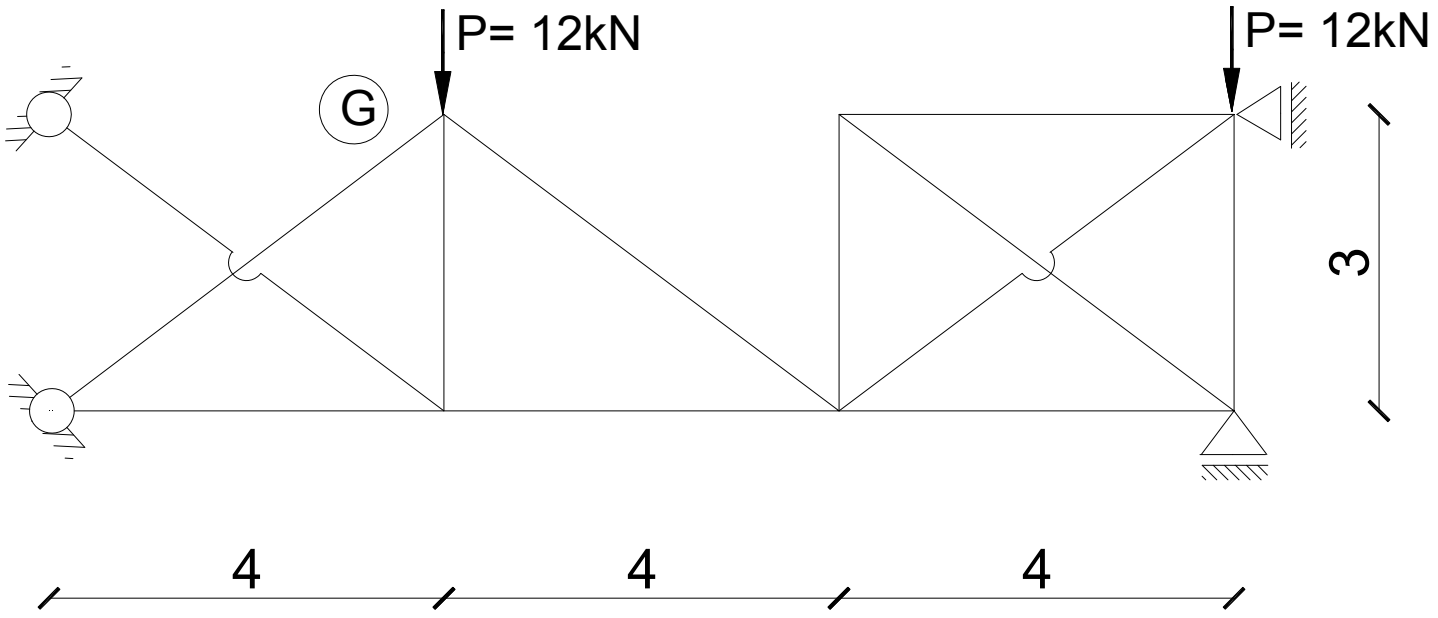
Zadanie: Narysuj wykres sił normalnych dla zadanej kratownicy i policz przemieszczenie poziome węzła G. Zadanie rozwiąż metodą sił.



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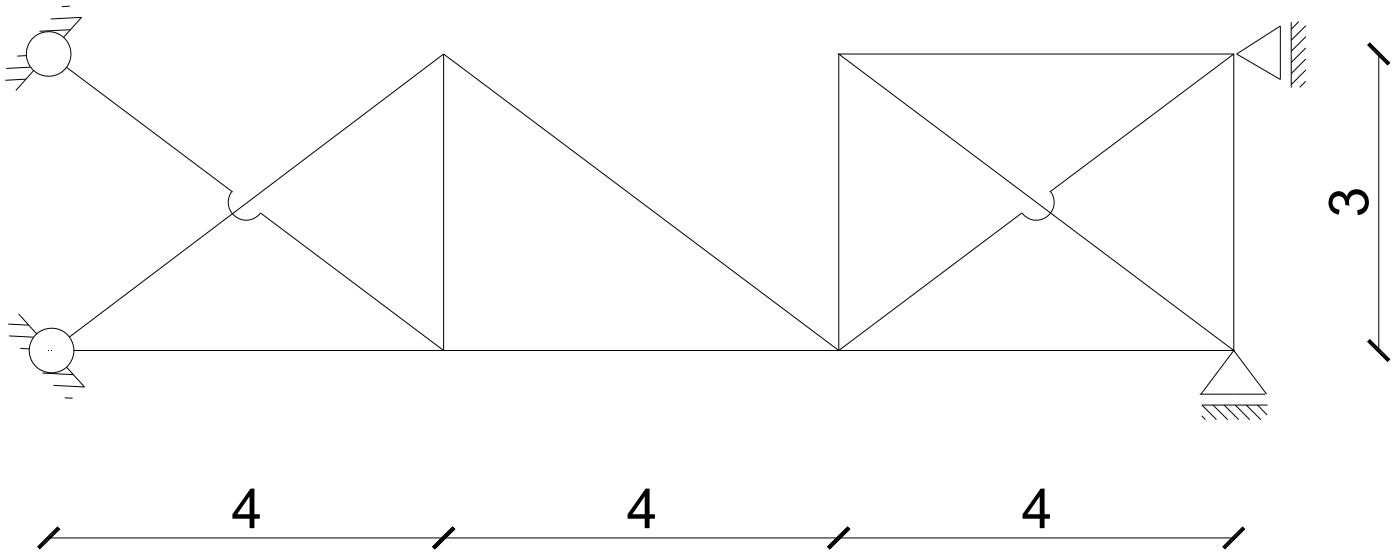

Stopień statycznej niewyznaczalności:

$$n_s = l_r + l_{pr} - 2 \cdot w = 6 + 12 - 2 \cdot 8 = 2$$

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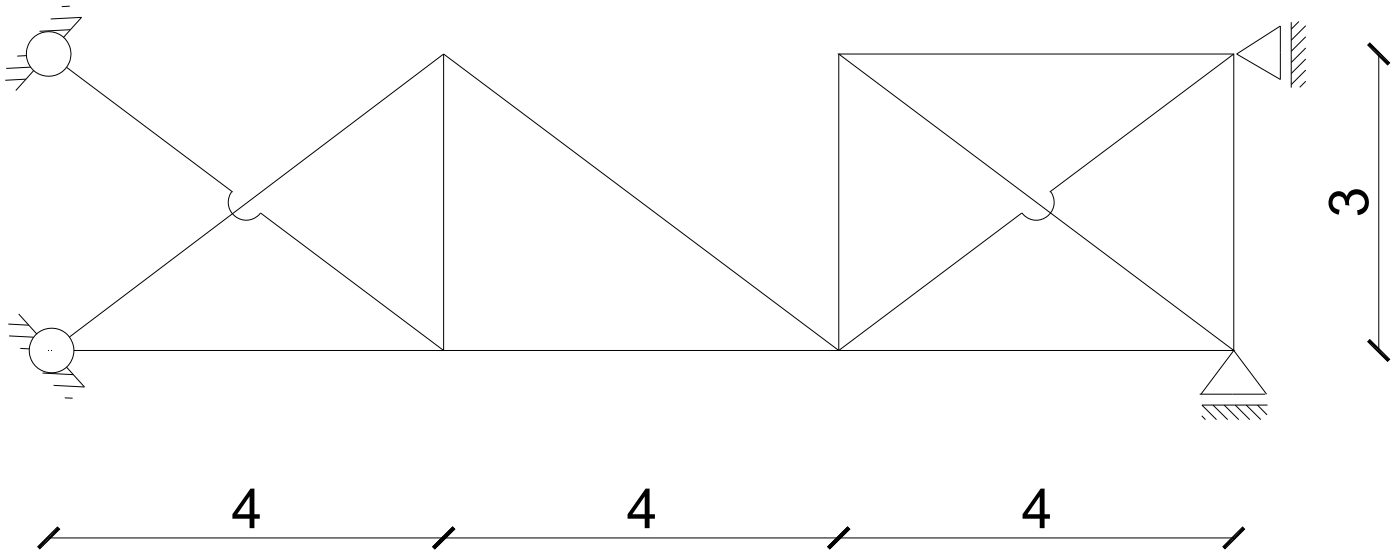
Oznaczenie prętów:



Stopień statycznej niewyznaczalności:

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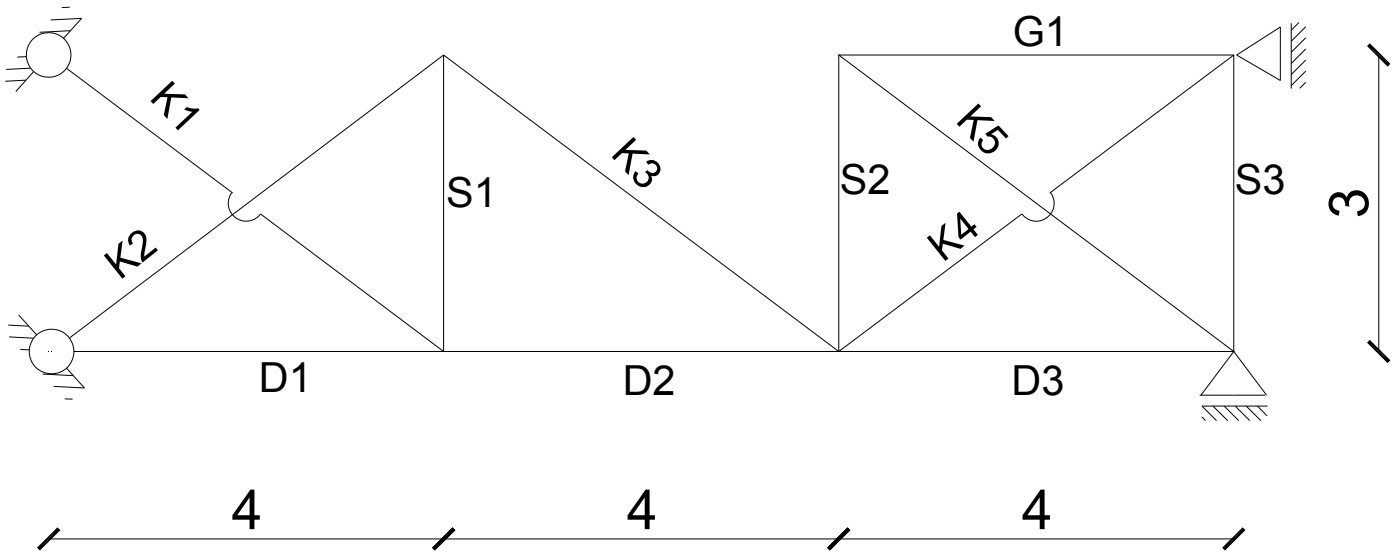
Oznaczenie prętów:



Stopień statycznej niewyznaczalności:

$$n_s = l_r + l_{pr} - 2 \cdot w = 6 + 12 - 2 \cdot 8 = 2$$

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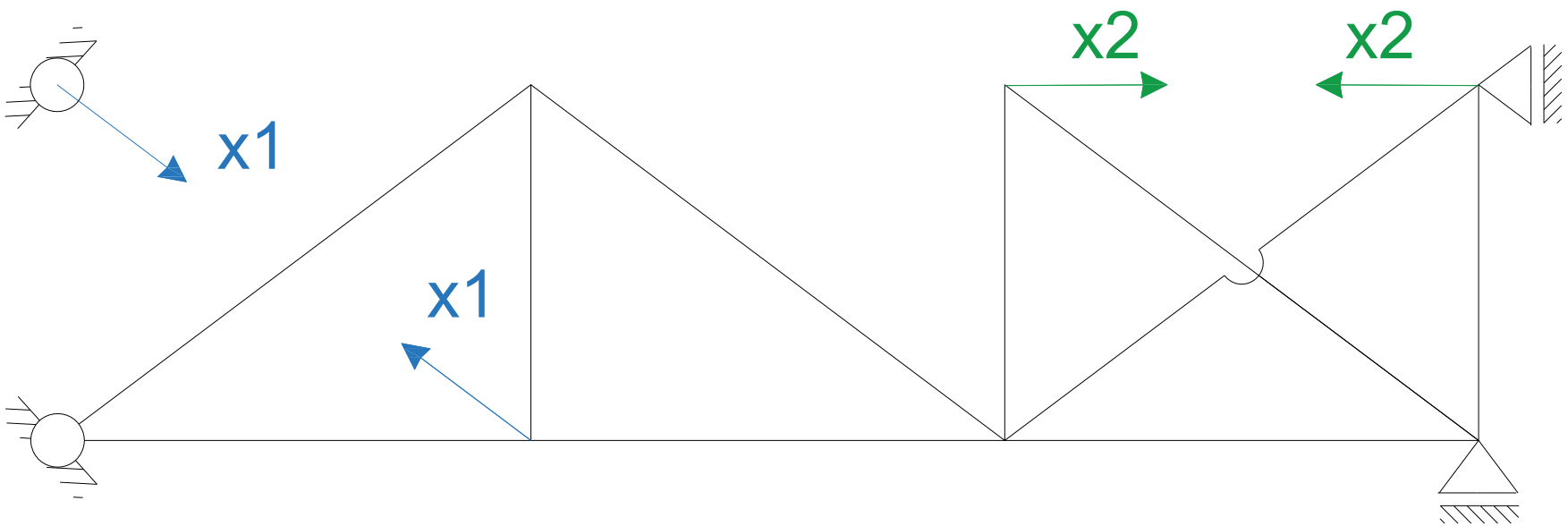
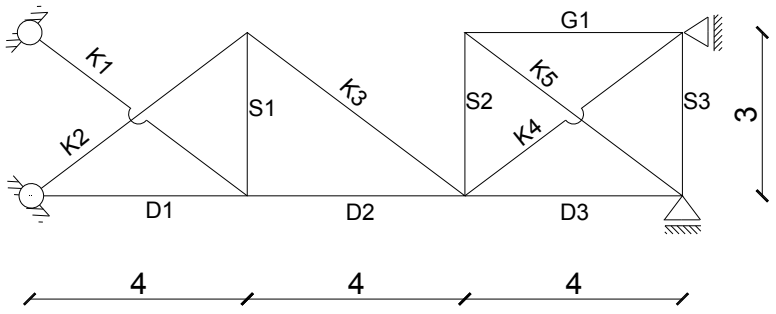
Dobór schematu podstawowego:





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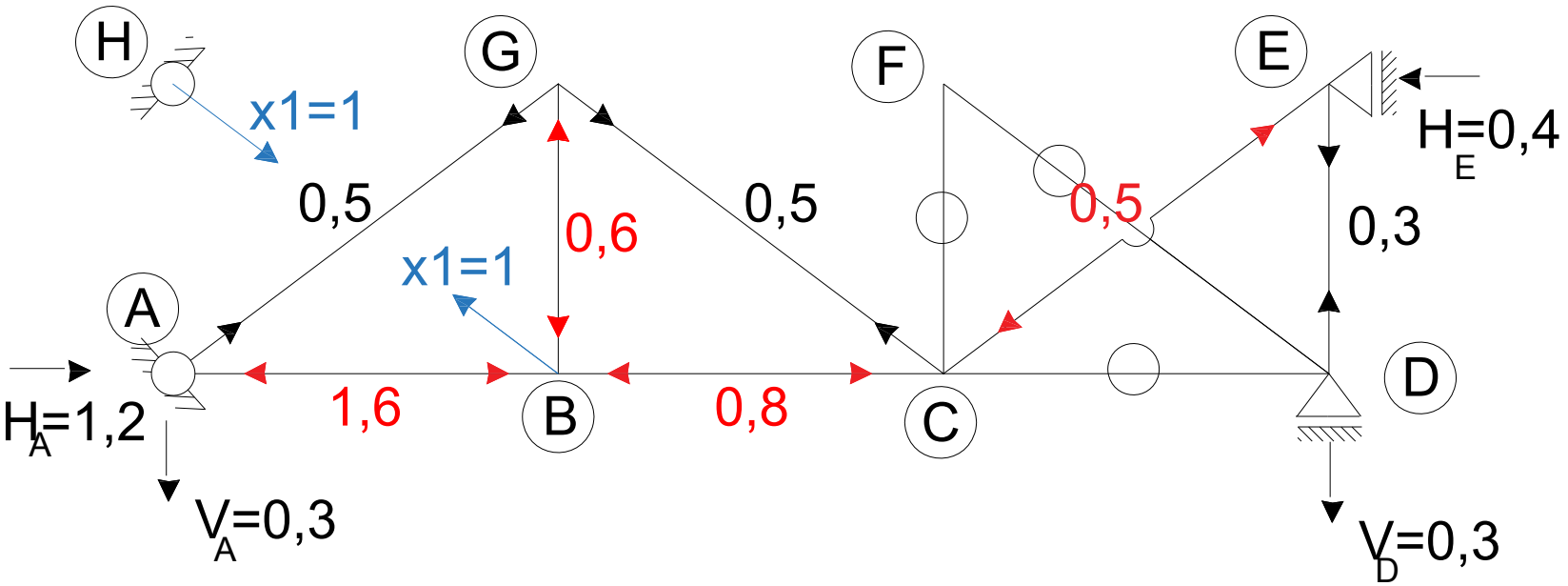
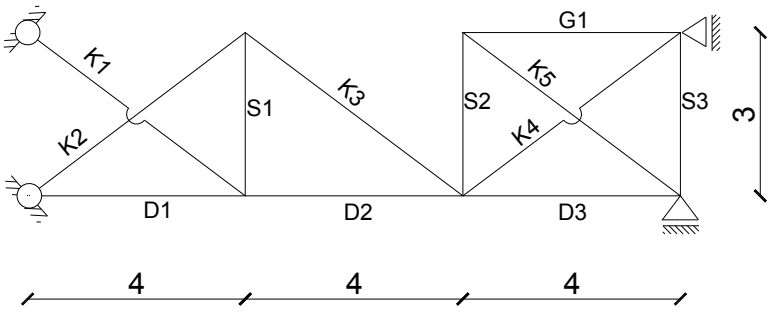
Wykresy: stan x1=1, siły N1



pręt	L/EA	N1
D1	4	-1,6
D2	4	-0,8
D3	4	0
G1	4	0
S1	3	-0,6
S2	3	0
S3	3	0,3
K1	5	1
K2	5	0,5
K3	5	0,5
K4	5	-0,5
K5	5	0



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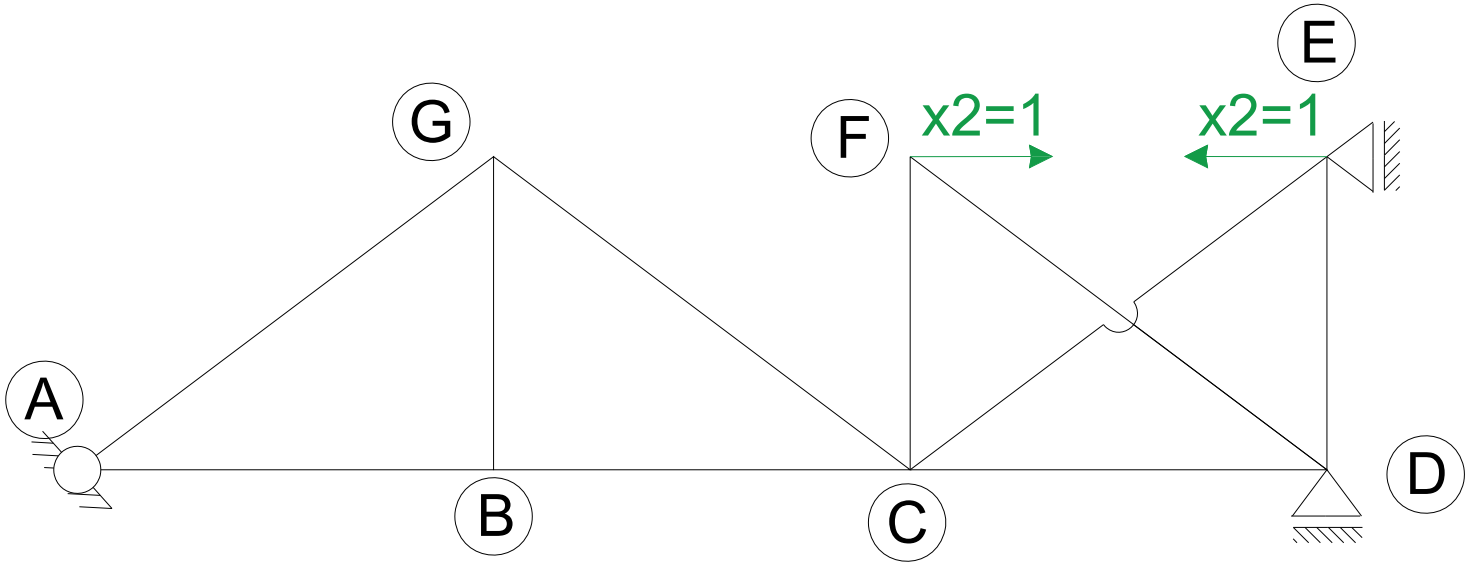
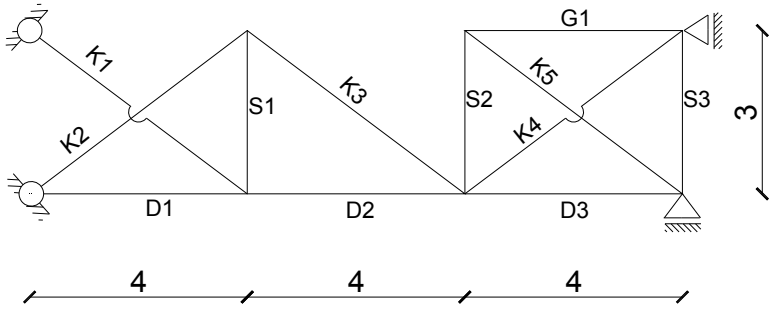
Wykresy: stan x2=1, siły N2





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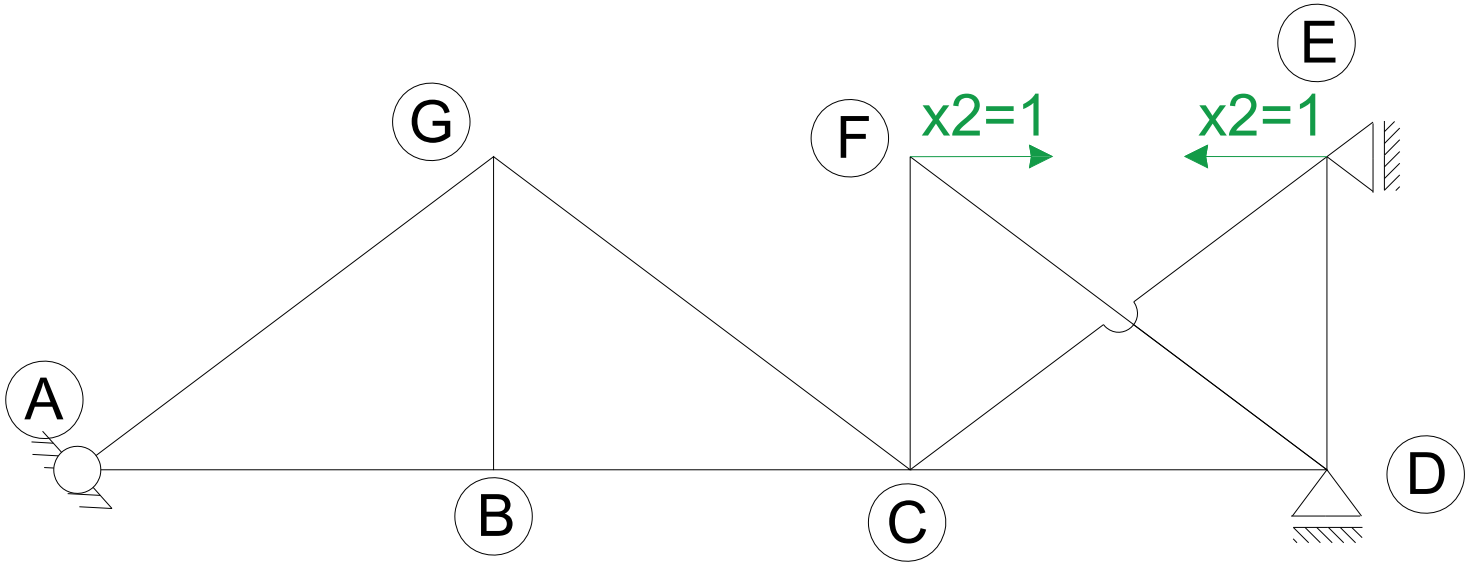
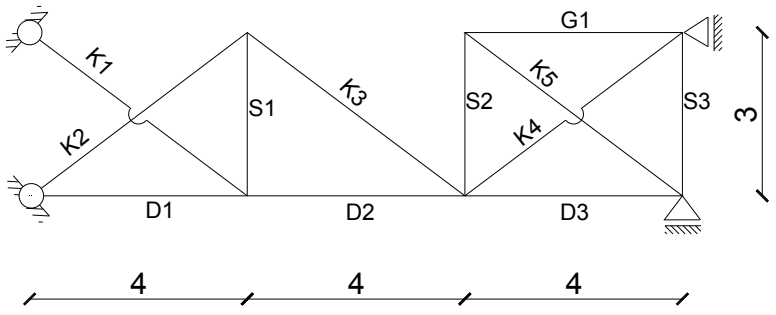
Wykresy: stan x2=1, siły N2

