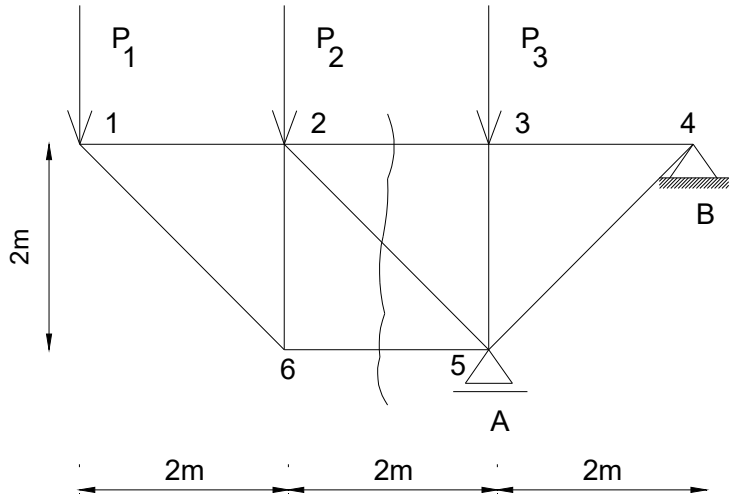


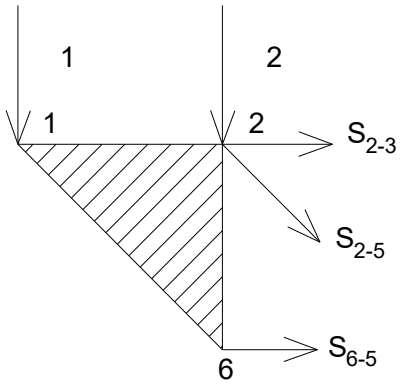
$$\sum F_y = 0 \quad ; \qquad -P_1 - P_2 - P_3 + R_B = 0$$

$$R_B = -1t - 1t - 1t + 6t = 3{,}0t$$

$$\sum M_B = 0 \quad ; \qquad -P_1 \cdot 6{,}0m - P_2 \cdot 4{,}0m - P_3 \cdot 2{,}0m + R_A \cdot 2{,}0m = 0$$

$$R_A = \frac{1t \cdot 6{,}0m + 1t \cdot 4{,}0m + 1t \cdot 2{,}0m}{2{,}0m} = 6{,}0t$$





$$\sum M_5 = 0 \quad ; \qquad -P_1 \cdot 4{,}0m - P_2 \cdot 2{,}0m + S_{2-3} \cdot 2{,}0m = 0$$

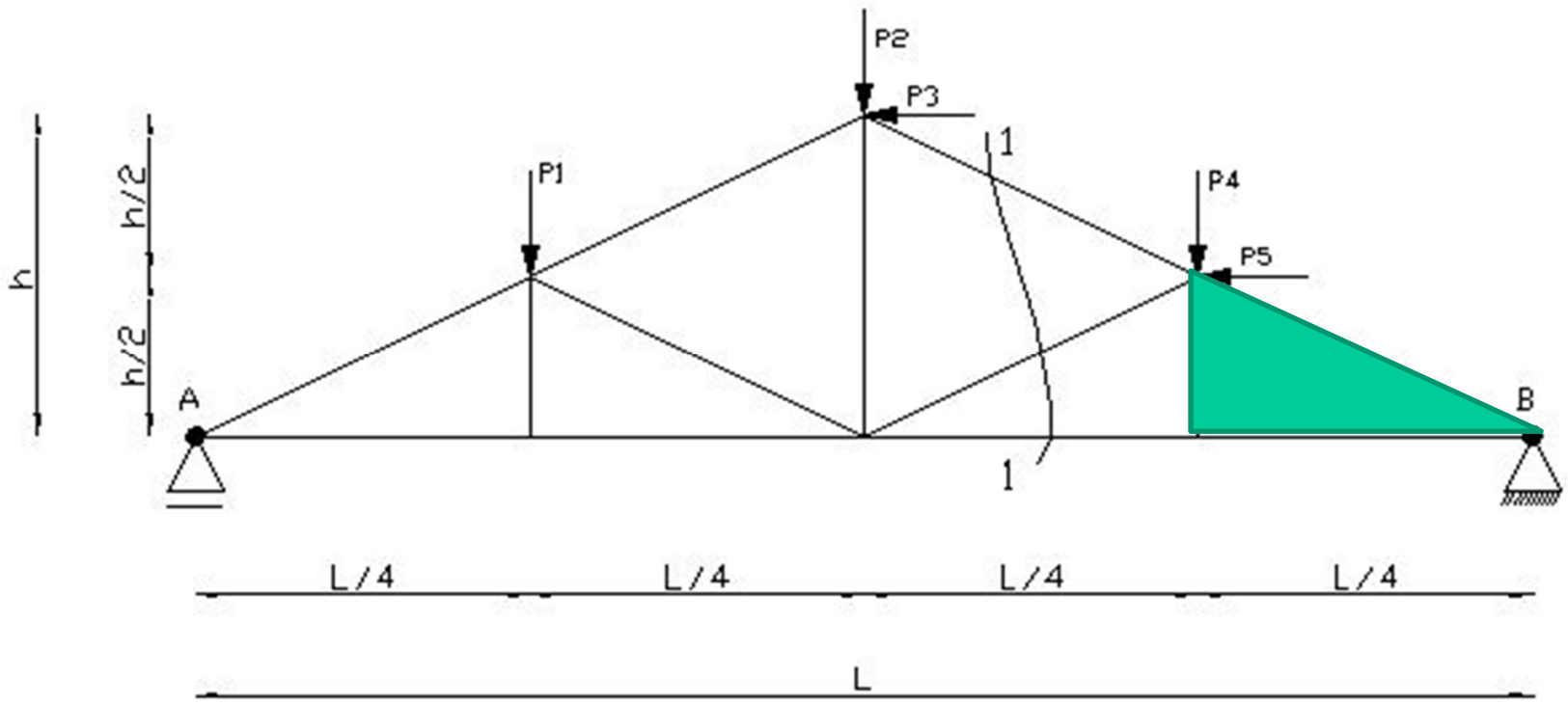
$$S_{2-3} = \frac{1t \cdot 4{,}0m + 1t \cdot 2{,}0m}{2{,}0m} = 3{,}0t \qquad \text{(Tracción)}$$