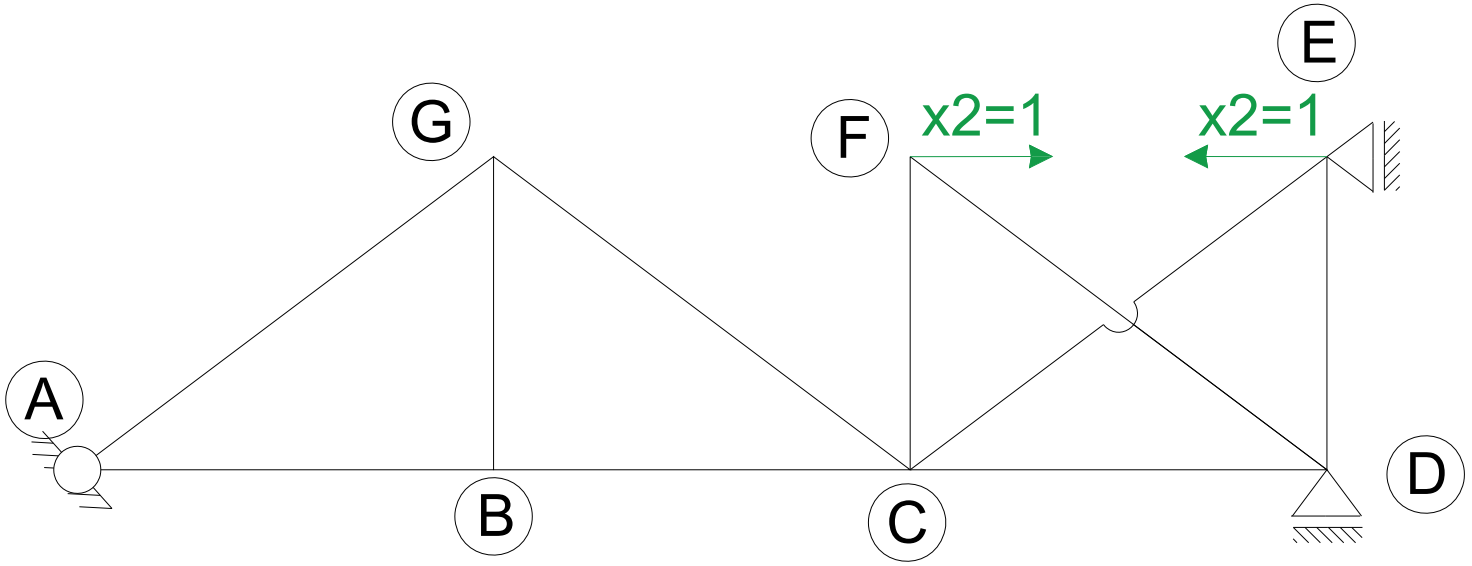


pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	
S1	3	
S2	3	
S3	3	
K1	5	
K2	5	
K3	5	
K4	5	
K5	5	

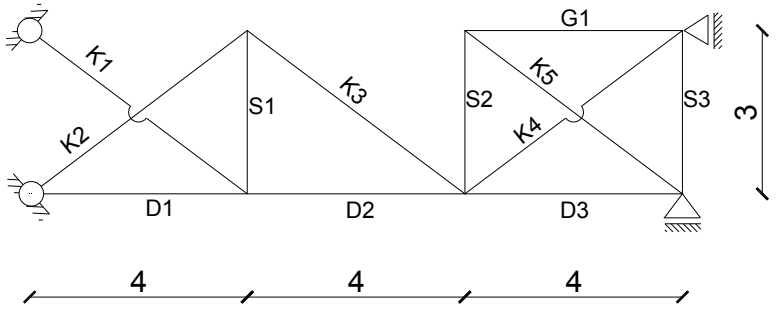


dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



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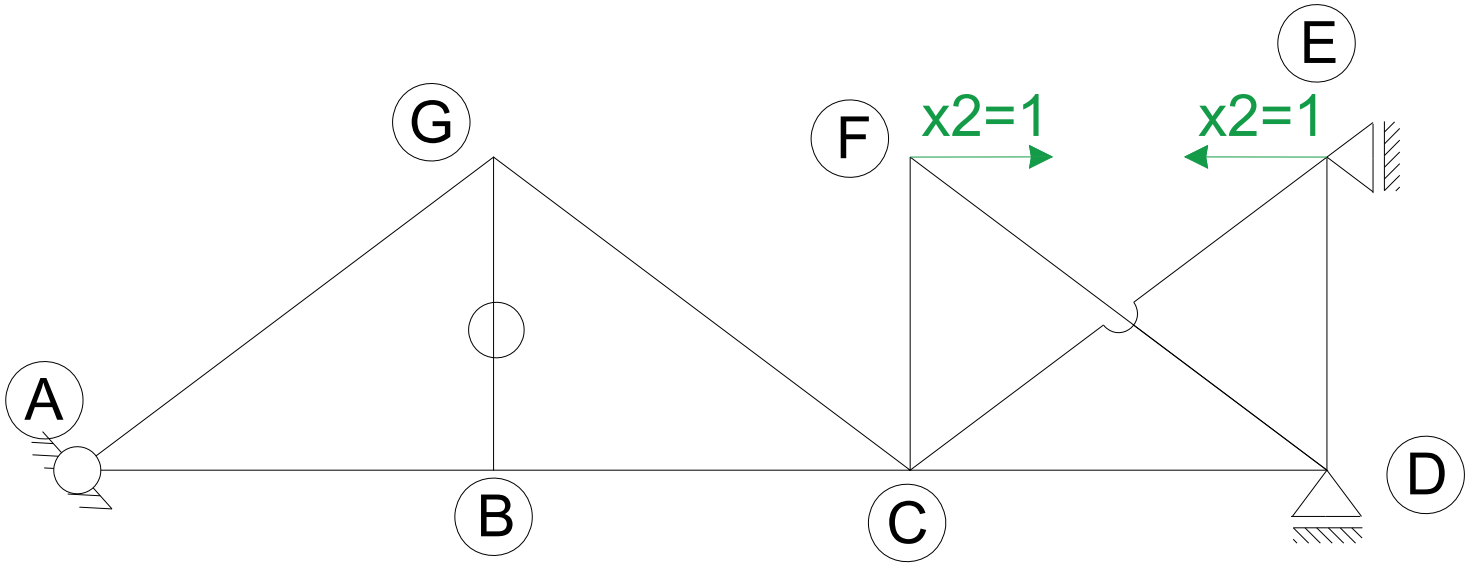
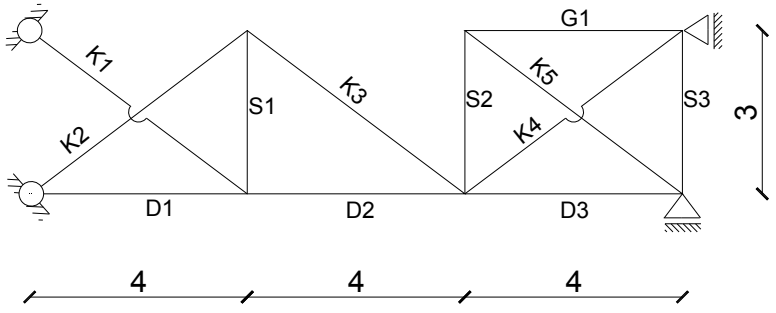
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



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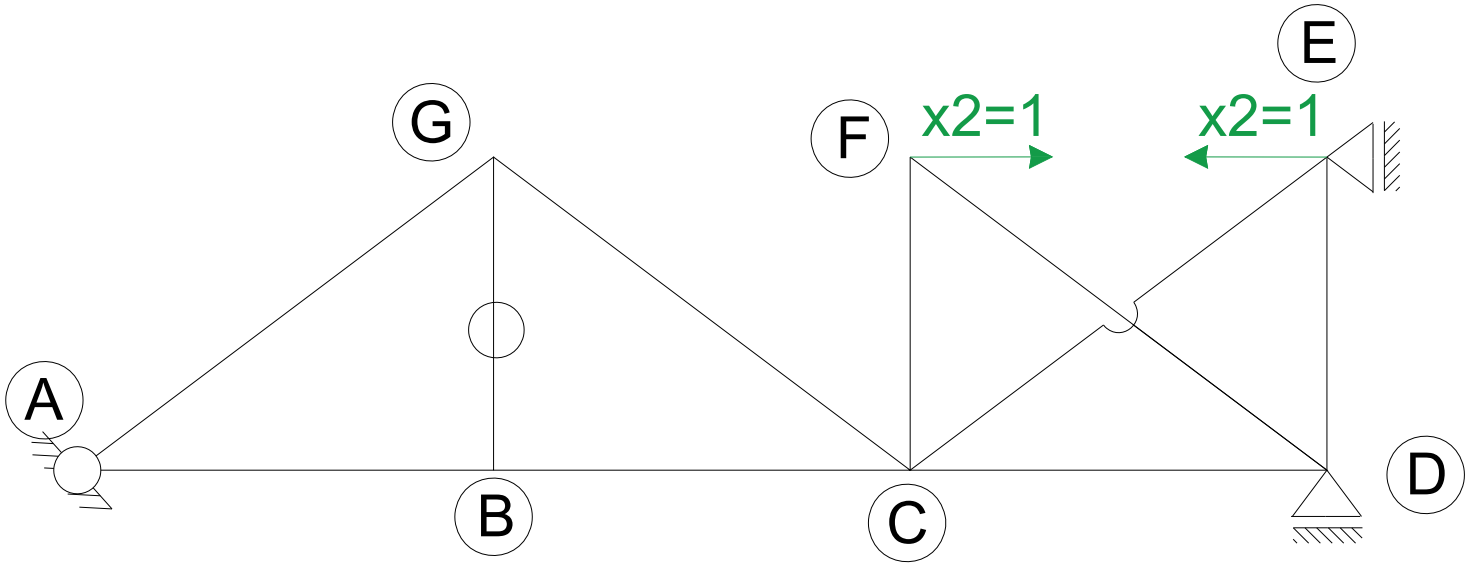
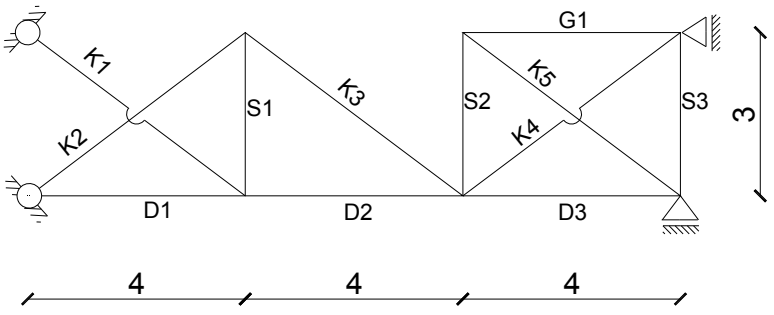
Wykresy: stan x2=1, siły N2

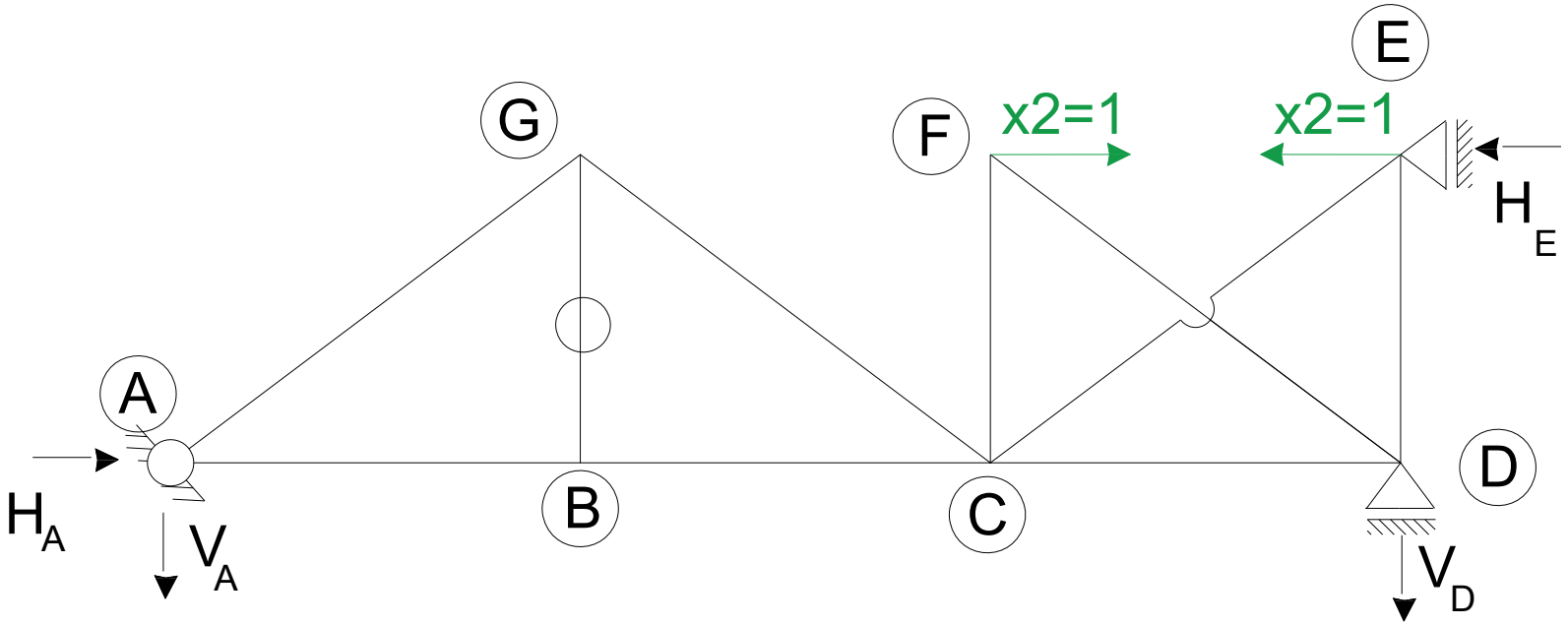


pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	

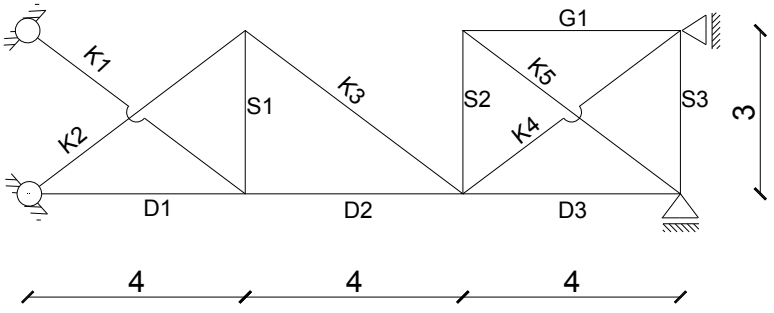


dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



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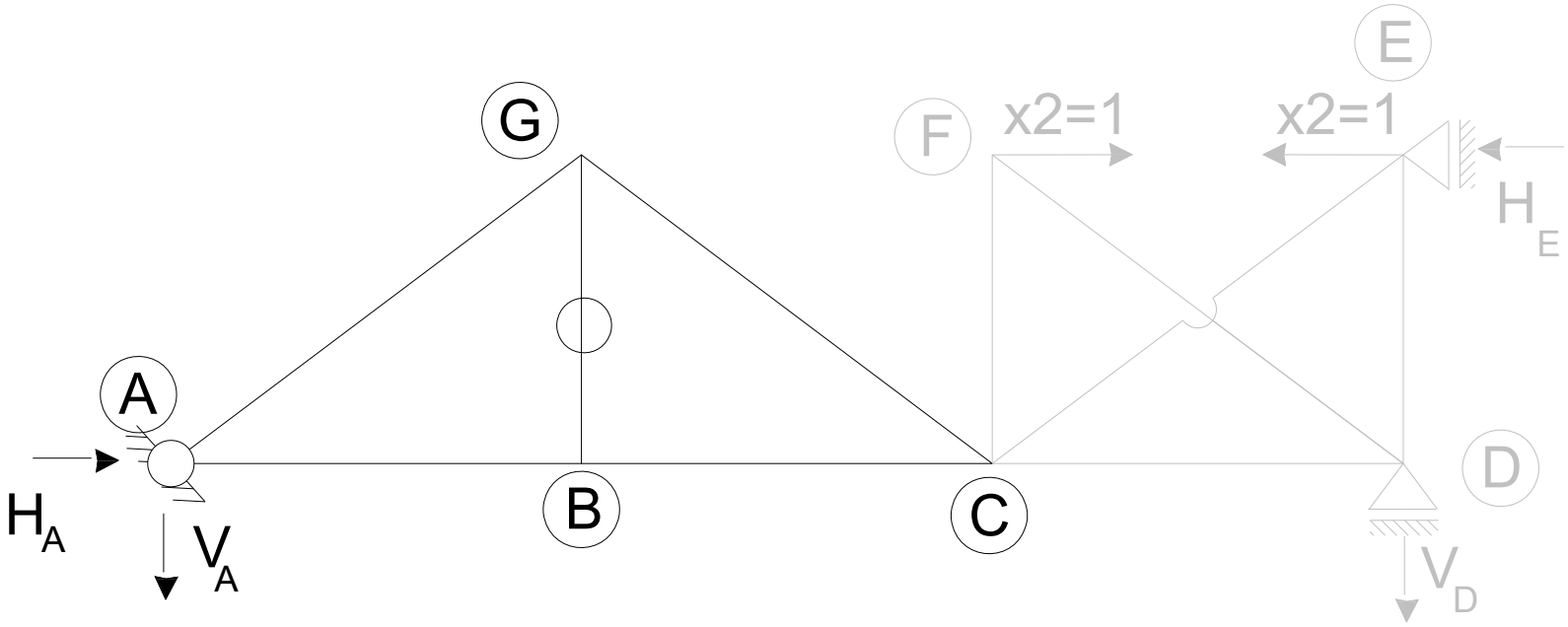
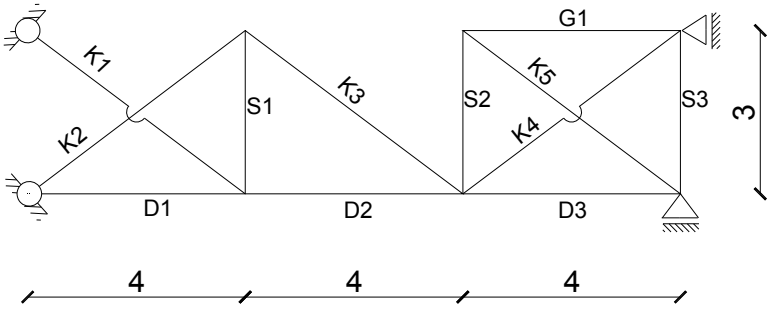
Wykresy: stan x2=1, siły N2

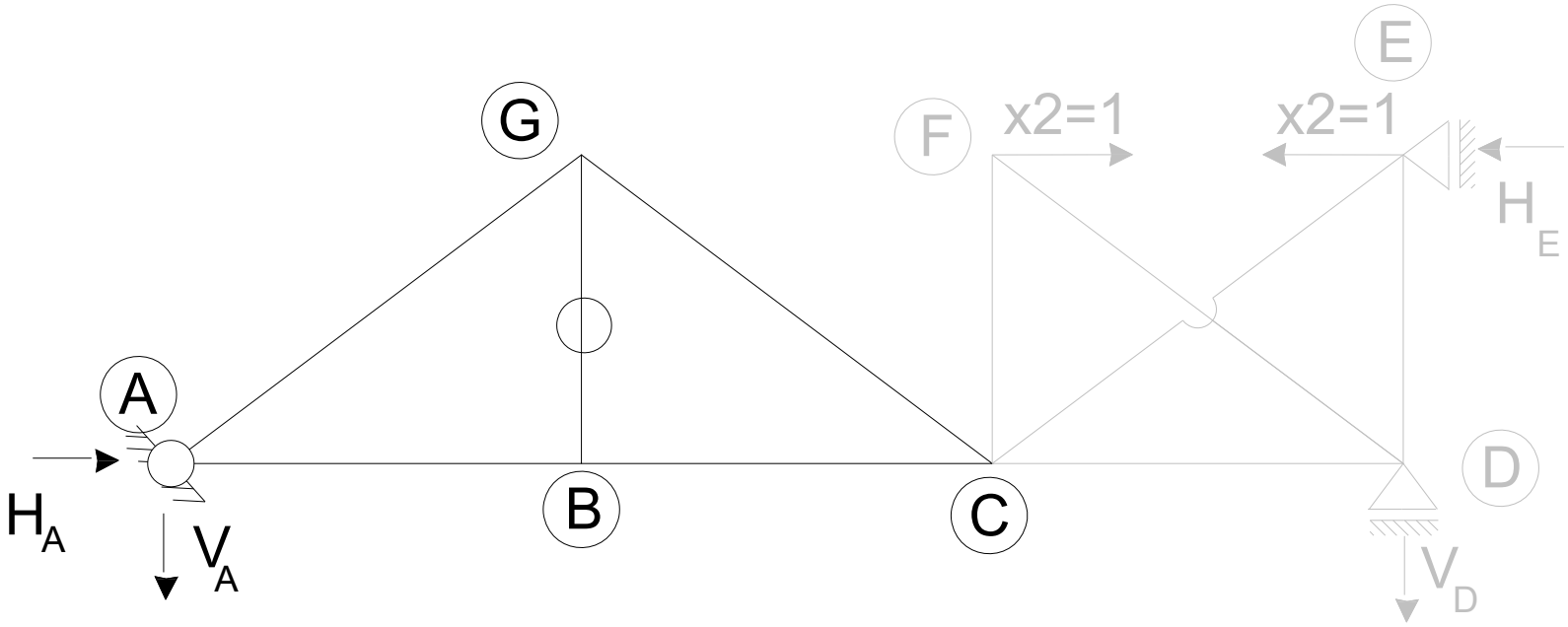


pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	

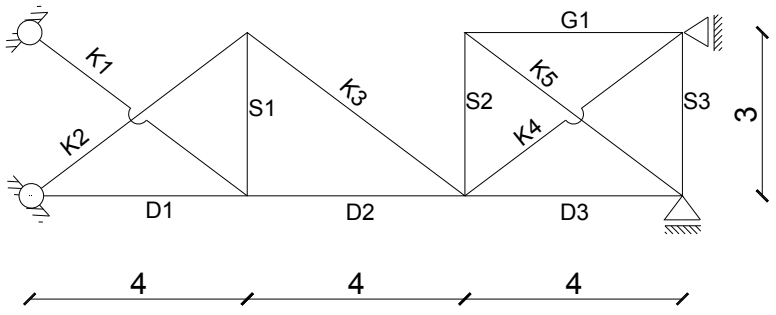


dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



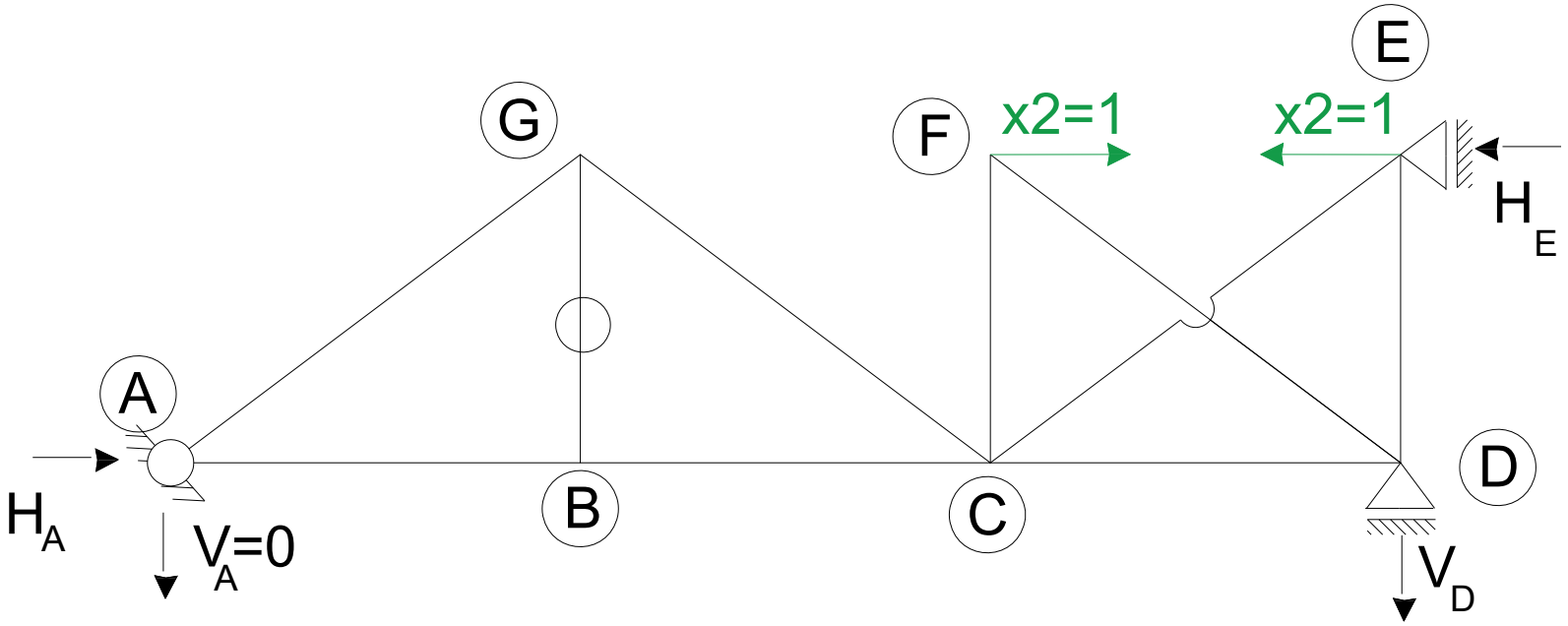
pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