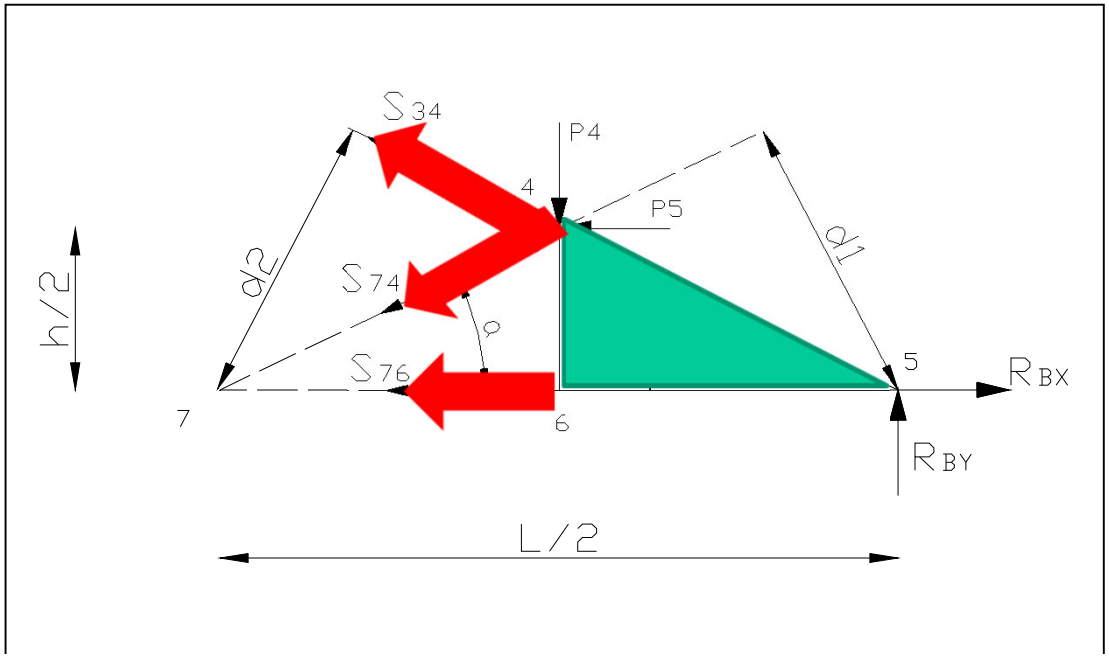
$$\sum M_2 = 0 \quad ; \qquad -P_1 \cdot 2{,}0m - S_{6-5} \cdot 2{,}0m = 0$$