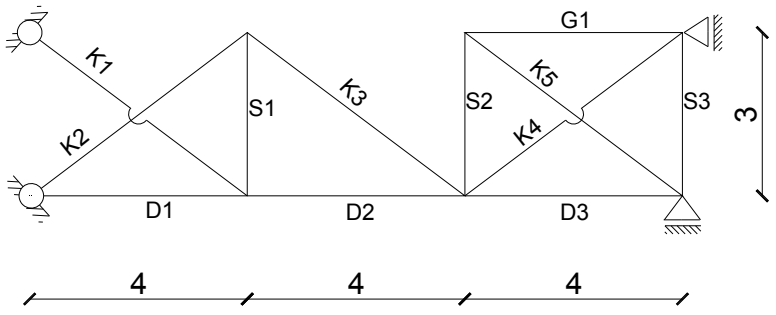
$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



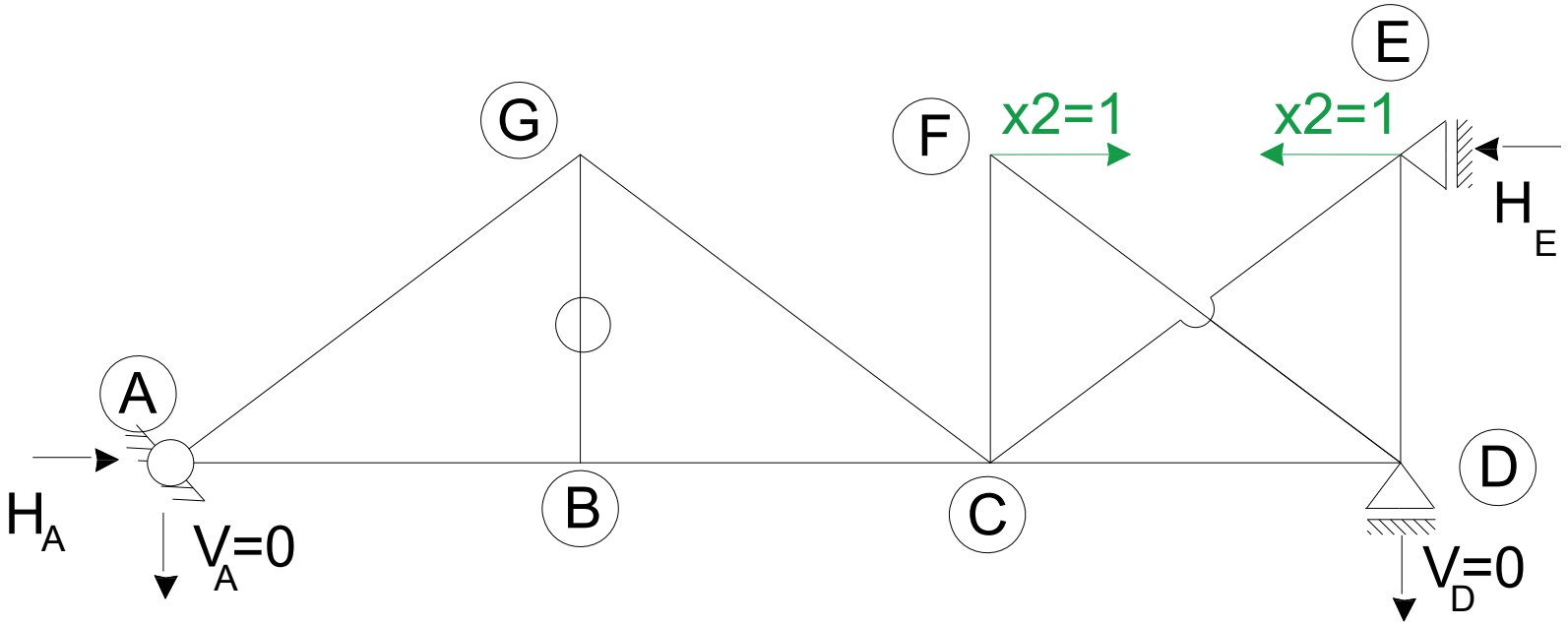
pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



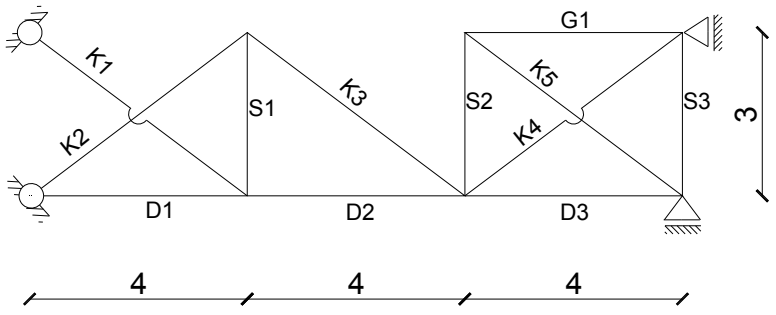
$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



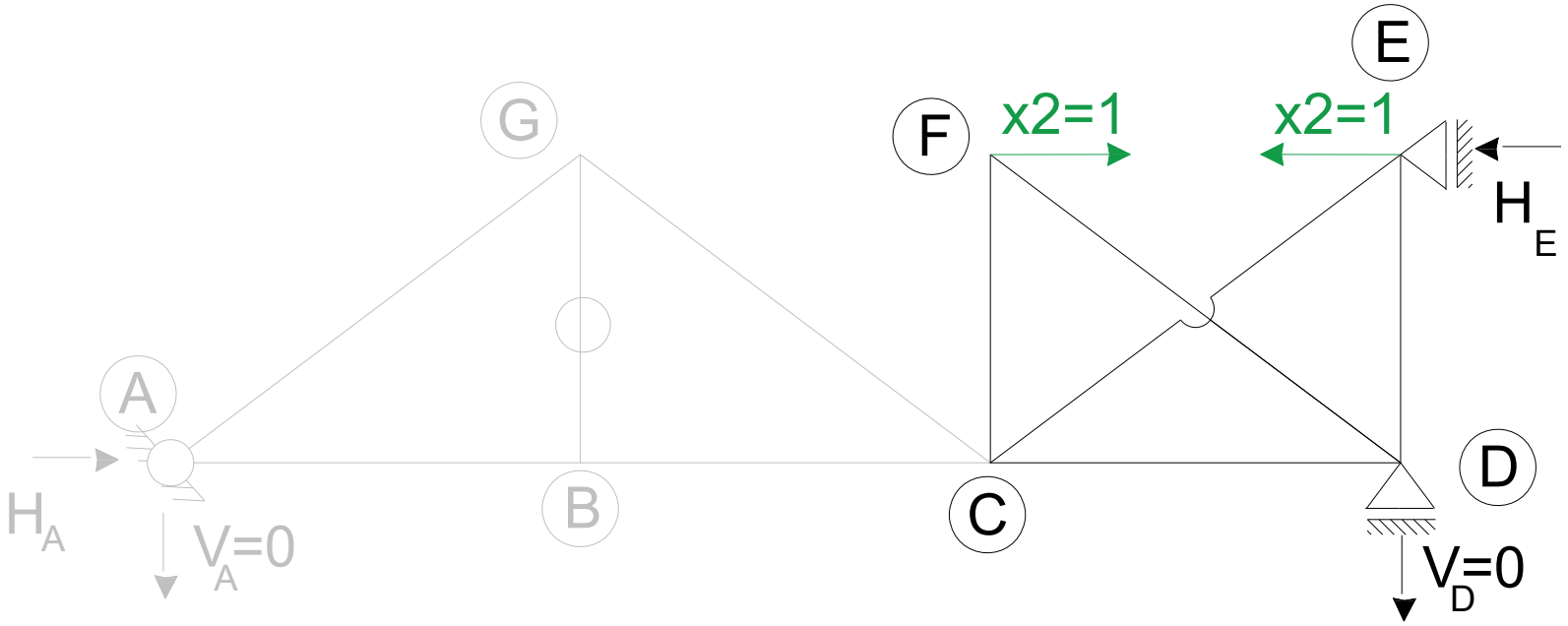
pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



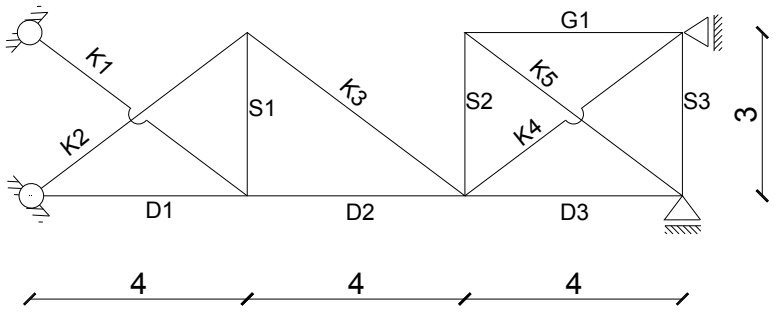
$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

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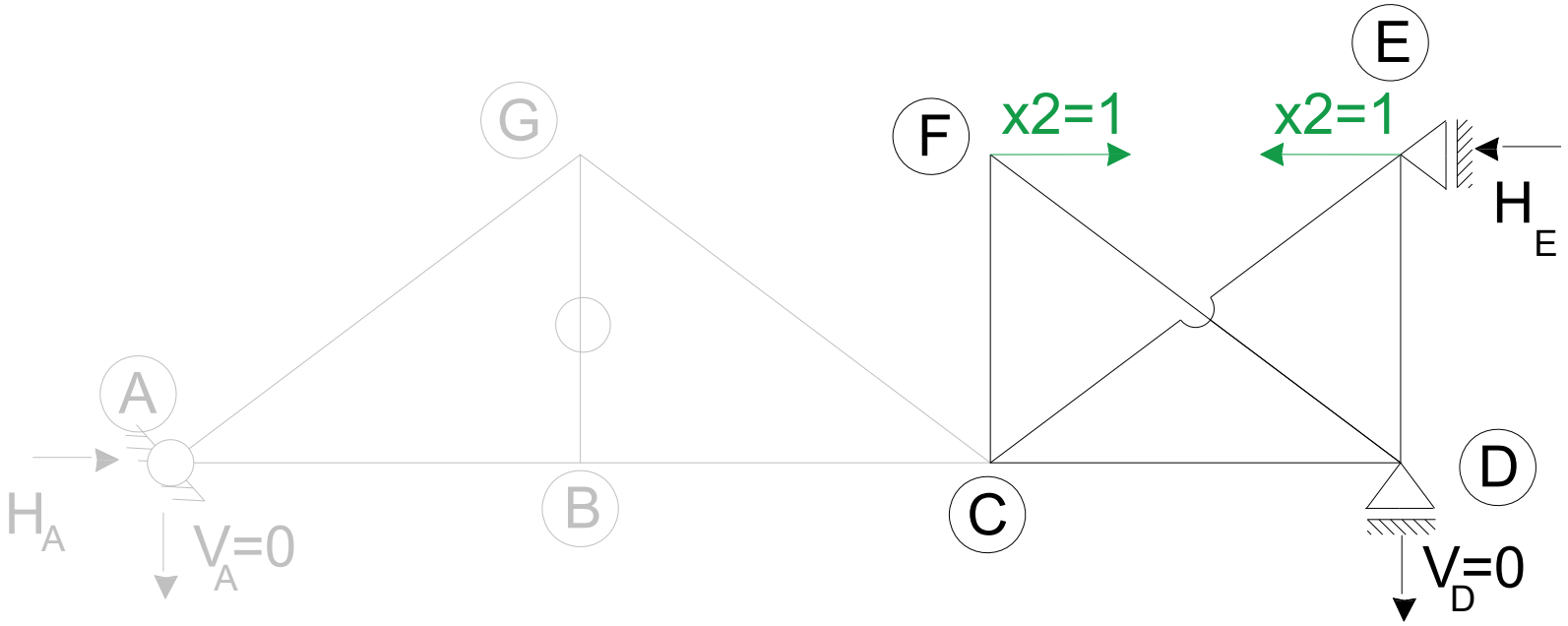
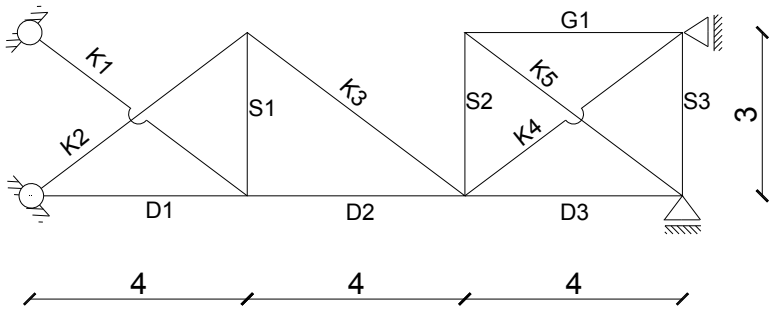
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	

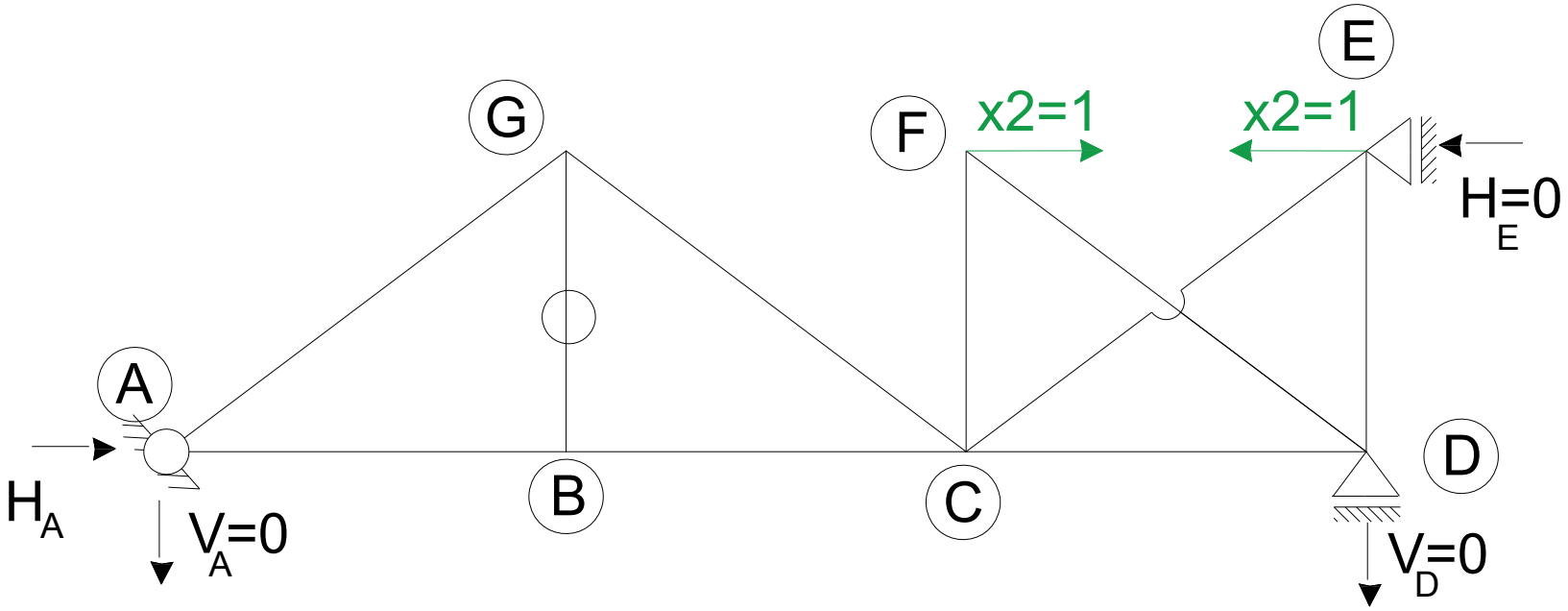


$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

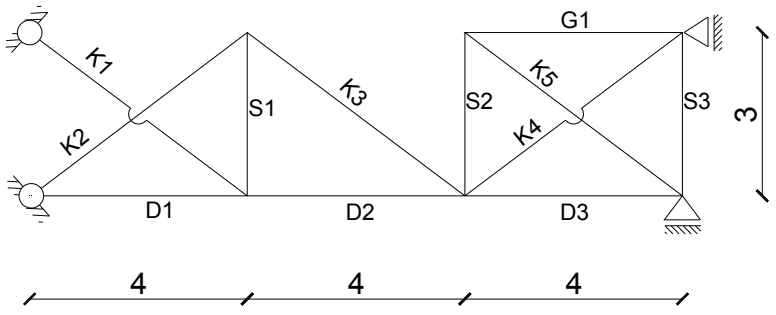
$$\sum M_C^P = 1 \cdot 3 - 1 \cdot 3 + 0 \cdot 4 - H_E \cdot 3 = 0 \rightarrow H_E = 0$$

dr inż. Hanna Weber

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

$$\sum M_C^P = 1 \cdot 3 - 1 \cdot 3 + 0 \cdot 4 - H_E \cdot 3 = 0 \rightarrow H_E = 0$$

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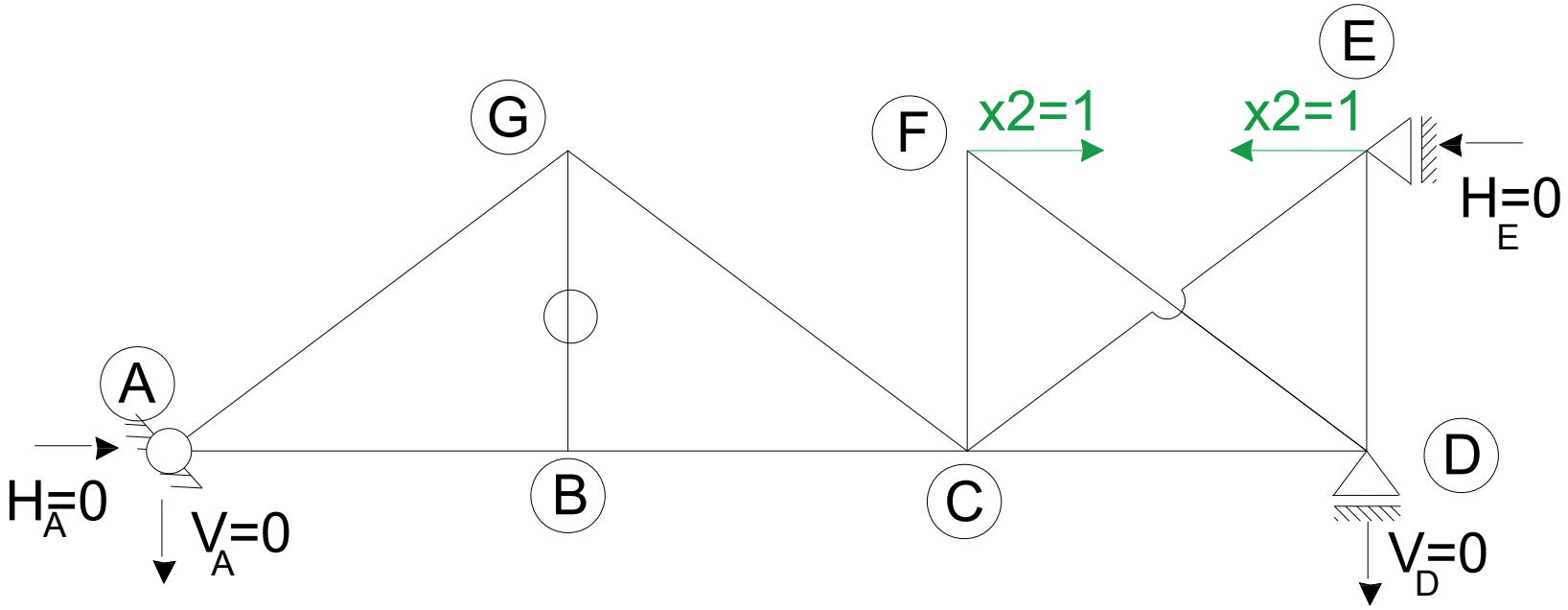
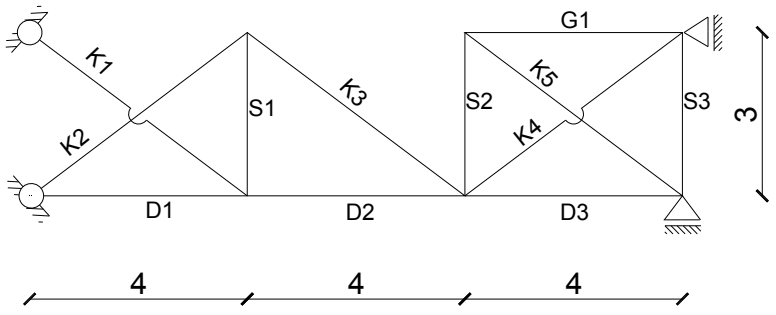
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



$$\sum M_C^L = -V_A \cdot 8 = 0 \rightarrow V_A = 0$$

$$\sum M_C^P = 1 \cdot 3 - 1 \cdot 3 + 0 \cdot 4 - H_E \cdot 3 = 0 \rightarrow H_E = 0$$

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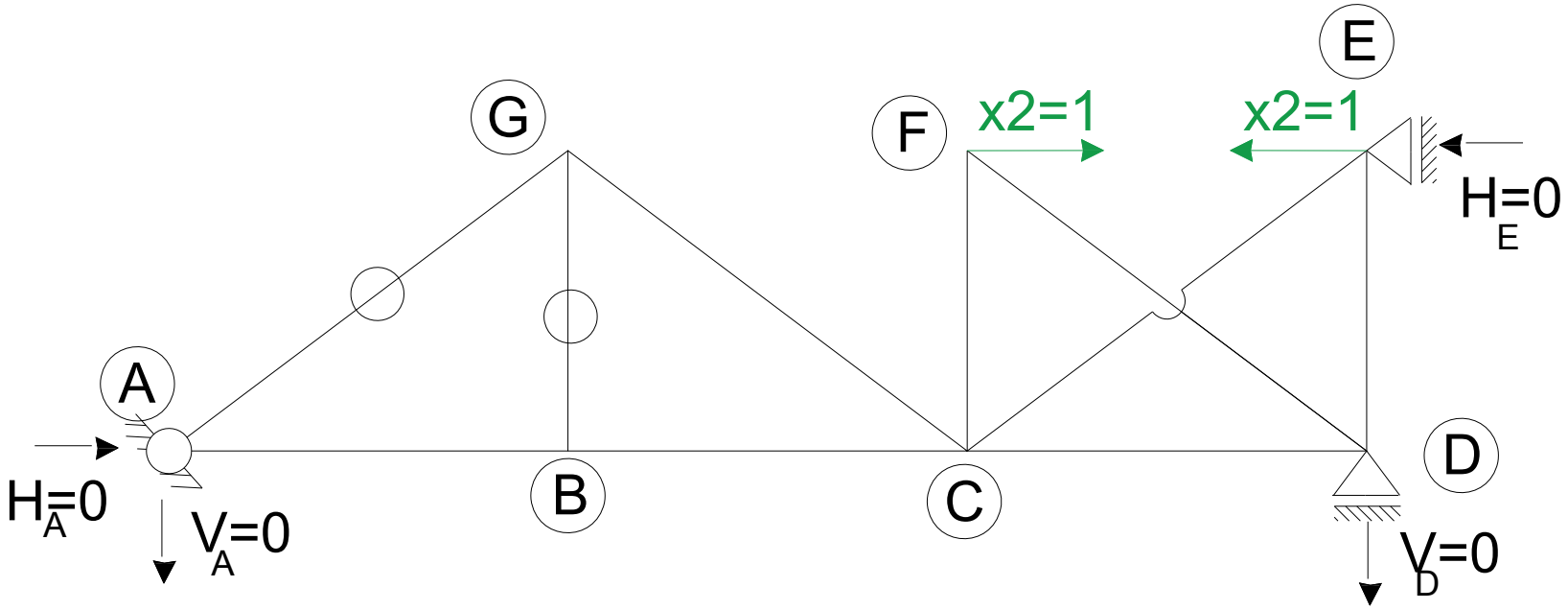
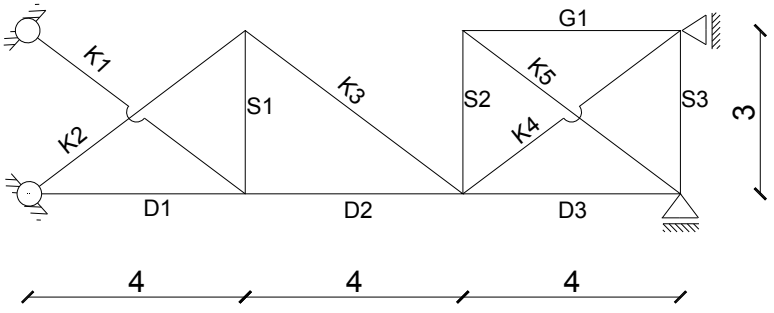
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	0
K3	5	
K4	5	
K5	5	



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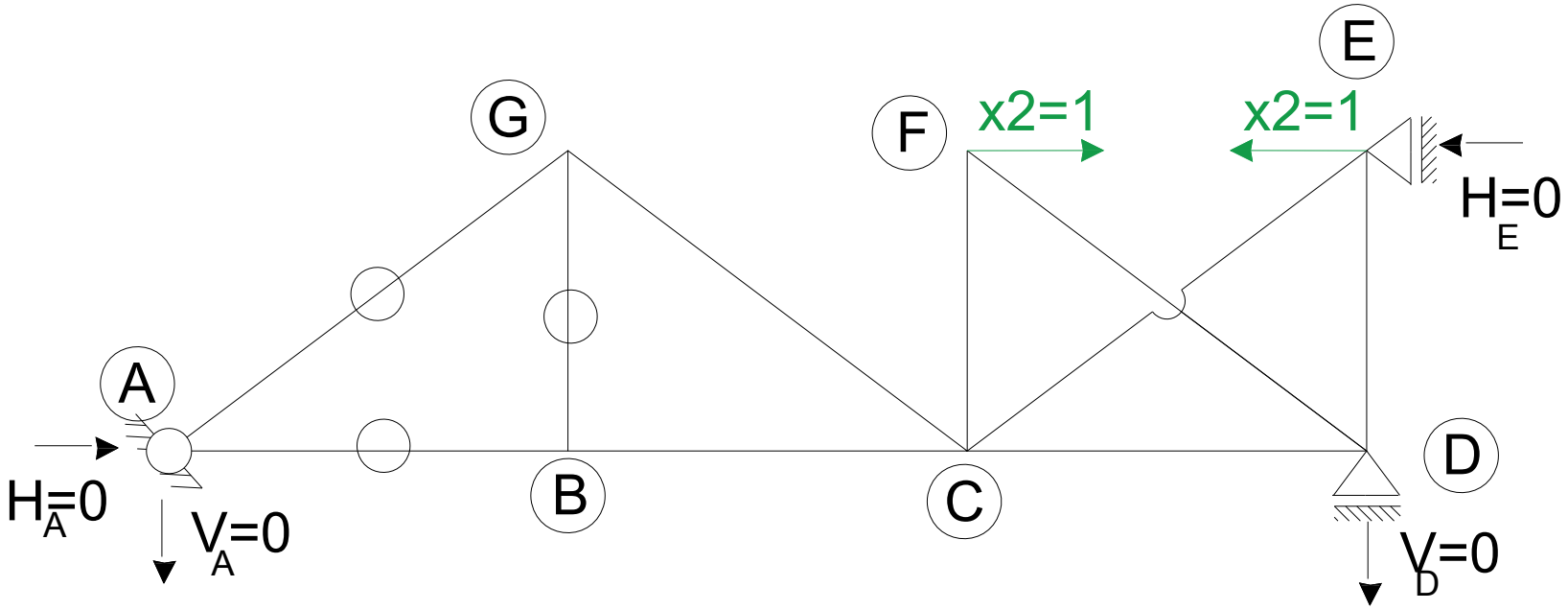
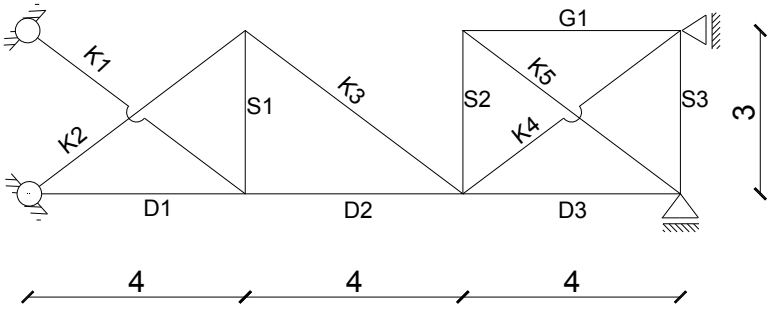
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	0
K3	5	
K4	5	
K5	5	



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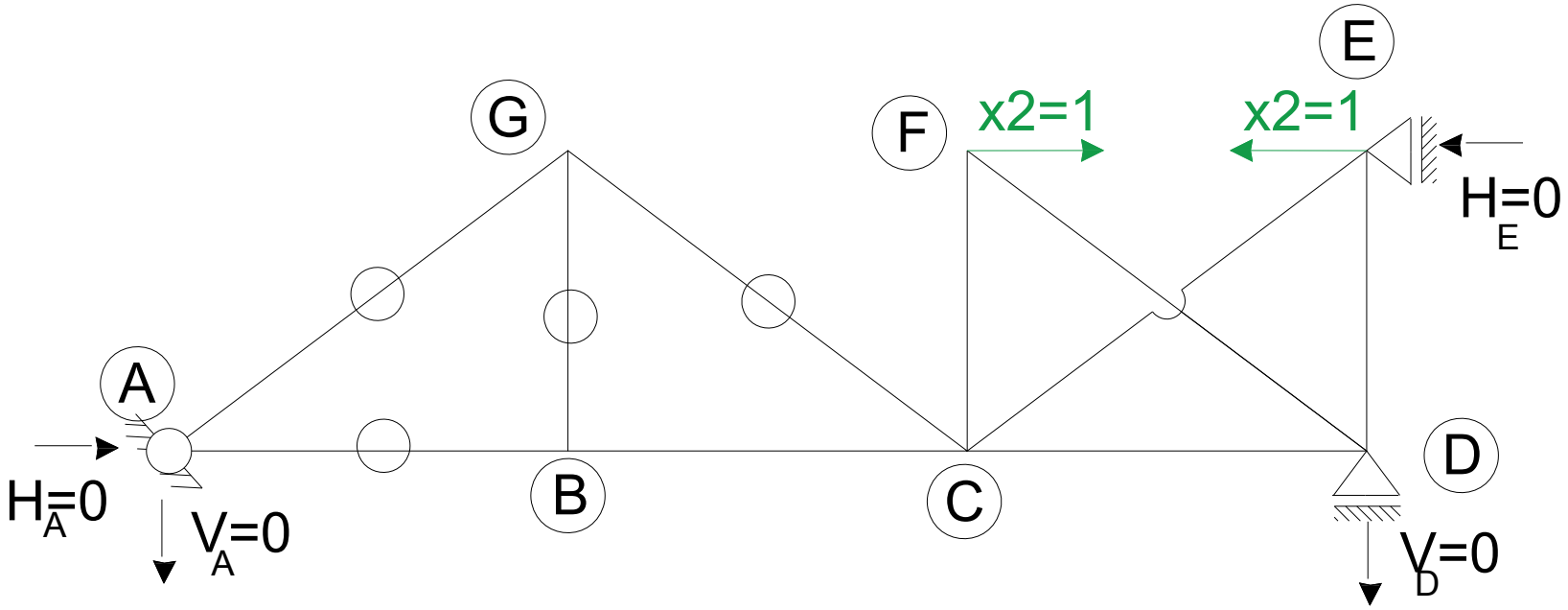
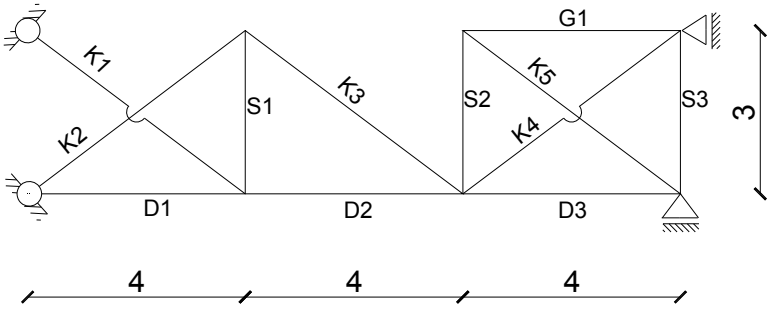
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	0
K3	5	0
K4	5	
K5	5	



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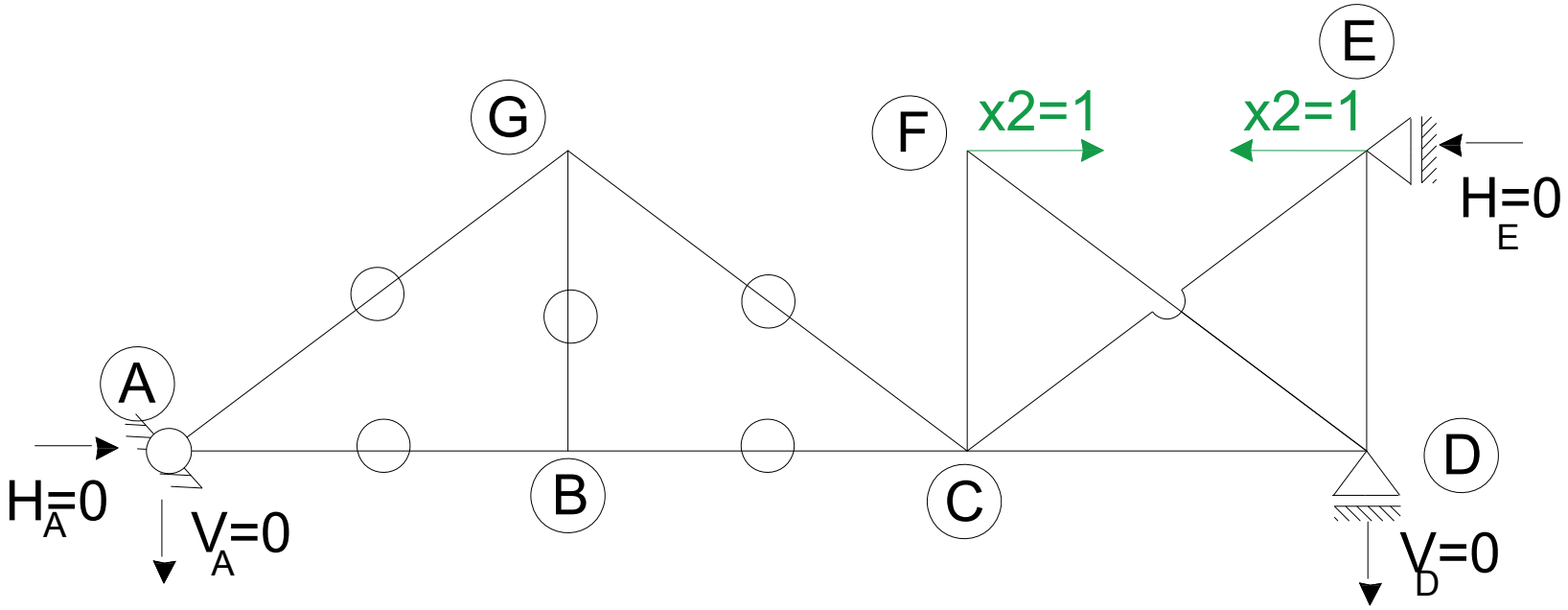
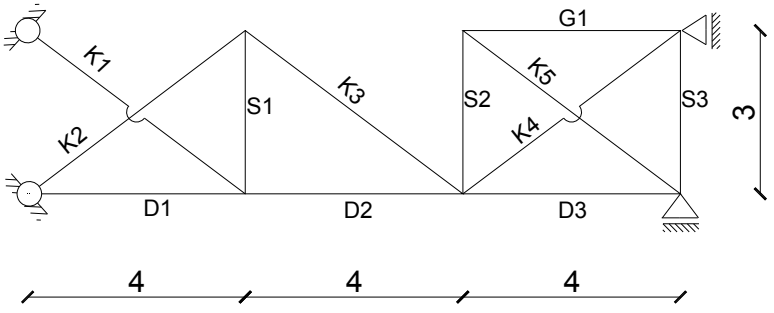
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	0
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	0
K3	5	0
K4	5	
K5	5	



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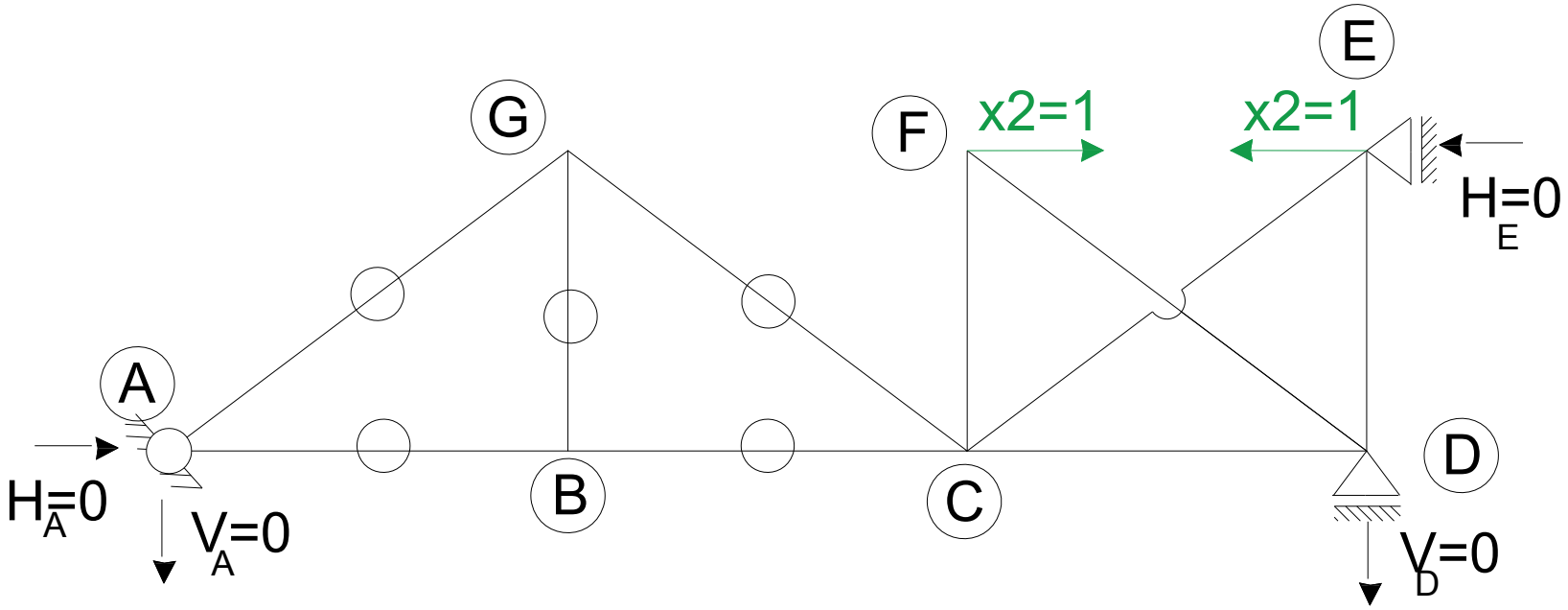
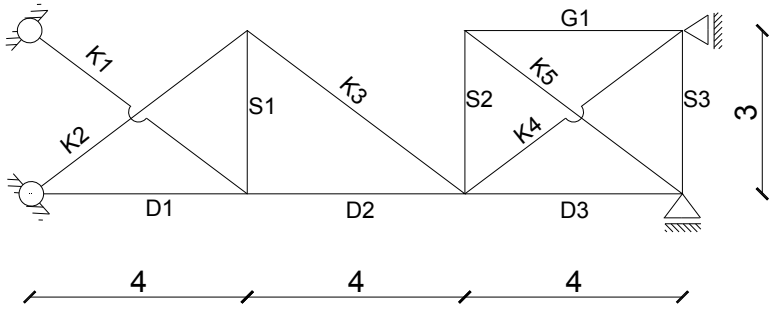
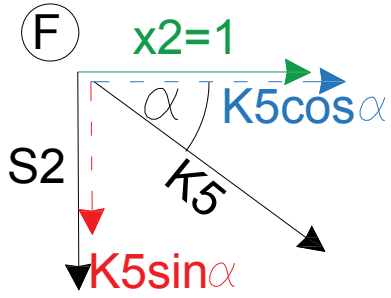
Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	0
D3	4	
G1	4	1
S1	3	0
S2	3	
S3	3	
K1	5	0
K2	5	0
K3	5	0
K4	5	
K5	5	





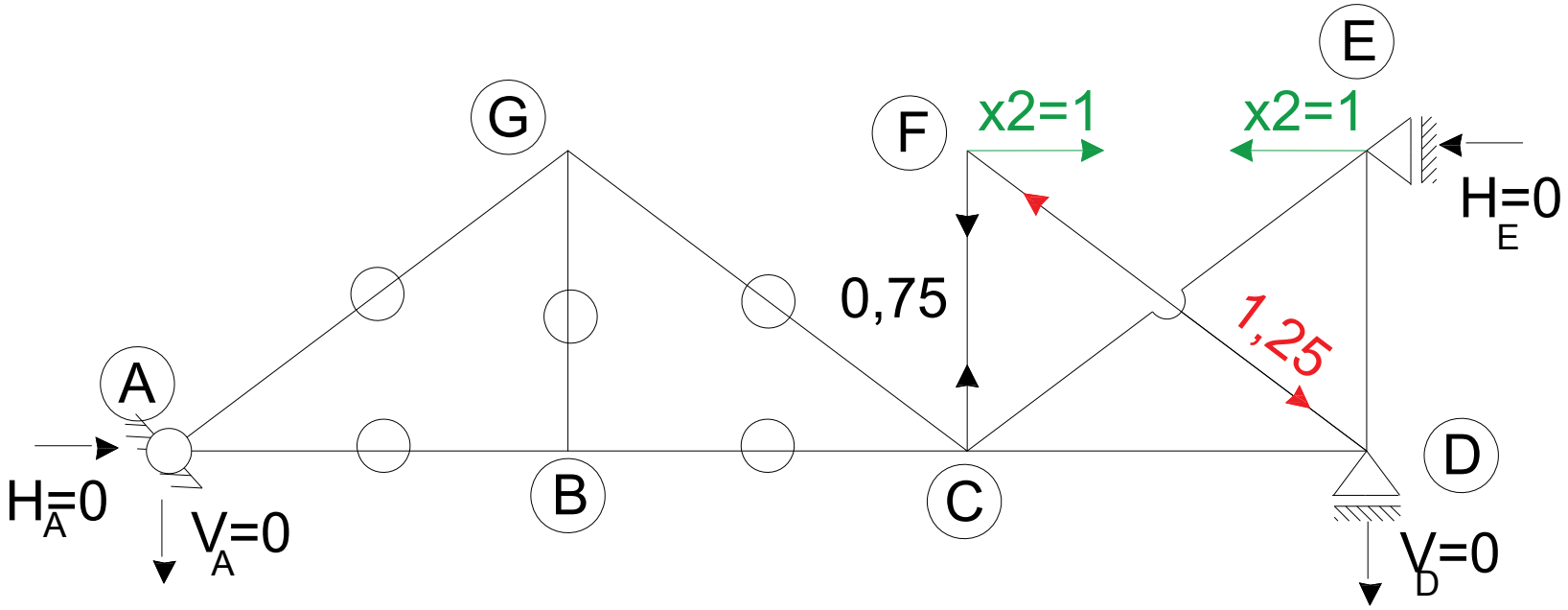
$$\sum R_x = x2 + K5 \cdot \cos\alpha = 0$$

$$K5 = -\frac{x2}{\cos\alpha} = -1 \cdot \frac{5}{4} = -1{,}25$$

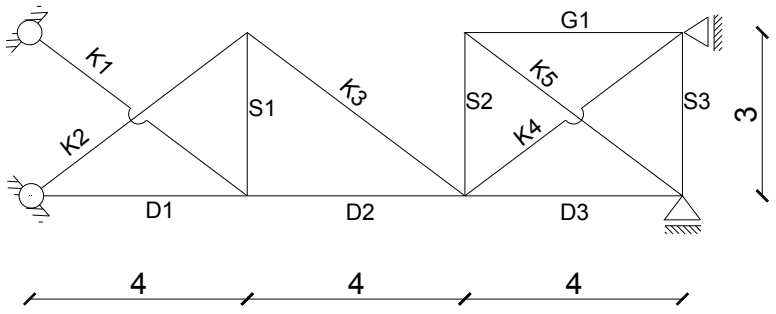
$$\sum R_Y = -S2 - K5 \cdot \sin\alpha = 0$$

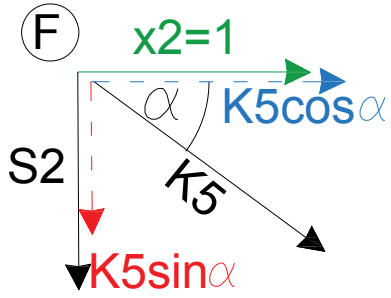
$$S2 = -K5 \cdot \sin\alpha = -\left(-\frac{5}{4}\right) \cdot \frac{3}{5} = \frac{3}{4} = 0{,}75$$

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	0
D3	4	
G1	4	1
S1	3	0
S2	3	0,75
S3	3	
K1	5	0
K2	5	0
K3	5	0
K4	5	
K5	5	-1,25





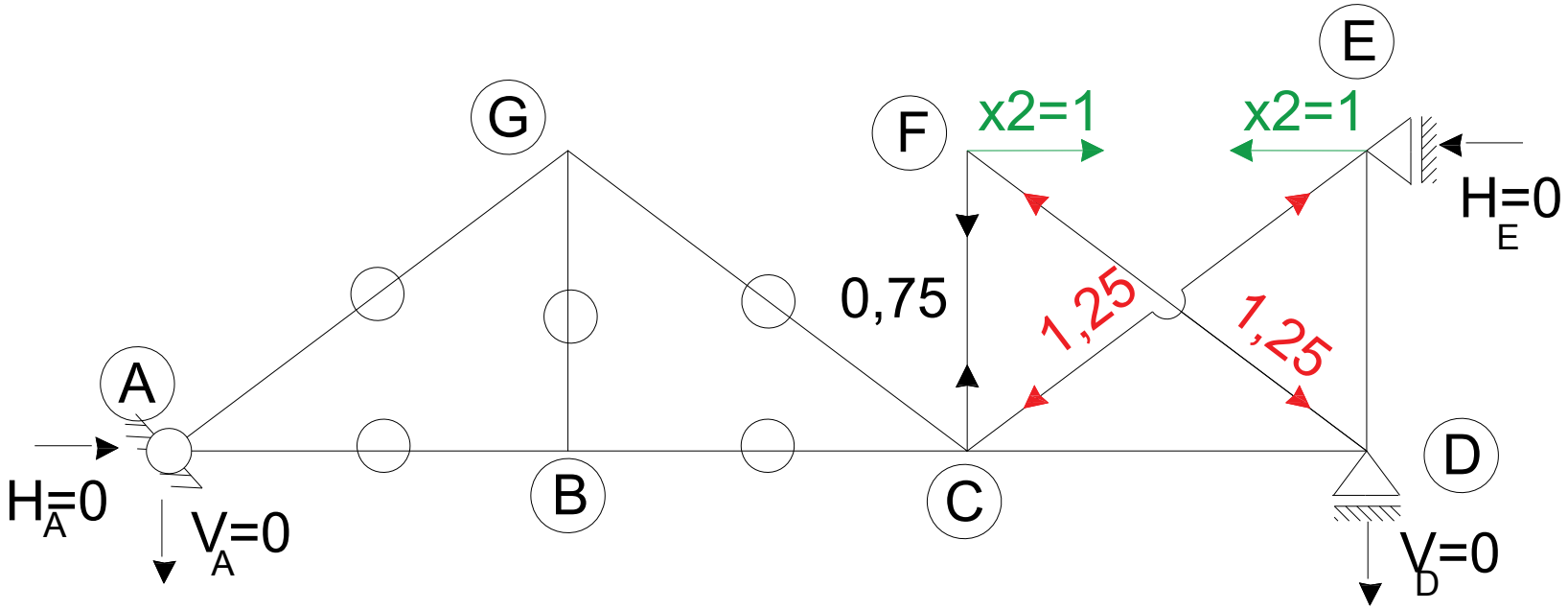
$$\sum R_x = x2 + K5 \cdot \cos\alpha = 0$$

$$K5 = -\frac{x2}{\cos\alpha} = -1 \cdot \frac{5}{4} = -1{,}25$$

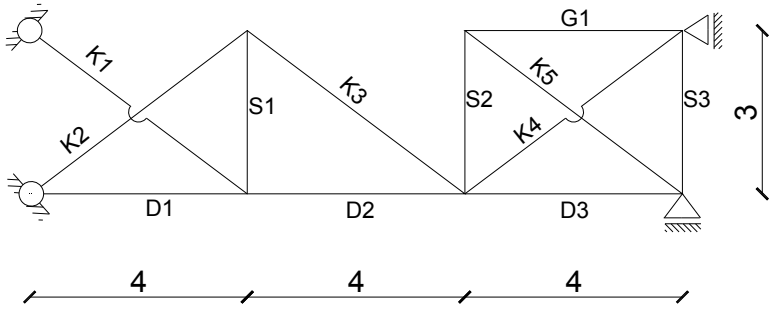
$$\sum R_Y = -S2 - K5 \cdot \sin\alpha = 0$$

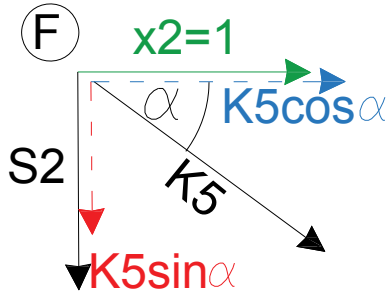
$$S2 = -K5 \cdot \sin\alpha = -\left(-\frac{5}{4}\right) \cdot \frac{3}{5} = \frac{3}{4} = 0{,}75$$

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	0
D3	4	
G1	4	1
S1	3	0
S2	3	0,75
S3	3	
K1	5	0
K2	5	0
K3	5	0
K4	5	-1,25
K5	5	-1,25