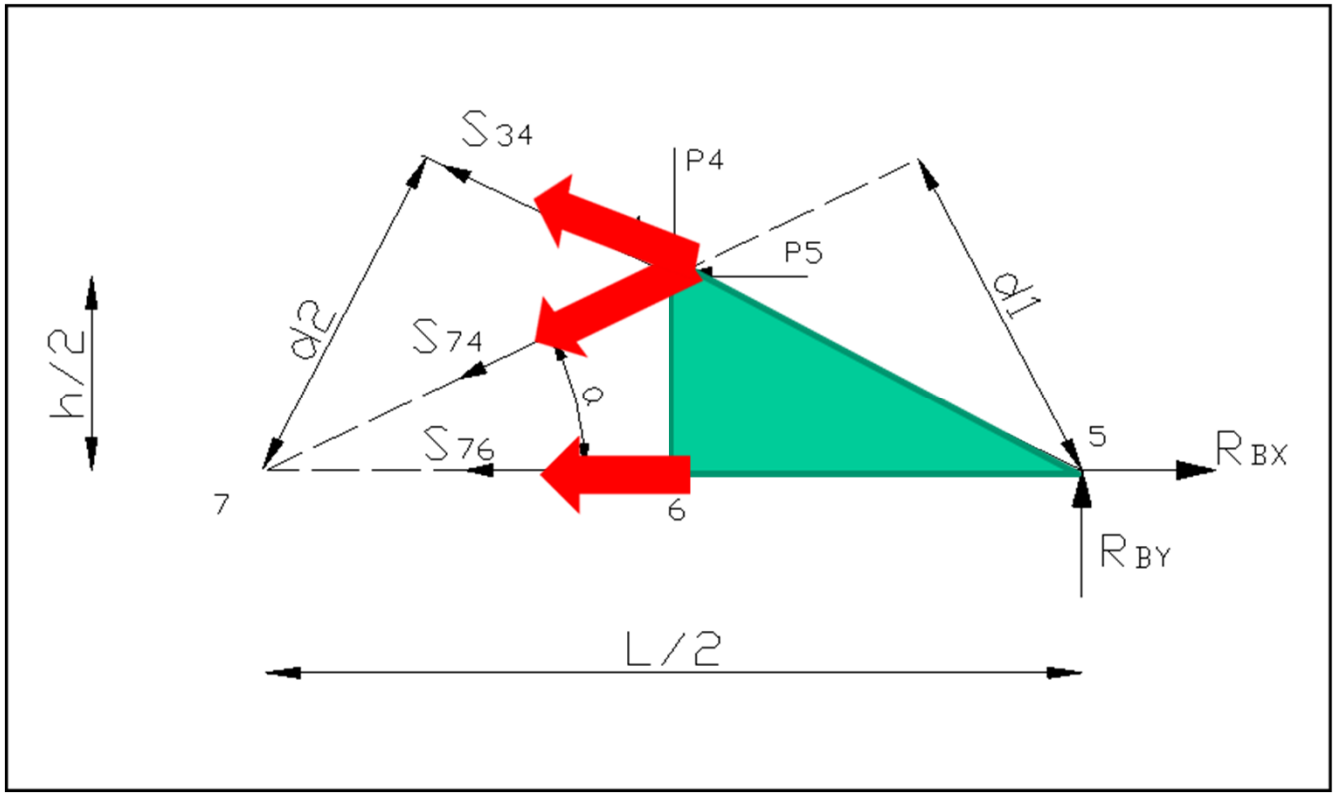
$$S_{6-5} = \frac{-1t \cdot 2{,}0m}{2{,}0m} = -1{,}0t \qquad \text{(Compresión)}$$

$$\sum F_y = 0 \quad ; \qquad -P_1 - P_2 - S_{2-5} \cdot \cos(45°) = 0$$

$$S_{2-5} = \frac{-1t - 1t}{0{,}707} = -2{,}83t \qquad \text{(Compresión)}$$


P2
P3
P1
P4
P5
1
1
A
B
h
h/2
h/2
L/4
L/4
L/4
L/4
L


S34
P4
4
P5
d/2
d/1
S74
h/2
ρ
S76
5
RBX
7
6
RBY
L/2



$\Sigma M_4 = S_{76}.h/2 - R_{BX}.h/2 - R_{BY}.L/4 = 0$ $\quad S_{76} = 127,5$ KN

$\Sigma M_5 = -P4.L/4 - P5.h/2 - S_{74}.d1 = 0$ $\quad S_{74} = -50,3$ KN

$\Sigma M_7 = P4.L/4 - P5.h/2 - S_{34}.d2 - R_{BY}.L/2 = 0$

$S_{34} = -58,7$ KN