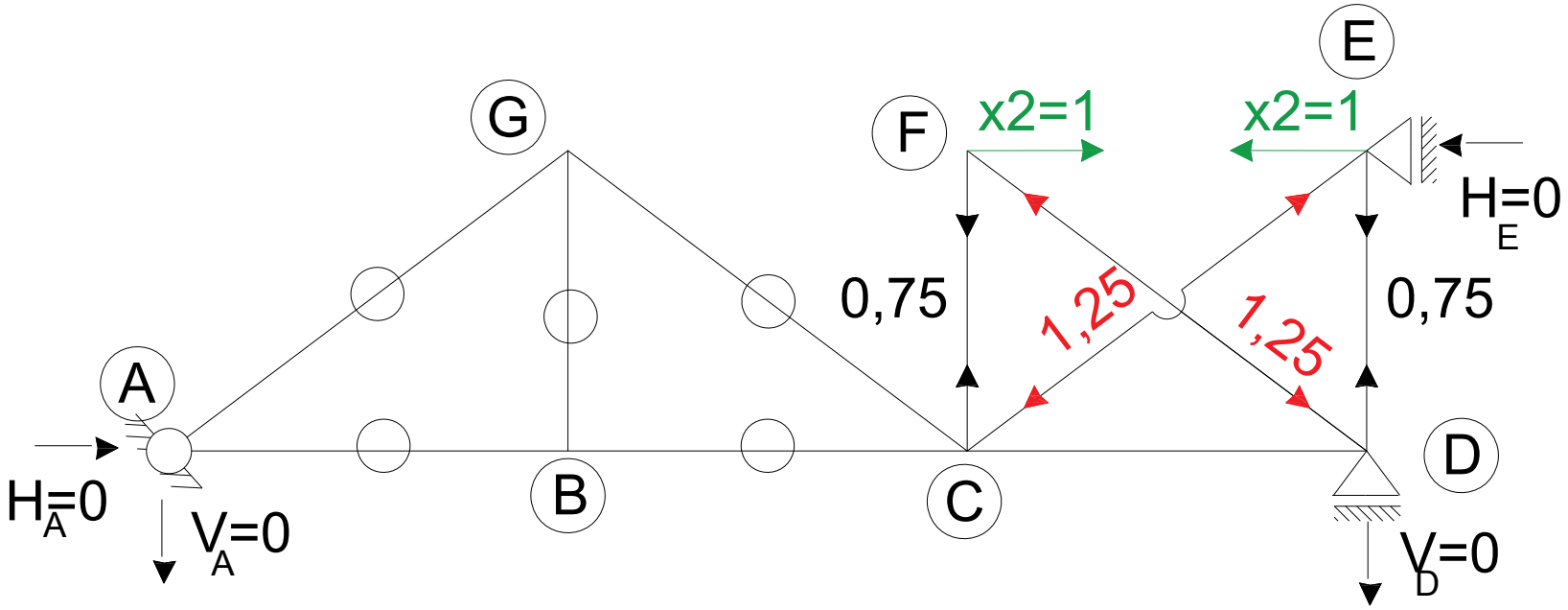
$$\sum R_x = x2 + K5 \cdot \cos\alpha = 0$$

$$K5 = -\frac{x2}{\cos\alpha} = -1 \cdot \frac{5}{4} = -1{,}25$$

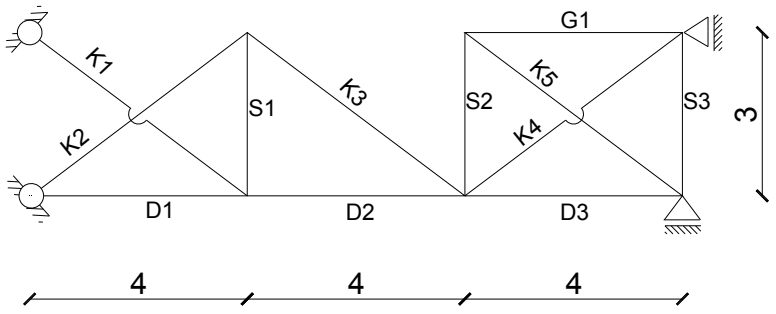
$$\sum R_Y = -S2 - K5 \cdot \sin\alpha = 0$$

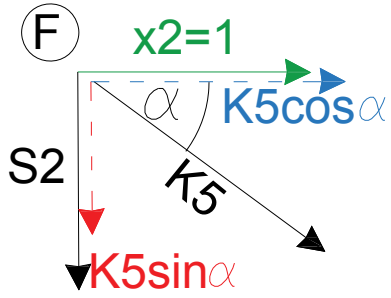
$$S2 = -K5 \cdot \sin\alpha = -\left(-\frac{5}{4}\right) \cdot \frac{3}{5} = \frac{3}{4} = 0{,}75$$

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	0
D3	4	
G1	4	1
S1	3	0
S2	3	0,75
S3	3	0,75
K1	5	0
K2	5	0
K3	5	0
K4	5	-1,25
K5	5	-1,25





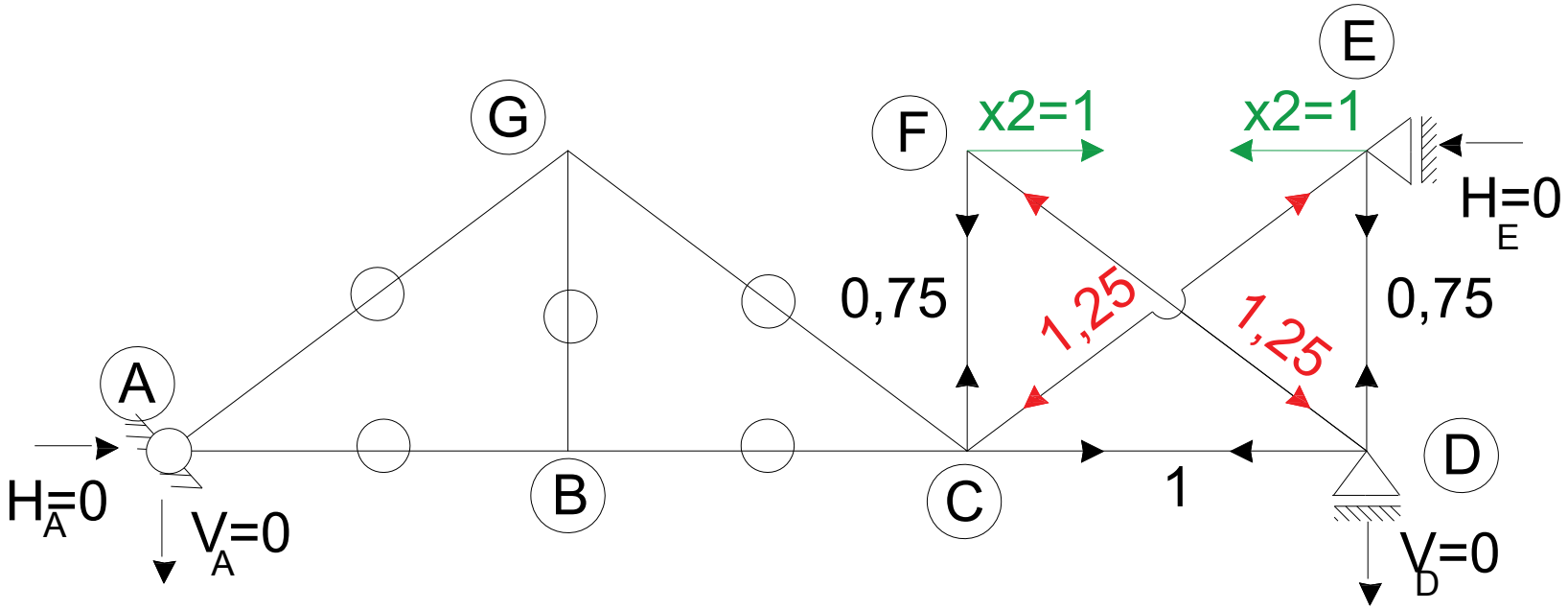
$$\sum R_x = x2 + K5 \cdot \cos\alpha = 0$$

$$K5 = -\frac{x2}{\cos\alpha} = -1 \cdot \frac{5}{4} = -1{,}25$$

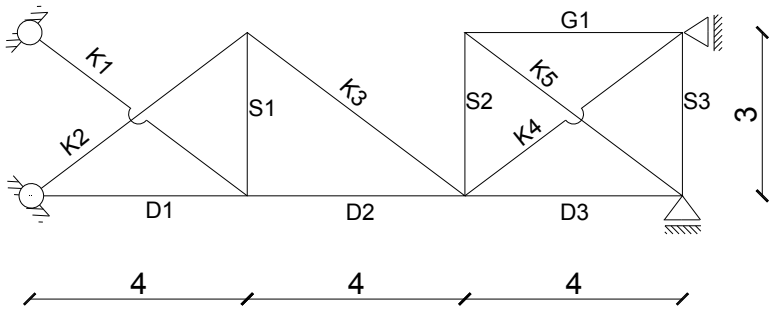
$$\sum R_Y = -S2 - K5 \cdot \sin\alpha = 0$$

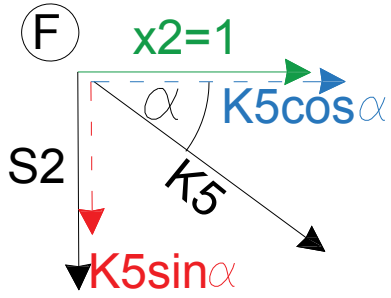
$$S2 = -K5 \cdot \sin\alpha = -\left(-\frac{5}{4}\right) \cdot \frac{3}{5} = \frac{3}{4} = 0{,}75$$

Wykresy: stan x2=1, siły N2



pręt	L/EA	N2
D1	4	0
D2	4	0
D3	4	1
G1	4	1
S1	3	0
S2	3	0,75
S3	3	0,75
K1	5	0
K2	5	0
K3	5	0
K4	5	-1,25
K5	5	-1,25





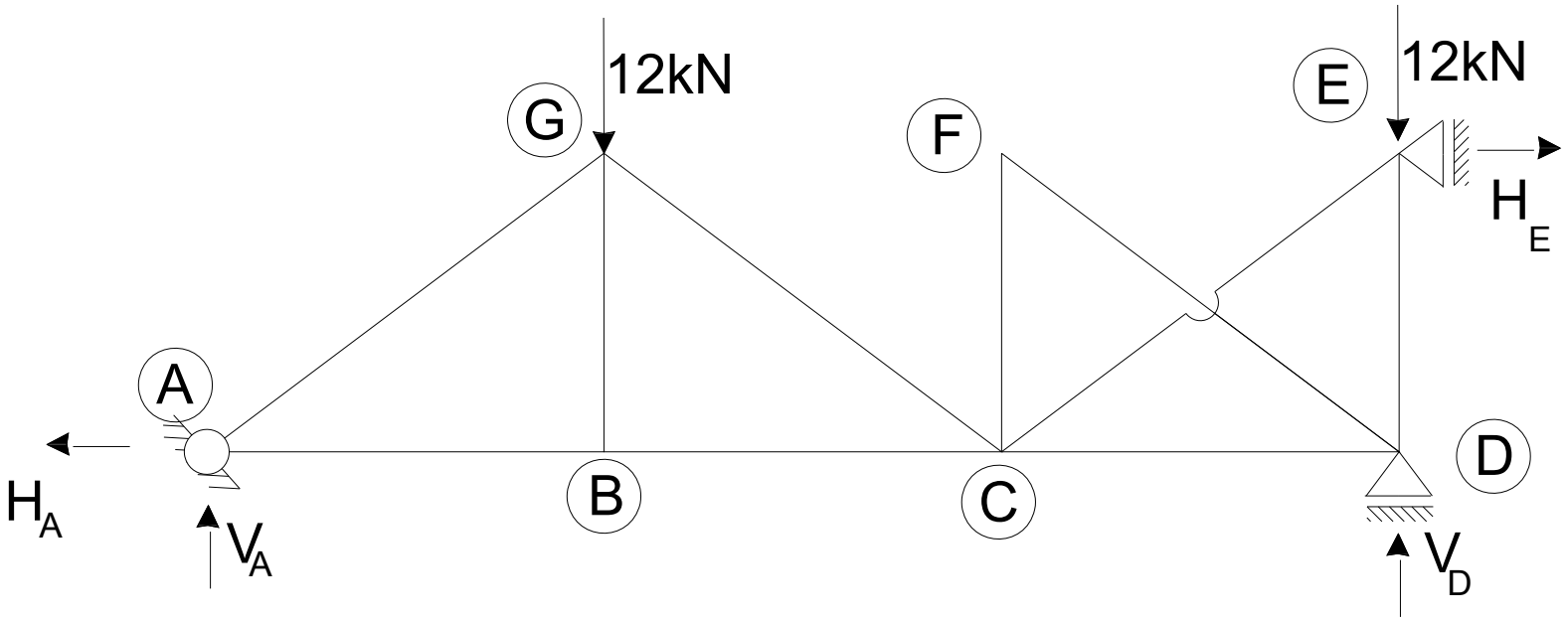
$$\sum R_x = x2 + K5 \cdot \cos\alpha = 0$$

$$K5 = -\frac{x2}{\cos\alpha} = -1 \cdot \frac{5}{4} = -1{,}25$$

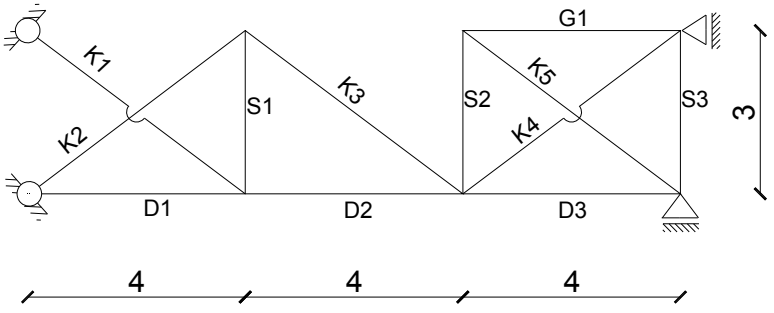
$$\sum R_Y = -S2 - K5 \cdot \sin\alpha = 0$$

$$S2 = -K5 \cdot \sin\alpha = -\left(-\frac{5}{4}\right) \cdot \frac{3}{5} = \frac{3}{4} = 0{,}75$$

Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	
G1	4	
S1	3	
S2	3	
S3	3	
K1	5	
K2	5	
K3	5	
K4	5	
K5	5	



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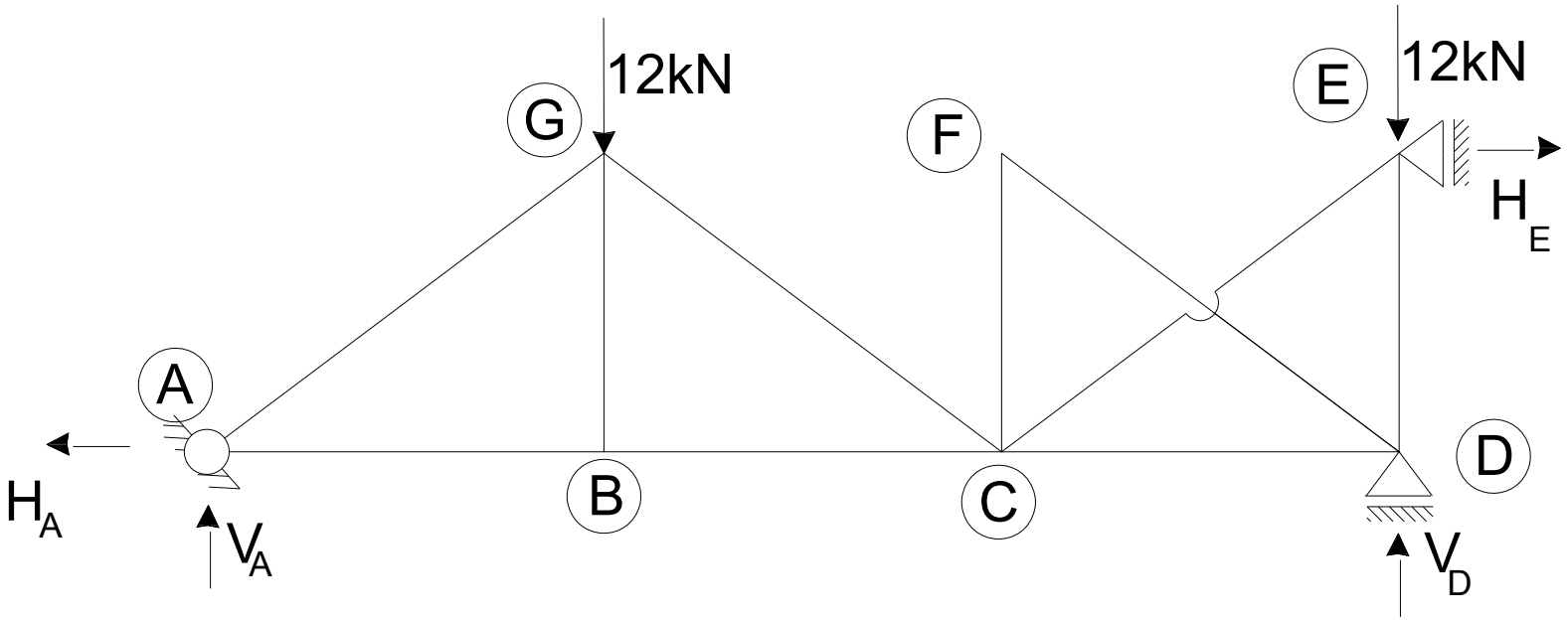
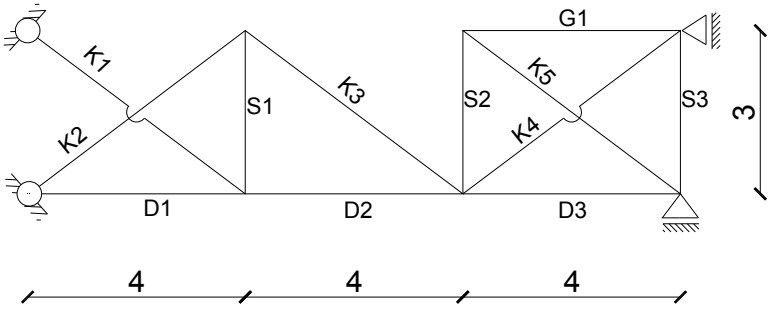
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	
G1	4	0
S1	3	
S2	3	
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	



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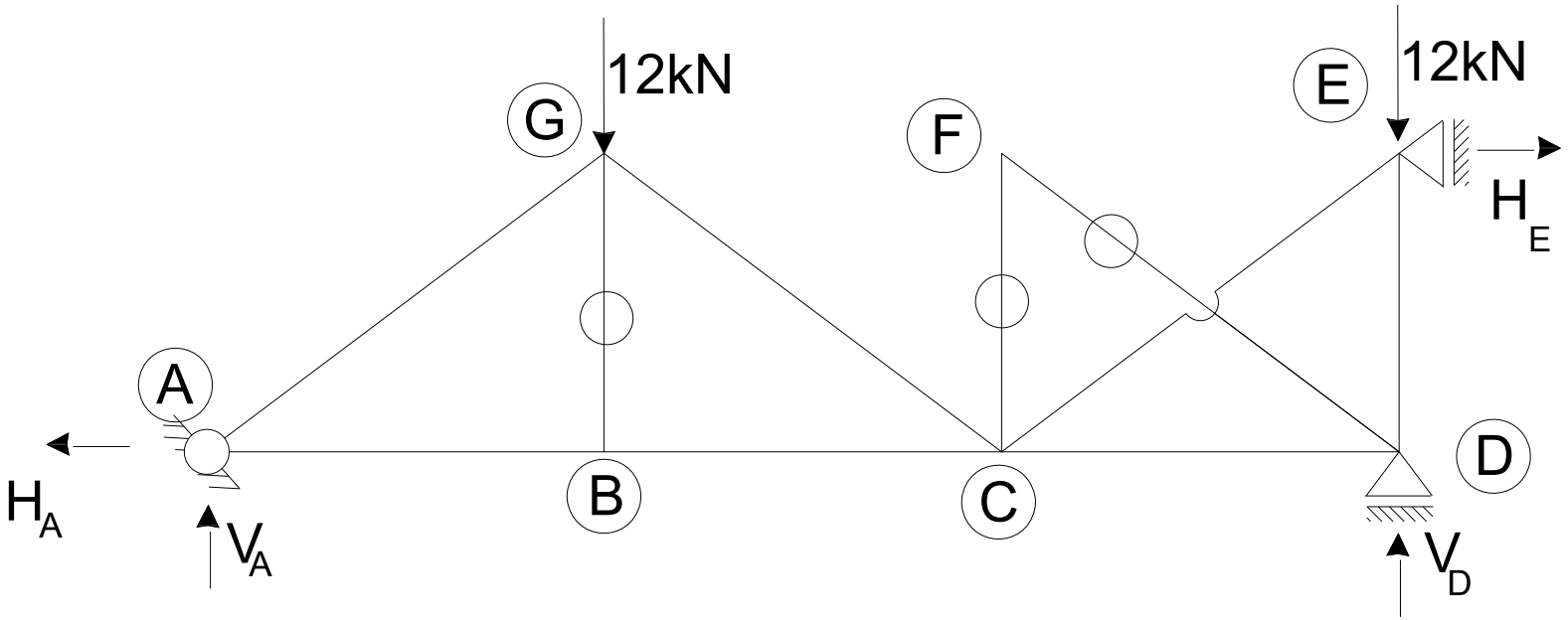
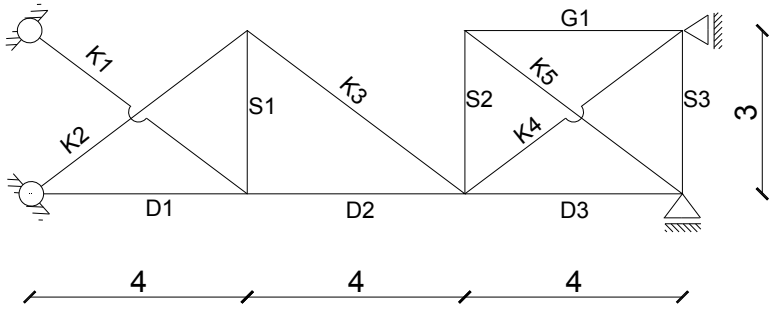
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



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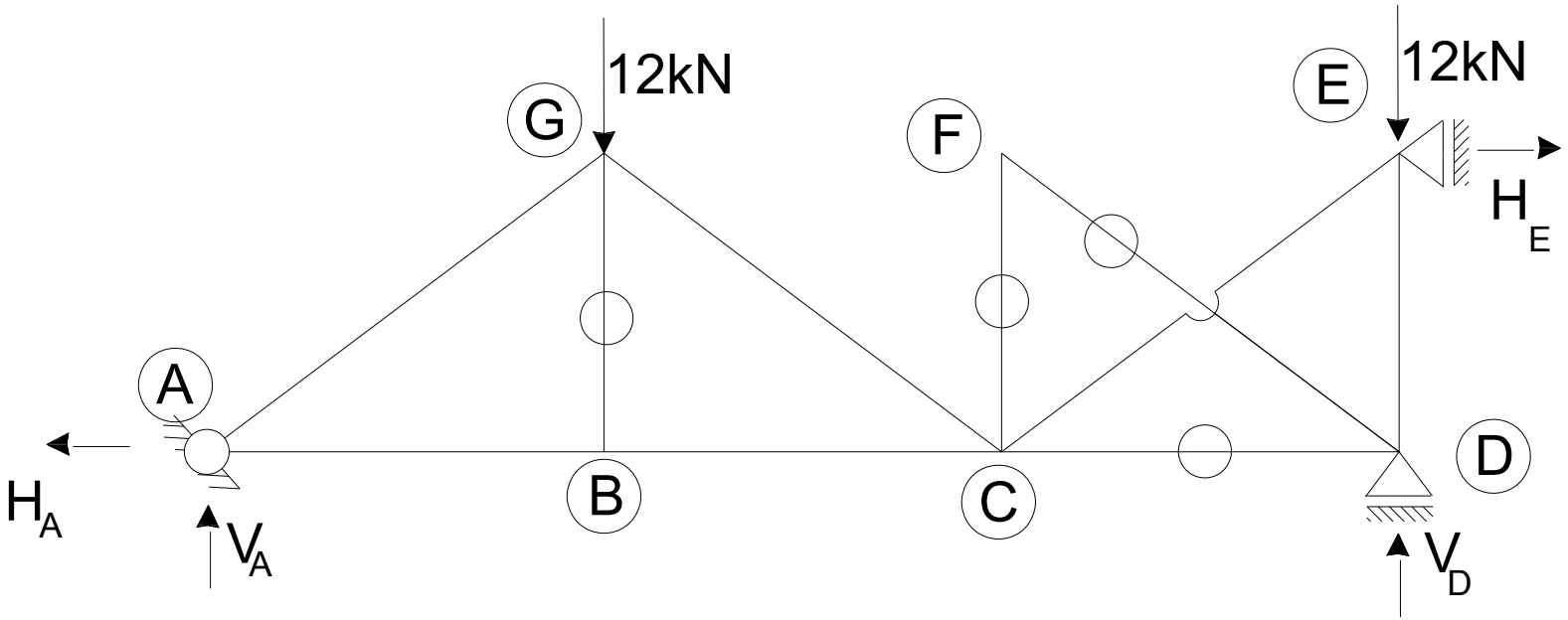
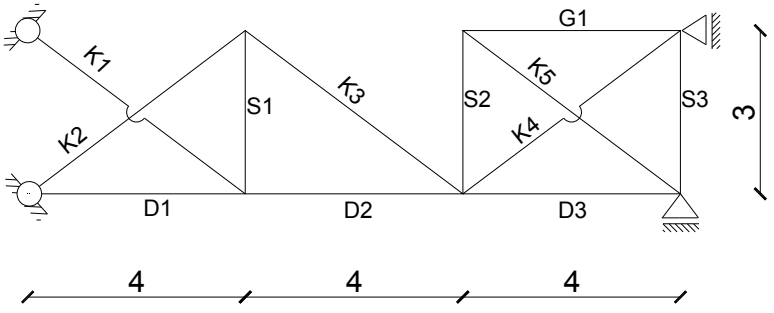
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



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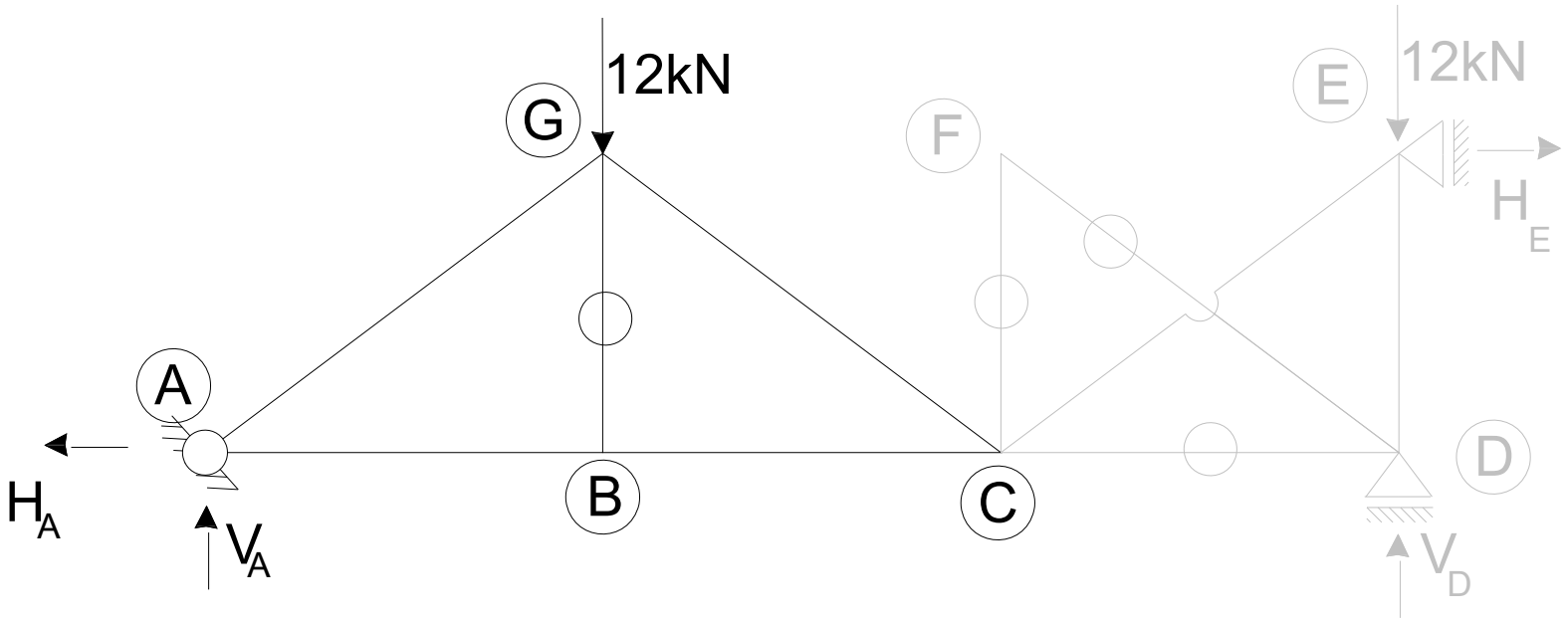
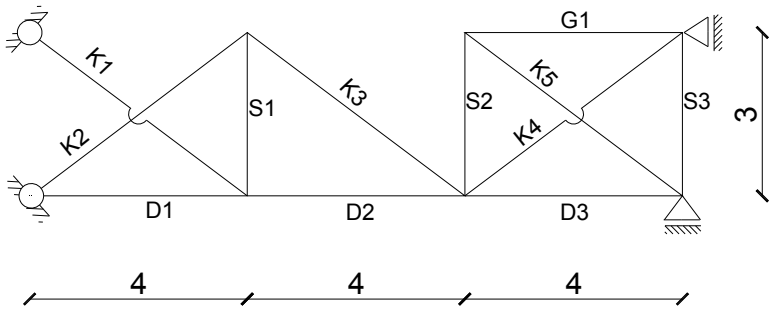
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



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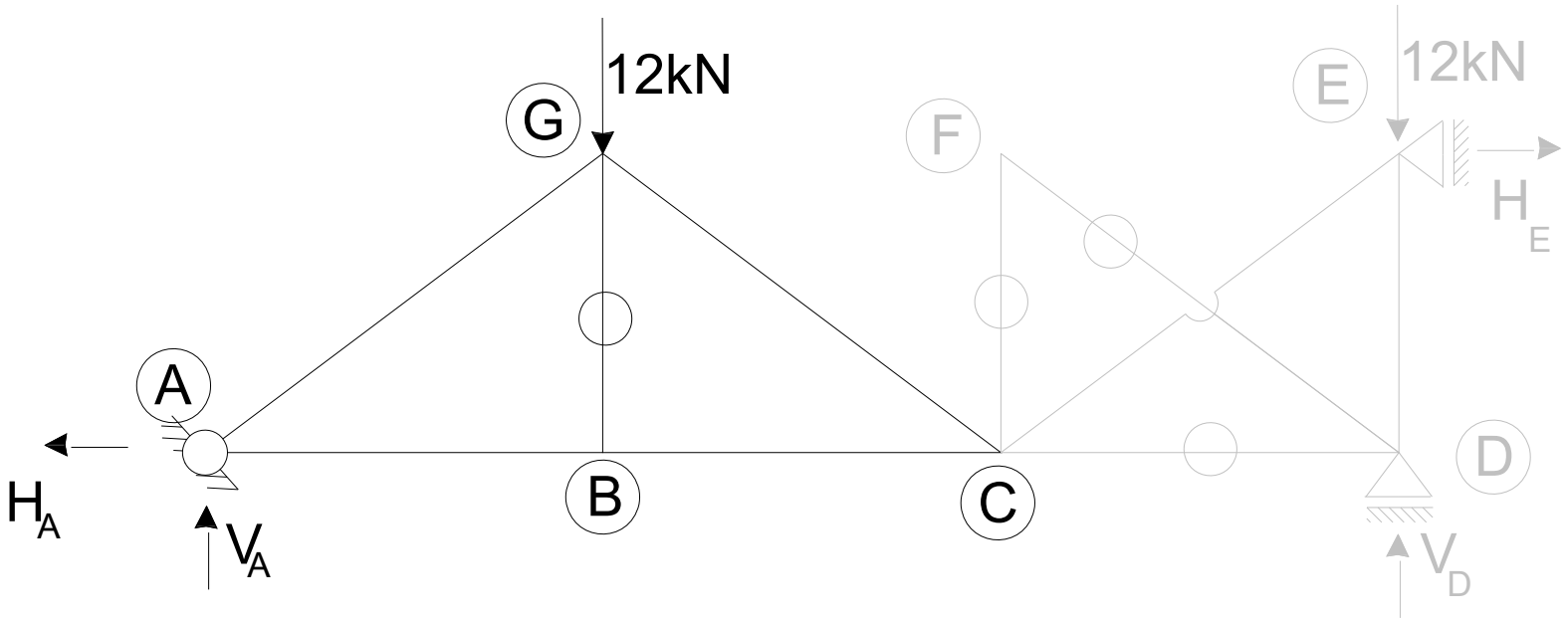
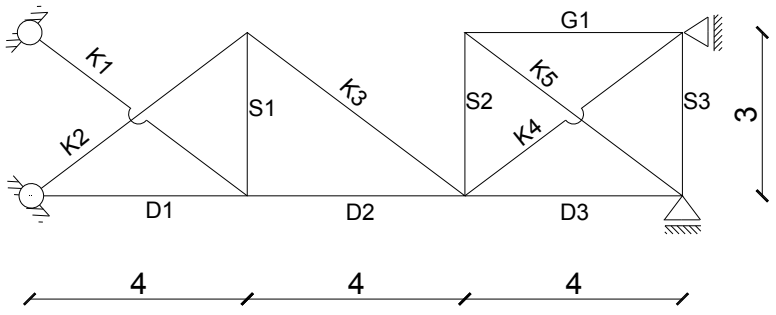
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



$$\sum M_C^L = -12 \cdot 4 + V_A \cdot 8 = 0 \rightarrow V_A = \frac{48}{8} = 6\text{kN}$$

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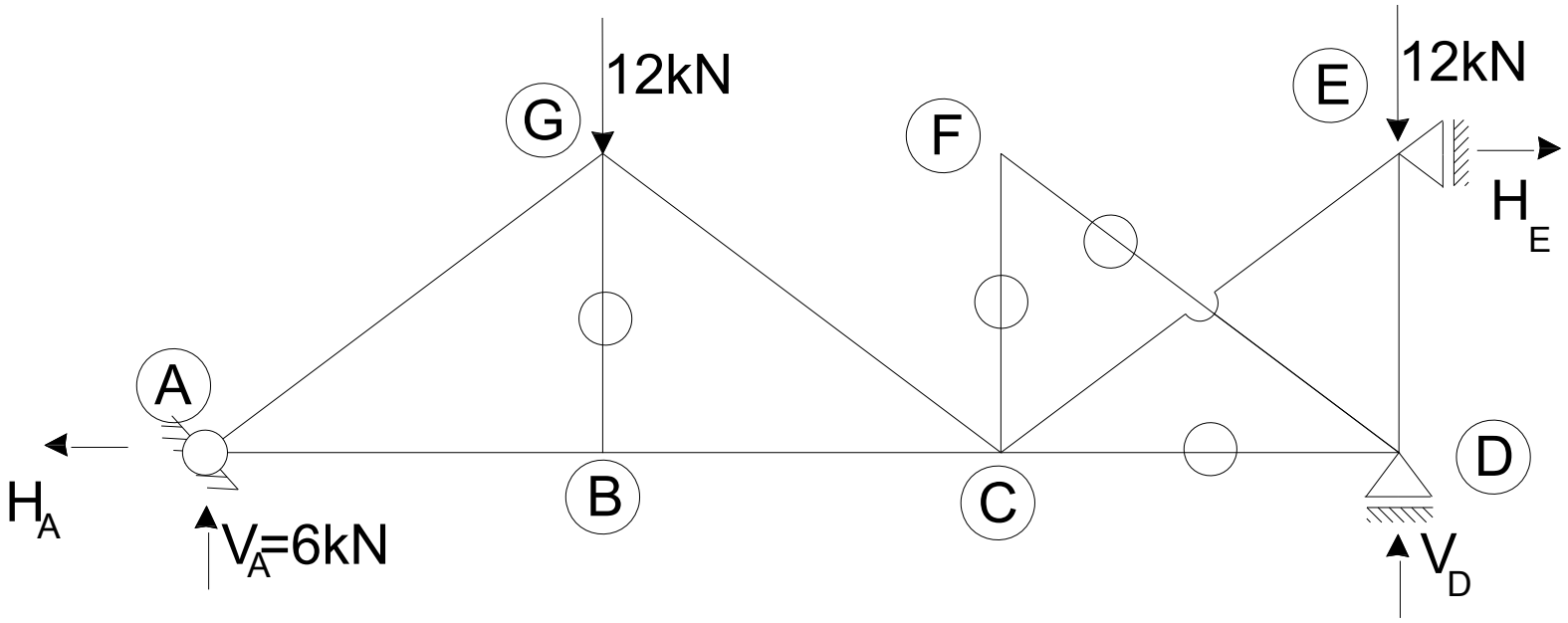
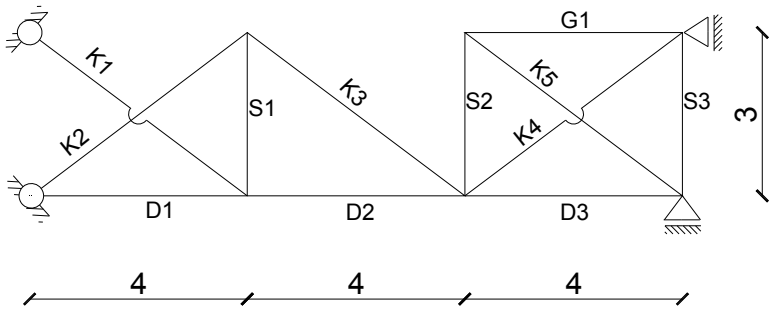
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



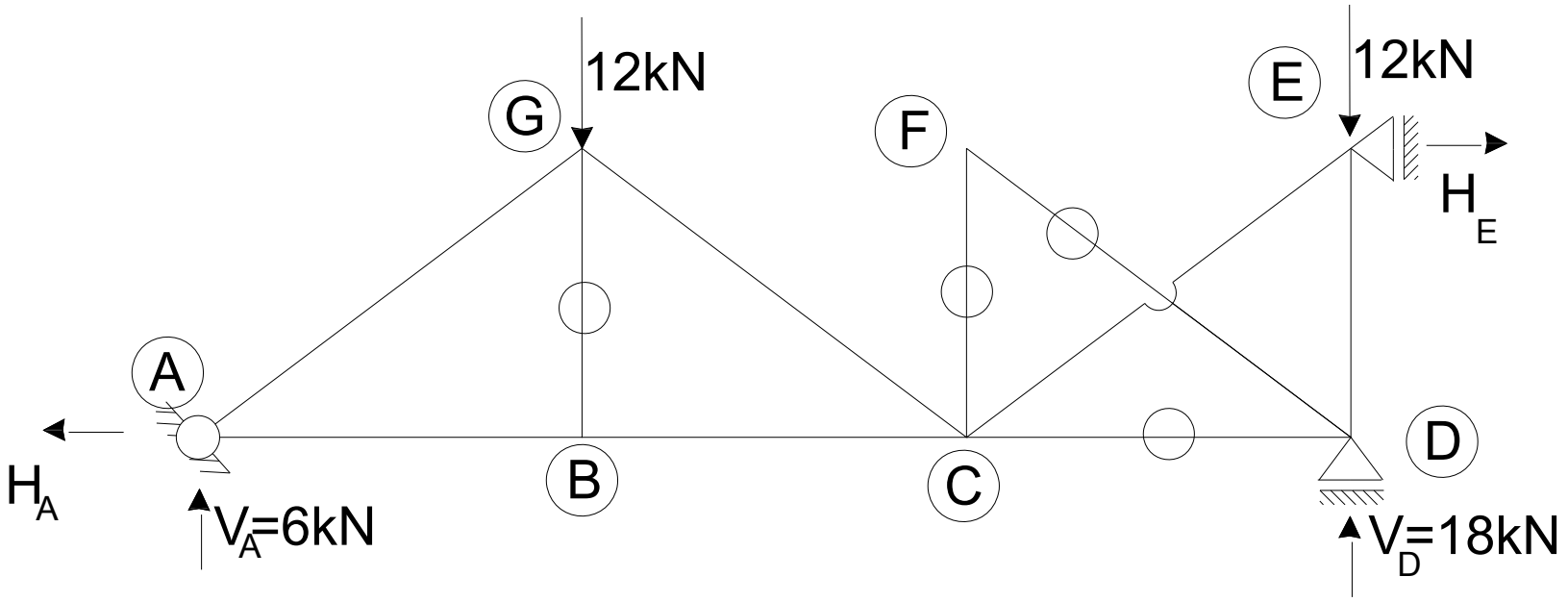
pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



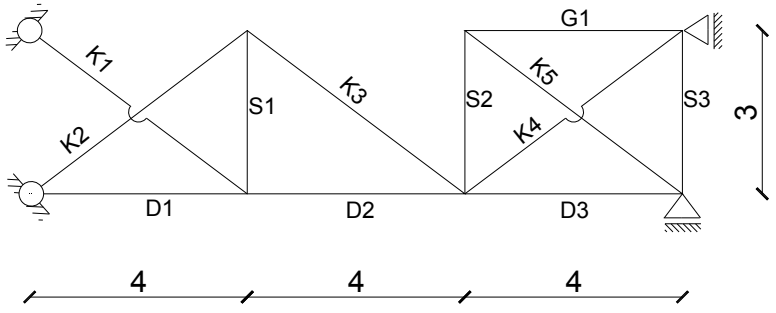
$$\sum M_C^L = -12 \cdot 4 + V_A \cdot 8 = 0 \rightarrow V_A = \frac{48}{8} = 6\text{kN}$$

dr inż. Hanna Weber

Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



$$\sum M_C^L = -12 \cdot 4 + V_A \cdot 8 = 0 \rightarrow V_A = \frac{48}{8} = 6\text{kN}$$

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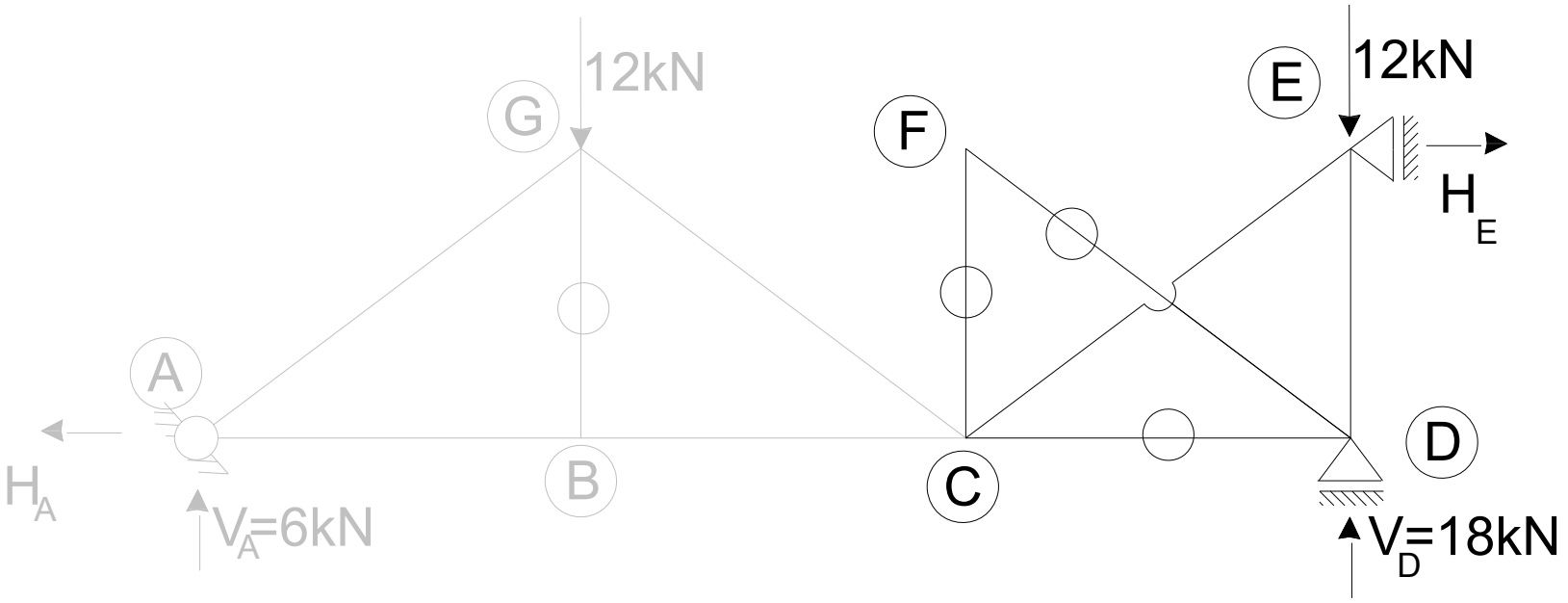
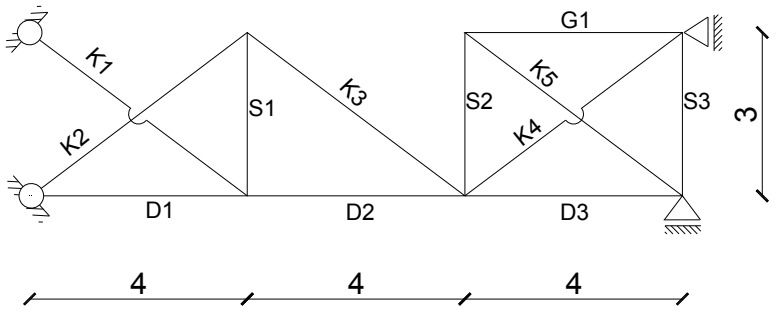
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



$$\sum M_C^L = -12 \cdot 4 + V_A \cdot 8 = 0 \rightarrow V_A = \frac{48}{8} = 6\text{kN}$$

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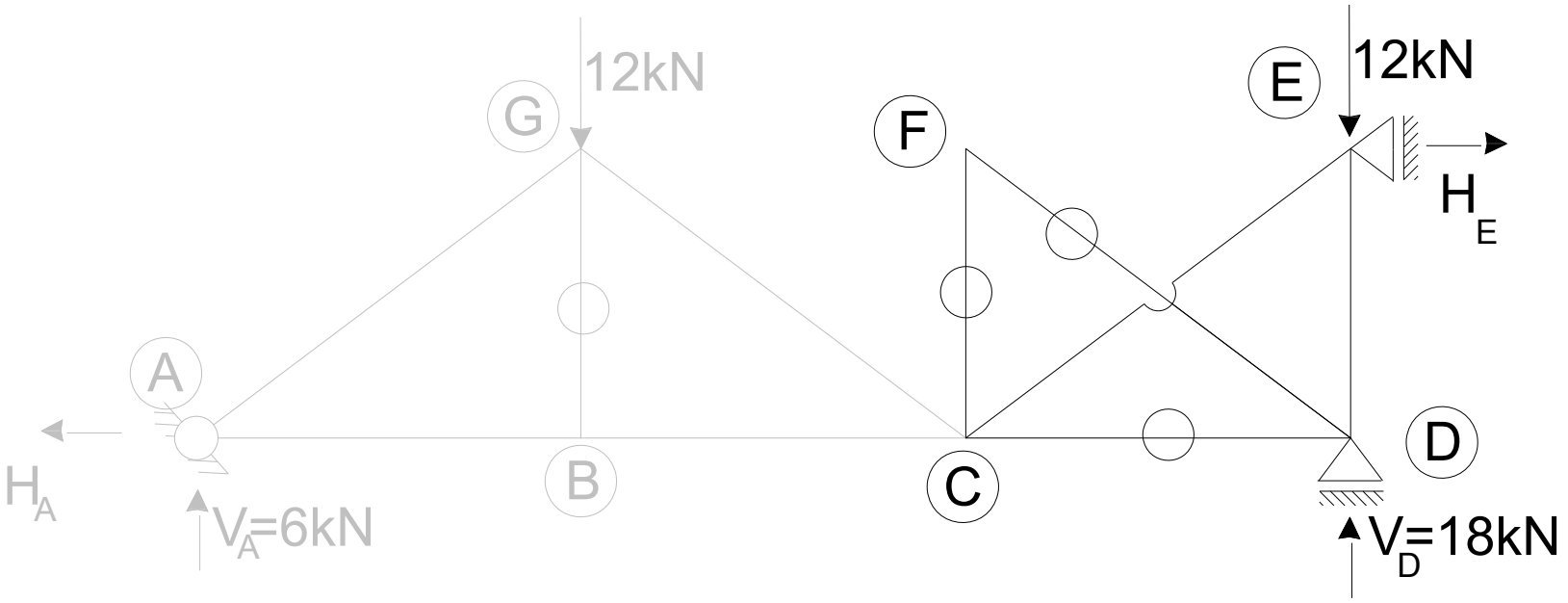
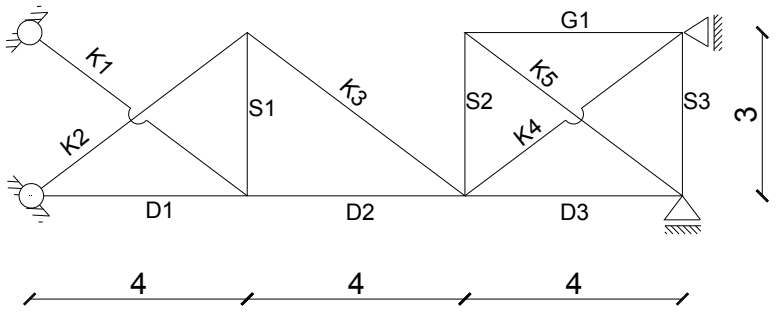
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



$$\sum M_C^L = -12\cdot 4 + V_A \cdot 8 = 0 \rightarrow V_A = \frac{48}{8} = 6\text{kN}$$

$$\sum M_C^P = 12\cdot 4 - 18\cdot 4 + H_E \cdot 3 = 0 \rightarrow H_E = \frac{24}{3} = 8\text{kN}$$

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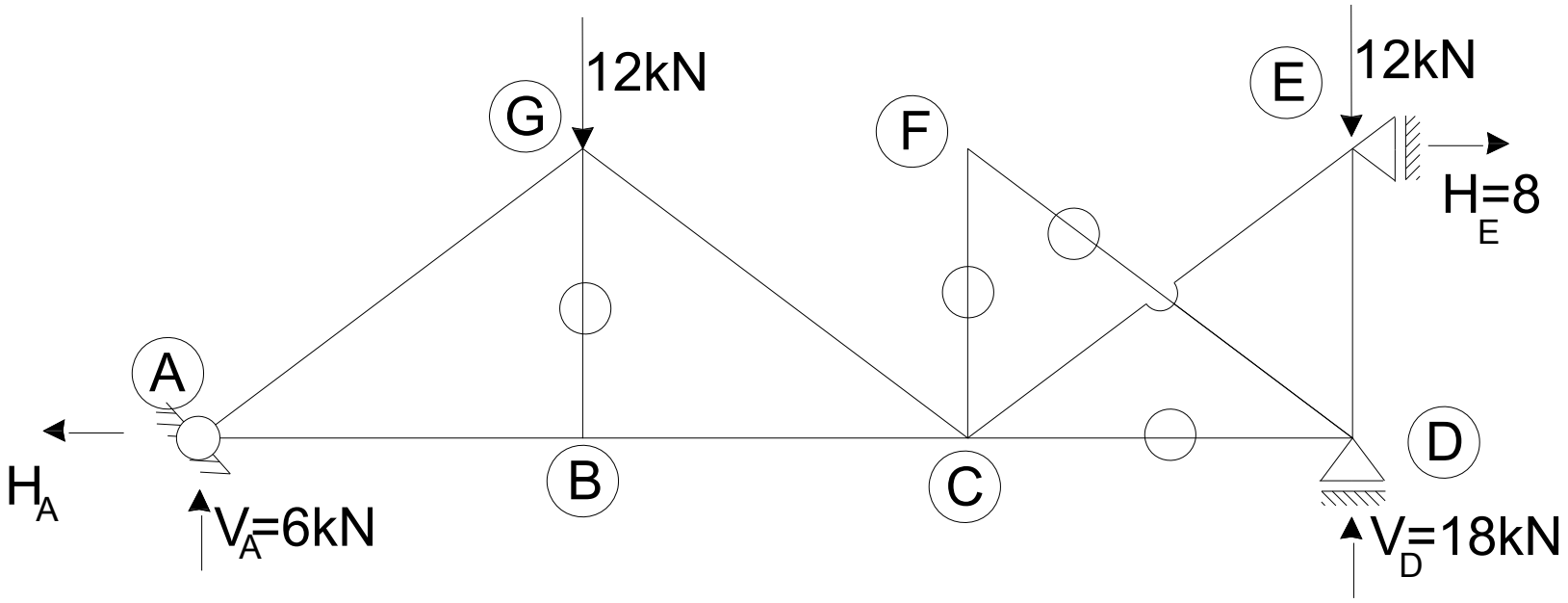
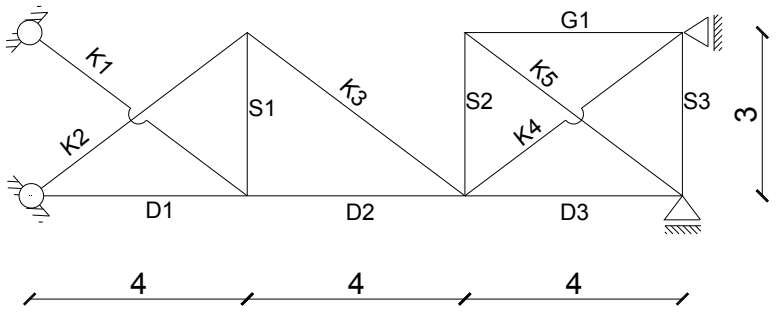
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0

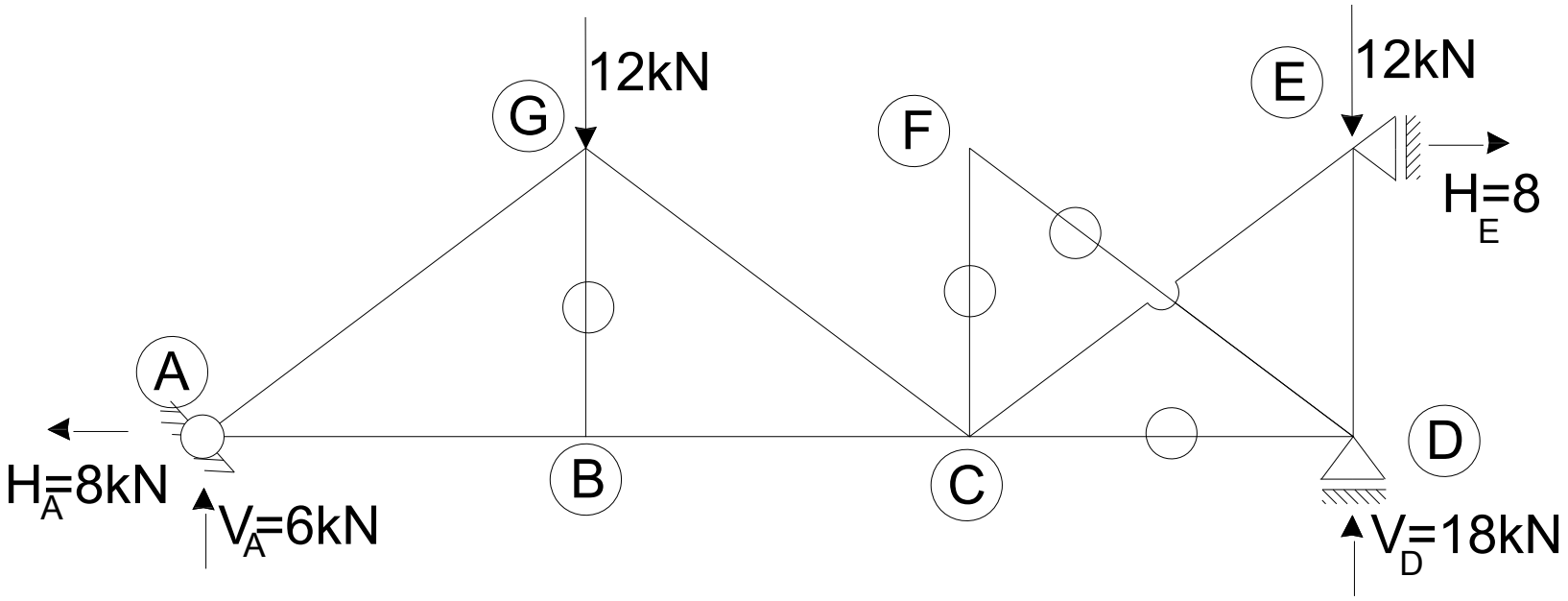


$$\sum M_C^L = -12\cdot 4 + V_A \cdot 8 = 0 \rightarrow V_A = \frac{48}{8} = 6\text{kN}$$

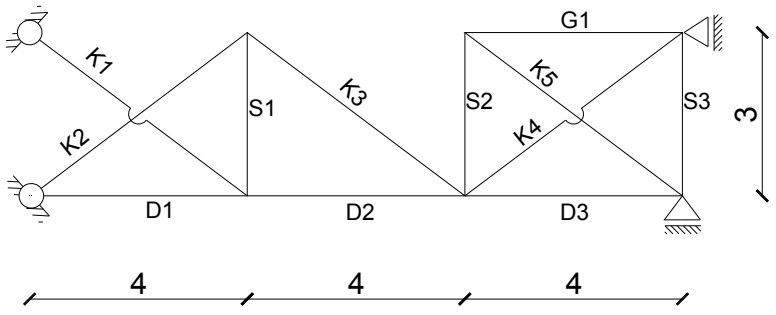
$$\sum M_C^P = 12\cdot 4 - 18\cdot 4 + H_E \cdot 3 = 0 \rightarrow H_E = \frac{24}{3} = 8\text{kN}$$

dr inż. Hanna Weber

Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0



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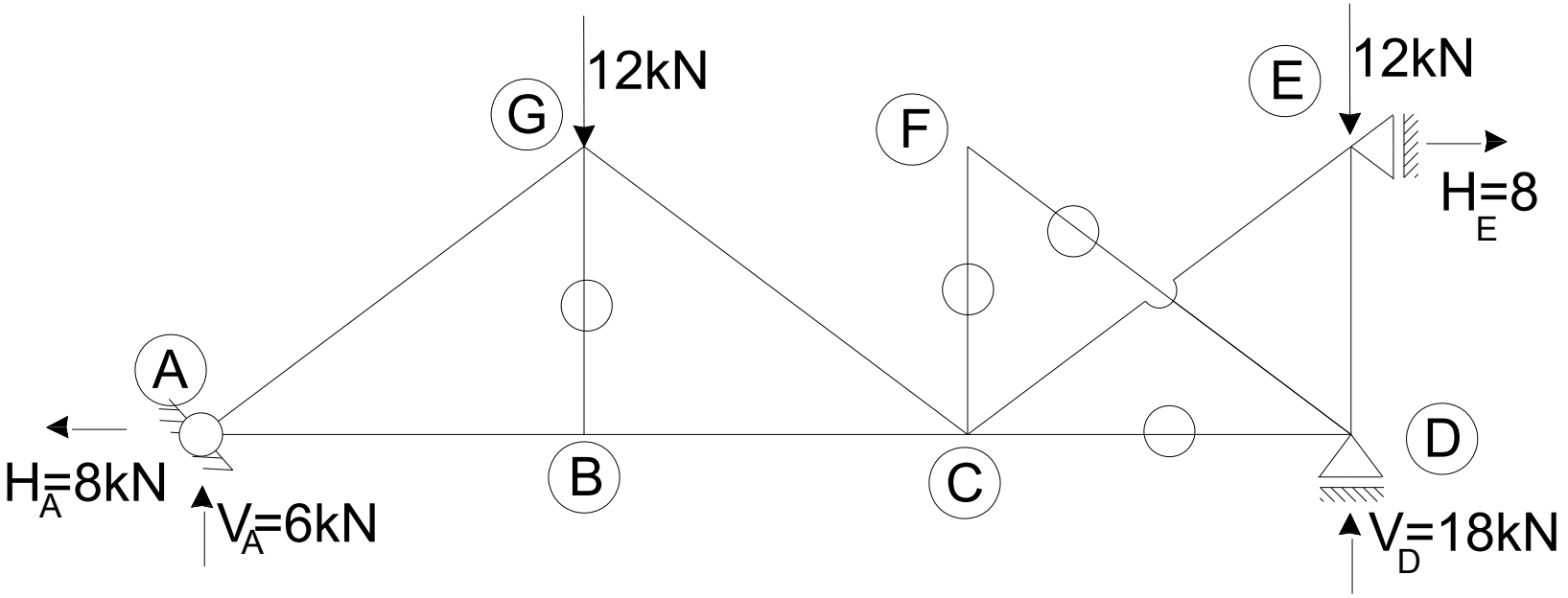
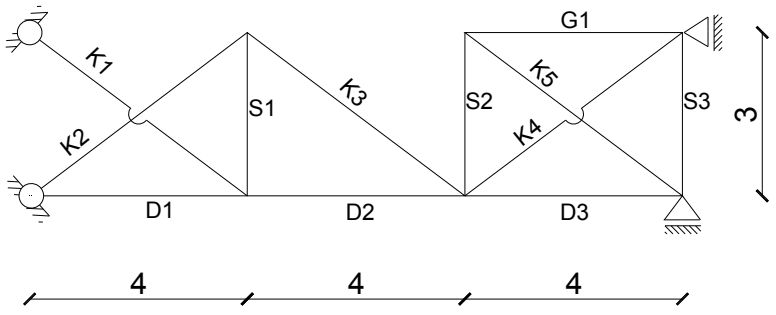
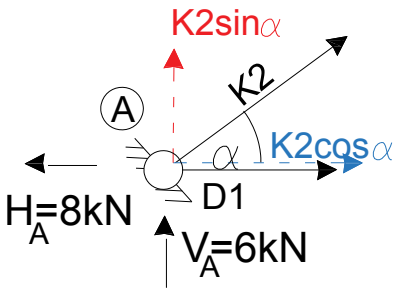
dr inż. Hanna Weber

Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	
K3	5	
K4	5	
K5	5	0





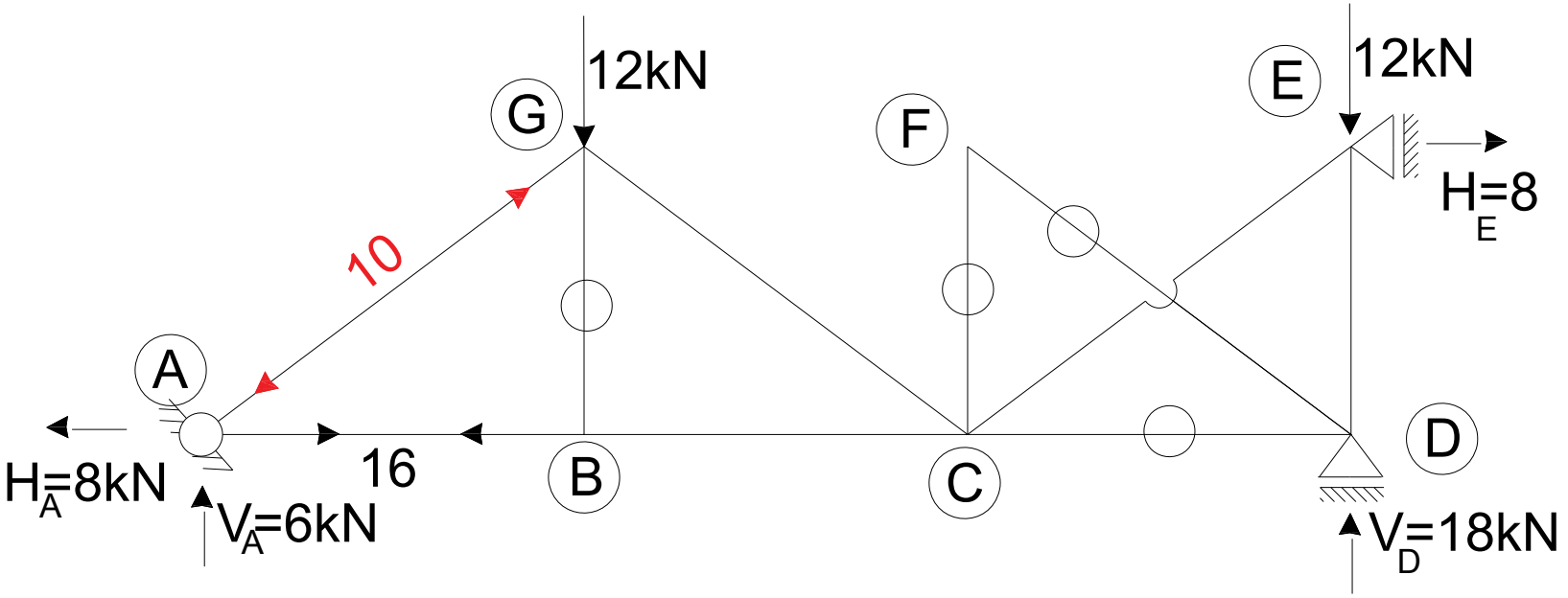
$$\sum R_Y = 6 + K2\sin\alpha = 0$$

$$K2 = -\frac{6}{\sin\alpha} = -6\cdot\frac{5}{3} = -10\text{kN}$$

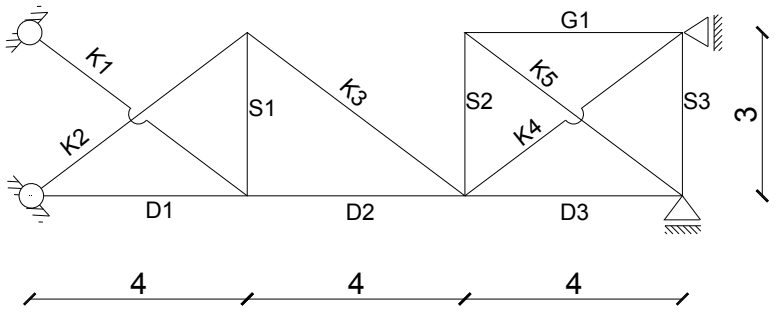
$$\sum R_X = -8 + K2\cos\alpha + D1 = 0$$

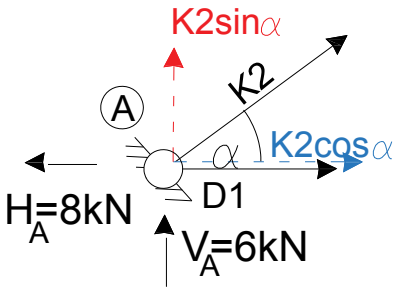
$$D1 = 8 - K2\cos\alpha = 8 - (-10)\cdot\frac{4}{5} = 16\text{kN}$$

Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	16
D2	4	
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	-10
K3	5	
K4	5	
K5	5	0





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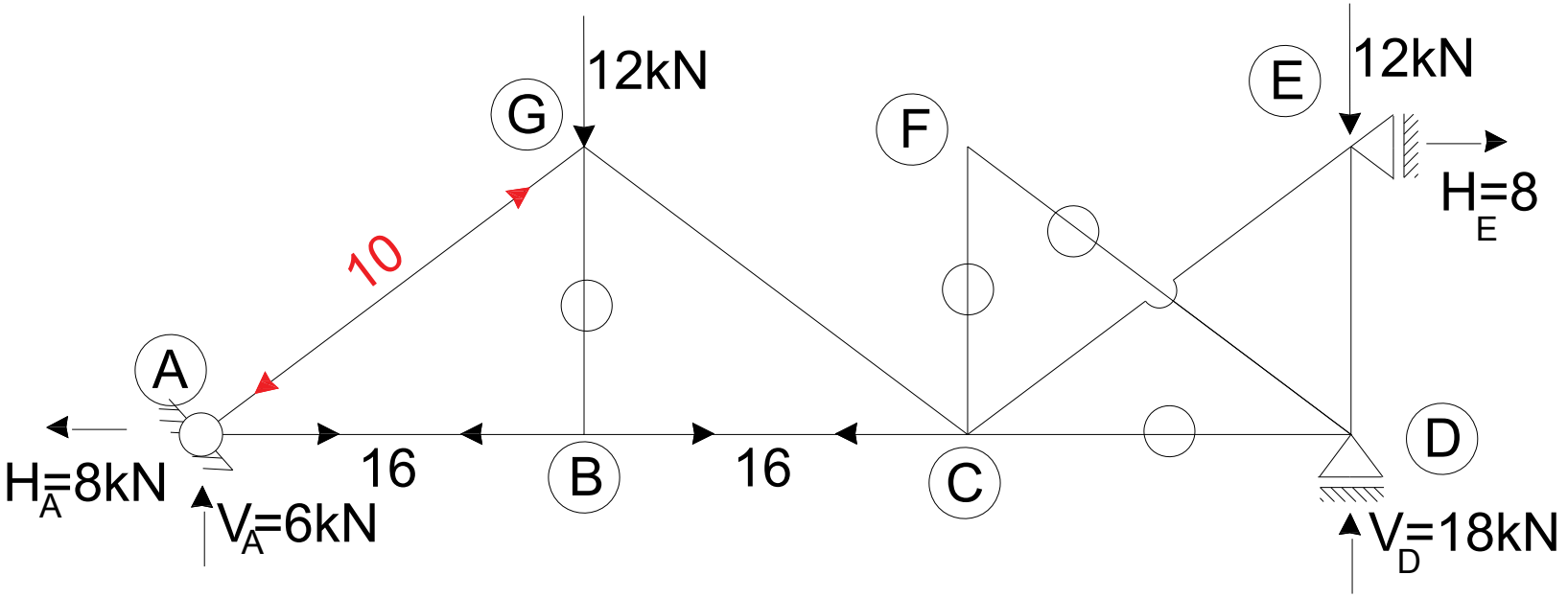
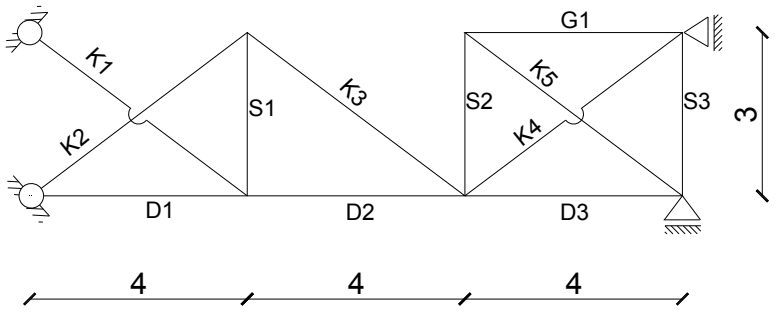
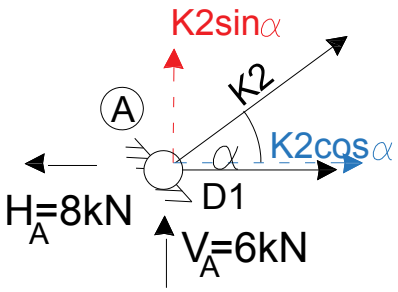
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	16
D2	4	16
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	-10
K3	5	
K4	5	
K5	5	0





$$\sum R_Y = 6 + K2\sin\alpha = 0$$

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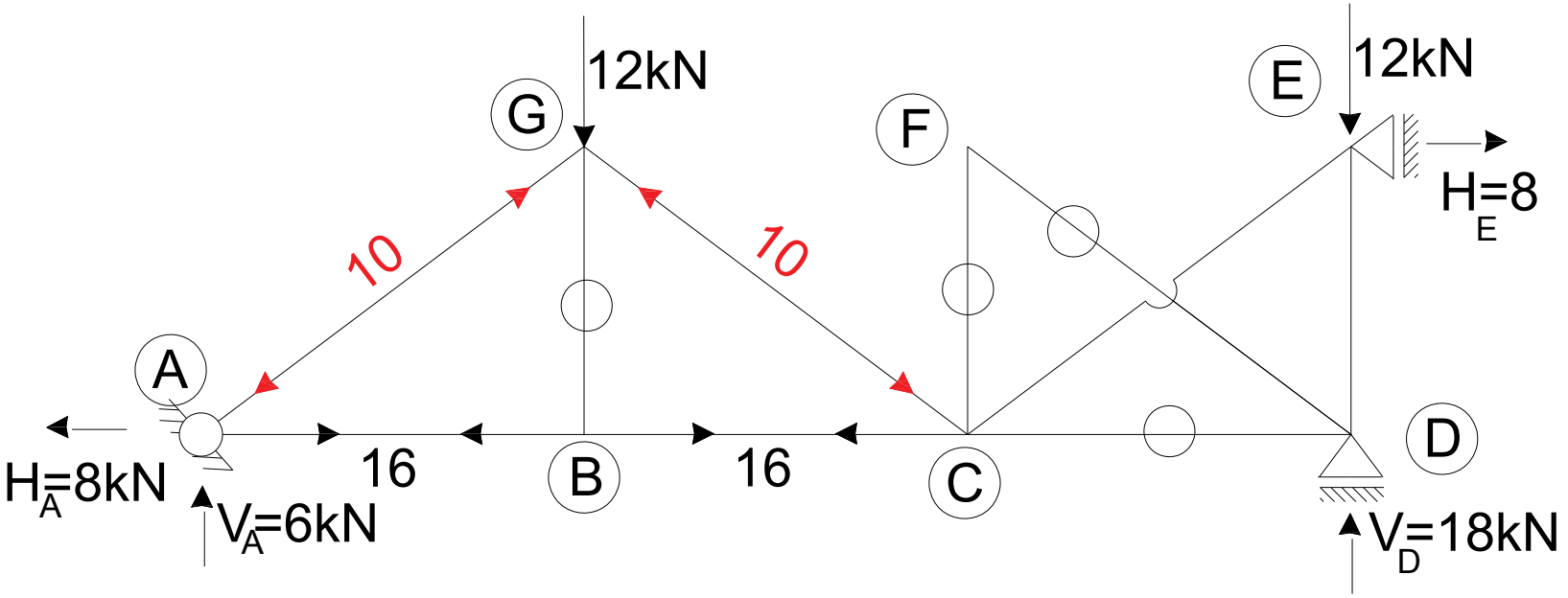
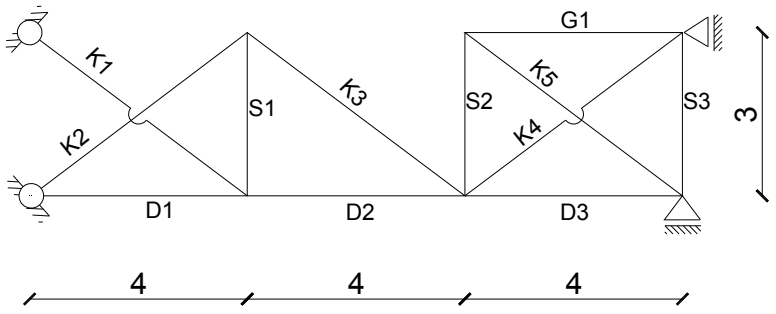
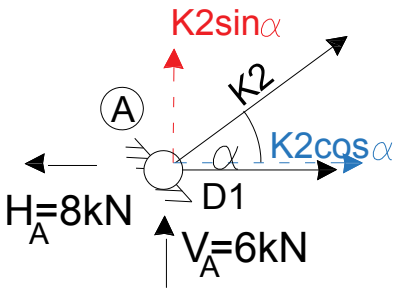
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	16
D2	4	16
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	-10
K3	5	-10
K4	5	
K5	5	0





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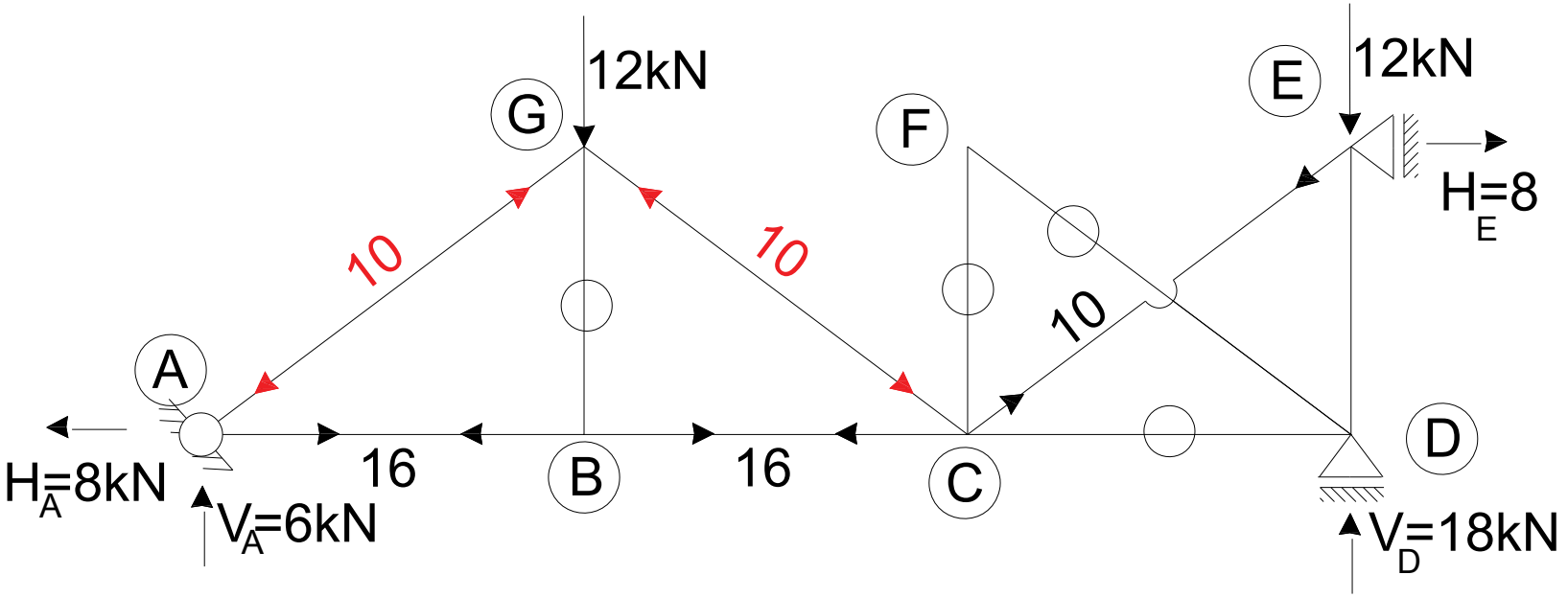
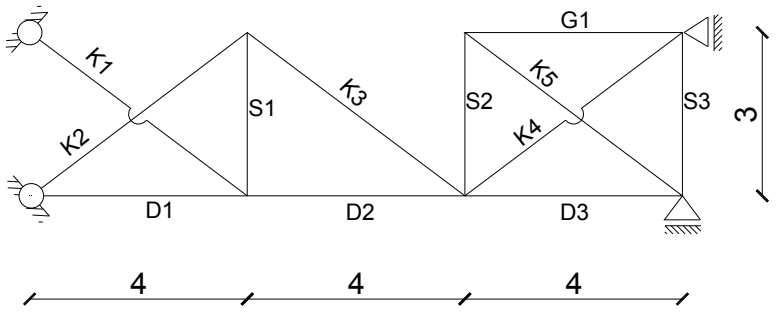
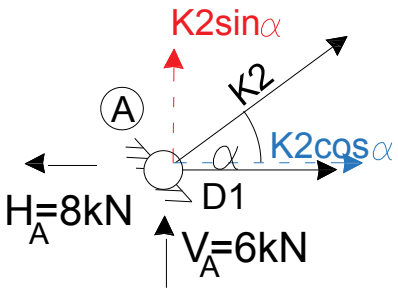
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	16
D2	4	16
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	
K1	5	0
K2	5	-10
K3	5	-10
K4	5	10
K5	5	0





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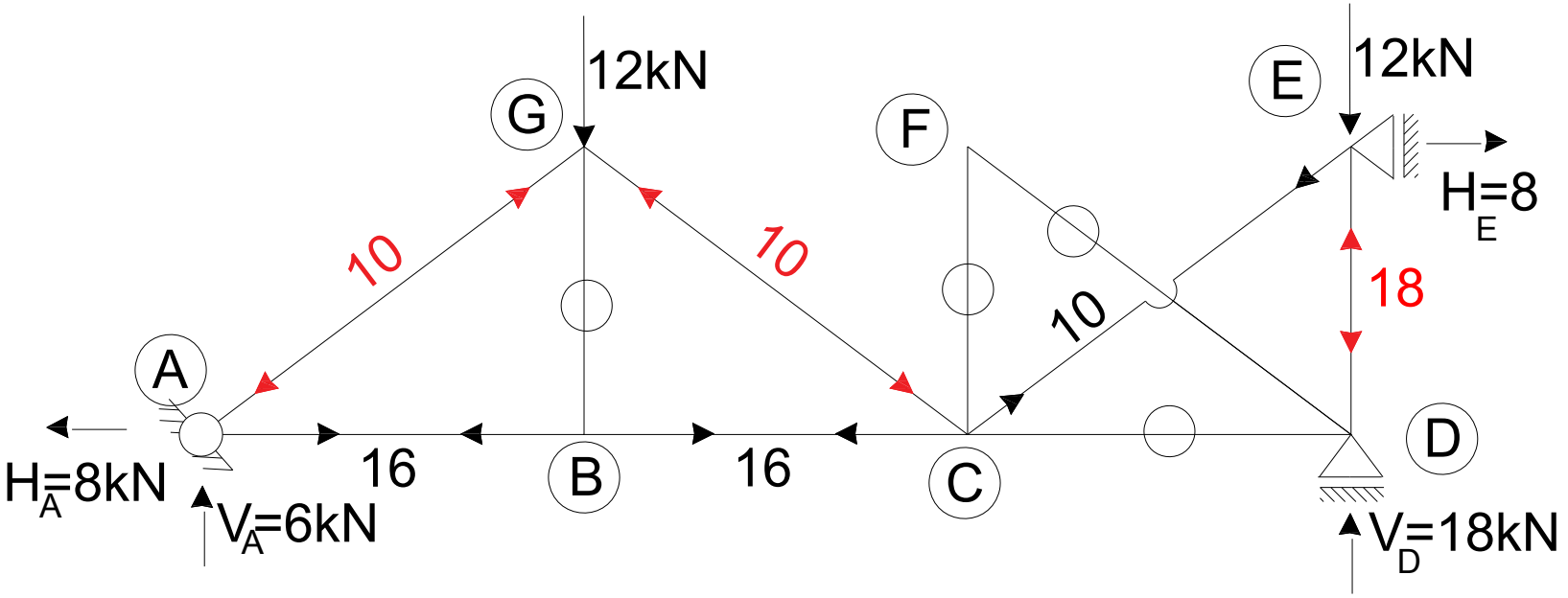
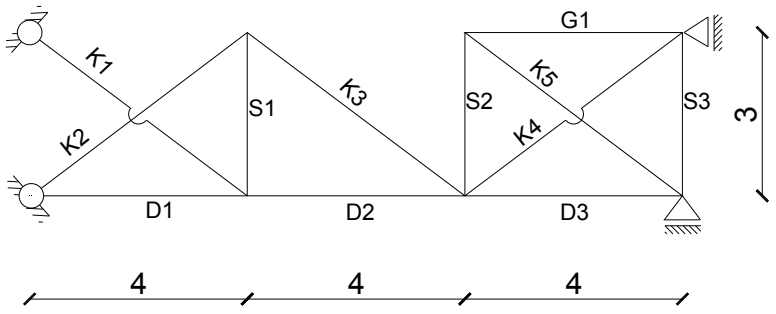
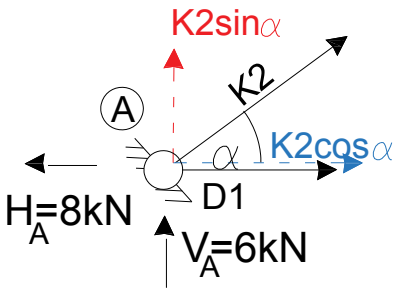
Wykresy: obciążenie zewnętrzne – siły N0 [kN]



pręt	L/EA	N0
D1	4	16
D2	4	16
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	-18
K1	5	0
K2	5	-10
K3	5	-10
K4	5	10
K5	5	0





$$\sum R_Y = 6 + K2\sin\alpha = 0$$

$$K2 = -\frac{6}{\sin\alpha} = -6\cdot\frac{5}{3} = -10\text{kN}$$

$$\sum R_X = -8 + K2\cos\alpha + D1 = 0$$

$$D1 = 8 - K2\cos\alpha = 8 - (-10)\cdot\frac{4}{5} = 16\text{kN}$$

Obliczenia metody sił:

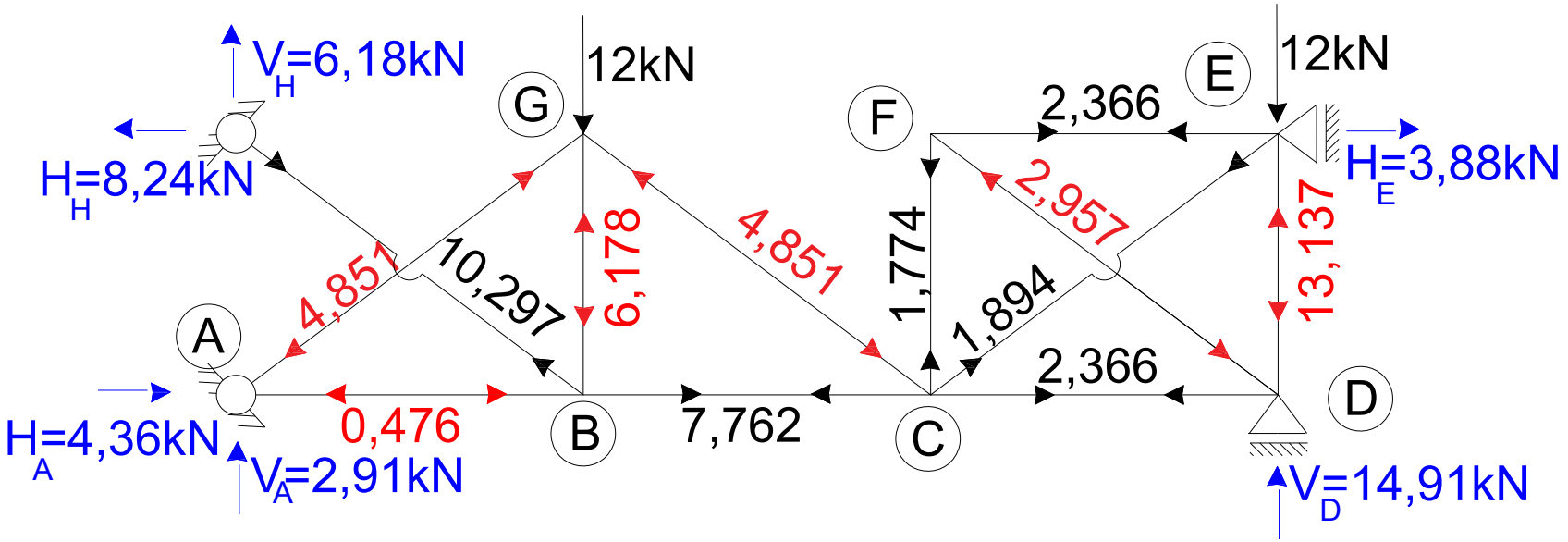
Pręt	L/EA	N1	N2	N0	$\frac{N1*N1*L}{EA}$	$\frac{N1*N2*L}{EA}$	$\frac{N2*N2*L}{EA}$	$\frac{N1*N0*L}{EA}$	$\frac{N2*N0*L}{EA}$	N1*X1	N2*X2	N	$\frac{N1*N*L}{EA}$	$\frac{N2*N*L}{EA}$
D1	4	-1,6	0	16	10,24	0	0	-102,4	0	-16,476	0,000	-0,476	3,046	0,000
D2	4	-0,8	0	16	2,56	0	0	-51,2	0	-8,238	0,000	7,762	-24,839	0,000
D3	4	0	1	0	0	0	4	0	0	0,000	2,366	2,366	0,000	9,462
G1	4	0	1	0	0	0	4	0	0	0,000	2,366	2,366	0,000	9,462
S1	3	-0,6	0	0	1,08	0	0	0	0	-6,178	0,000	-6,178	11,121	0,000
S2	3	0	0,75	0	0	0	1,6875	0	0	0,000	1,774	1,774	0,000	3,992
S3	3	0,3	0,75	-18	0,27	0,675	1,6875	-16,2	-40,5	3,089	1,774	-13,137	-11,823	-29,557
K1	5	1	0	0	5	0	0	0	0	10,297	0,000	10,297	51,487	0,000
K2	5	0,5	0	-10	1,25	0	0	-25	0	5,149	0,000	-4,851	-12,128	0,000
K3	5	0,5	0	-10	1,25	0	0	-25	0	5,149	0,000	-4,851	-12,128	0,000
K4	5	-0,5	-1,25	10	1,25	3,125	7,8125	-25	-62,5	-5,149	-2,957	1,894	-4,736	-11,840
K5	5	0	-1,25	0	0	0	7,8125	0	0	0,000	-2,957	-2,957	0,000	18,481
					22,9	3,8	27	-244,8	-103				0,000	0,000
					δ11	δ12	δ22	δ10	δ20					

Układ równań metody sił:

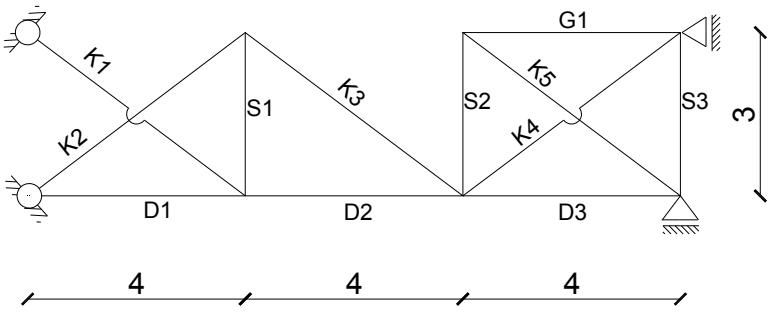
$$\begin{aligned}\delta_{11}\cdot x1+\delta_{12}\cdot x2+\delta_{10}&=0\\ \delta_{21}\cdot x1+\delta_{22}\cdot x2+\delta_{20}&=0\end{aligned}\quad\Rightarrow\quad\begin{aligned}22{,}9\cdot x1+3{,}8\cdot x2-244{,}8&=0\\ 3{,}8\cdot x1+27\cdot x2-103&=0\end{aligned}\quad\Rightarrow\quad\begin{aligned}x1&=10{,}297\text{kN}\\ x2&=2{,}366\text{kN}\end{aligned}$$

dr inż. Hanna Weber

Końcowy wykres sił normalnych – N [kN]



pręt	L/EA	N
D1	4	-0,476
D2	4	7,762
D3	4	2,366
G1	4	2,366
S1	3	-6,178
S2	3	1,774
S3	3	-13,137
K1	5	10,297
K2	5	-4,851
K3	5	-4,851
K4	5	1,894
K5	5	-2,957



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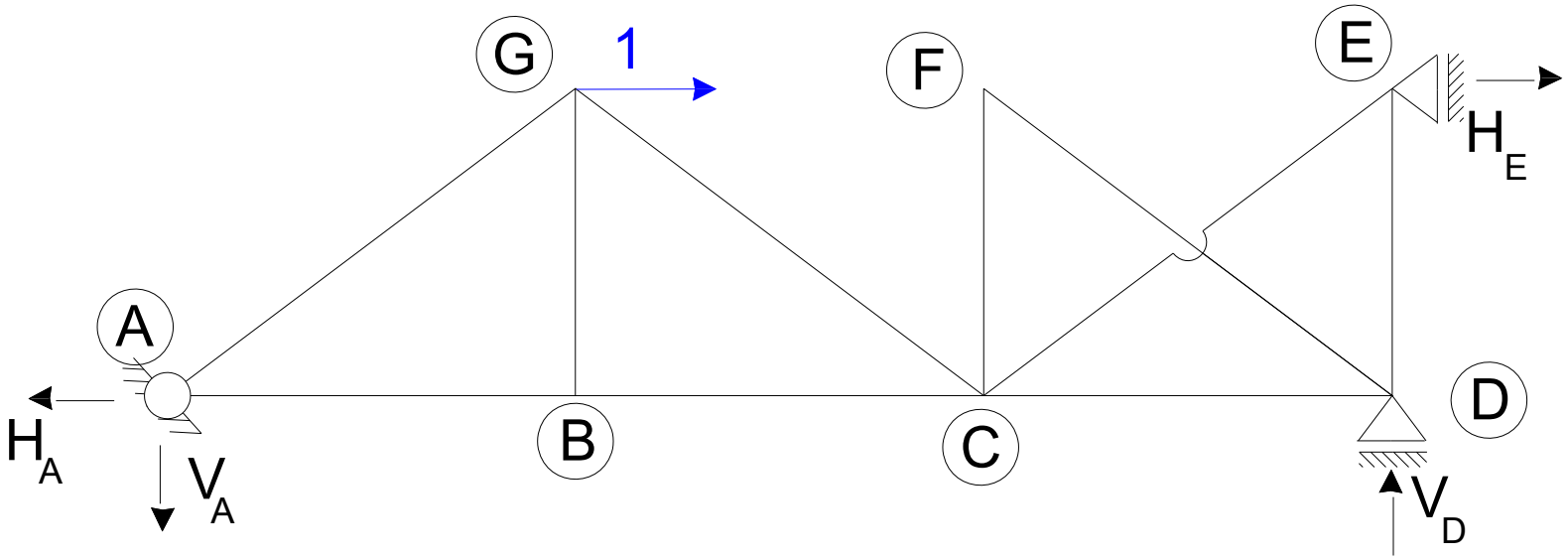
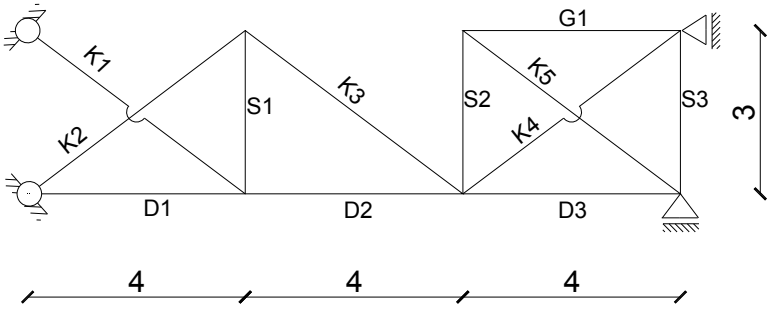
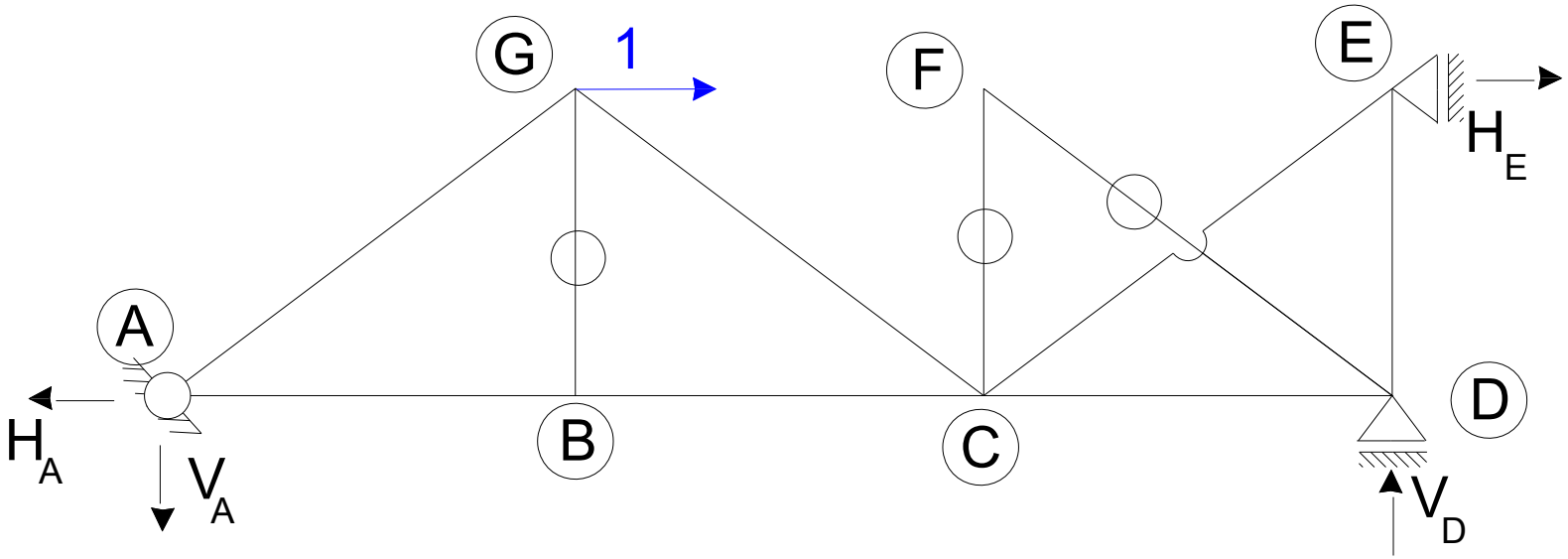
Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:

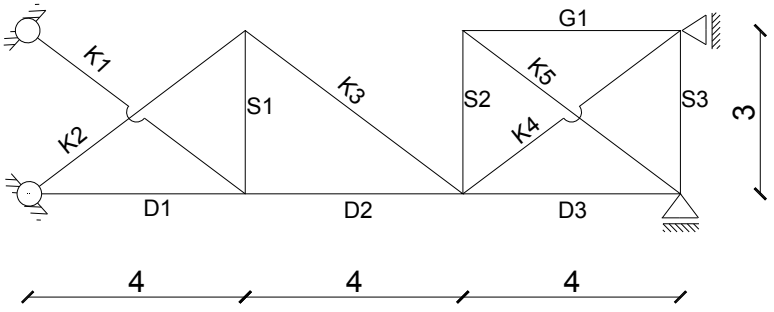




dr inż. Hanna Weber

Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:





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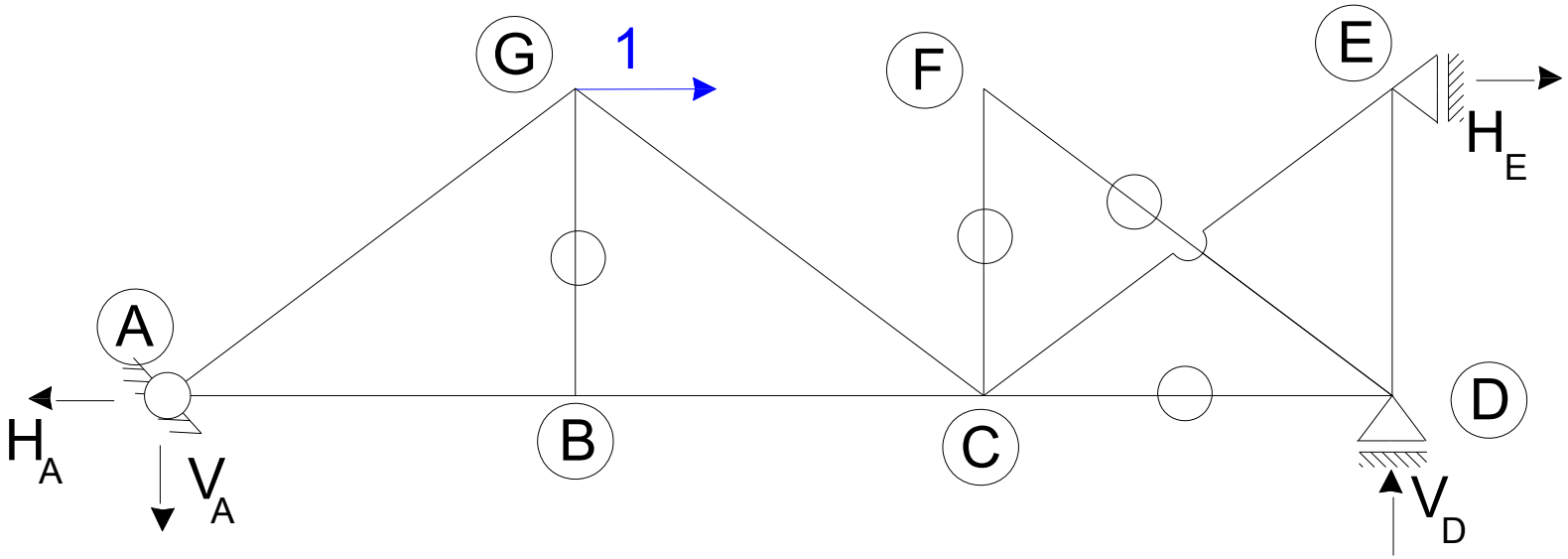
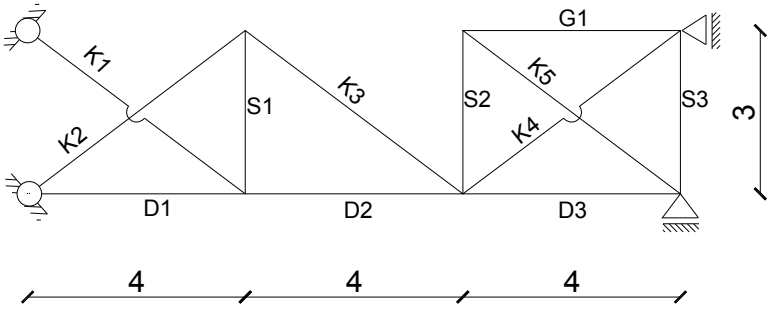
Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:





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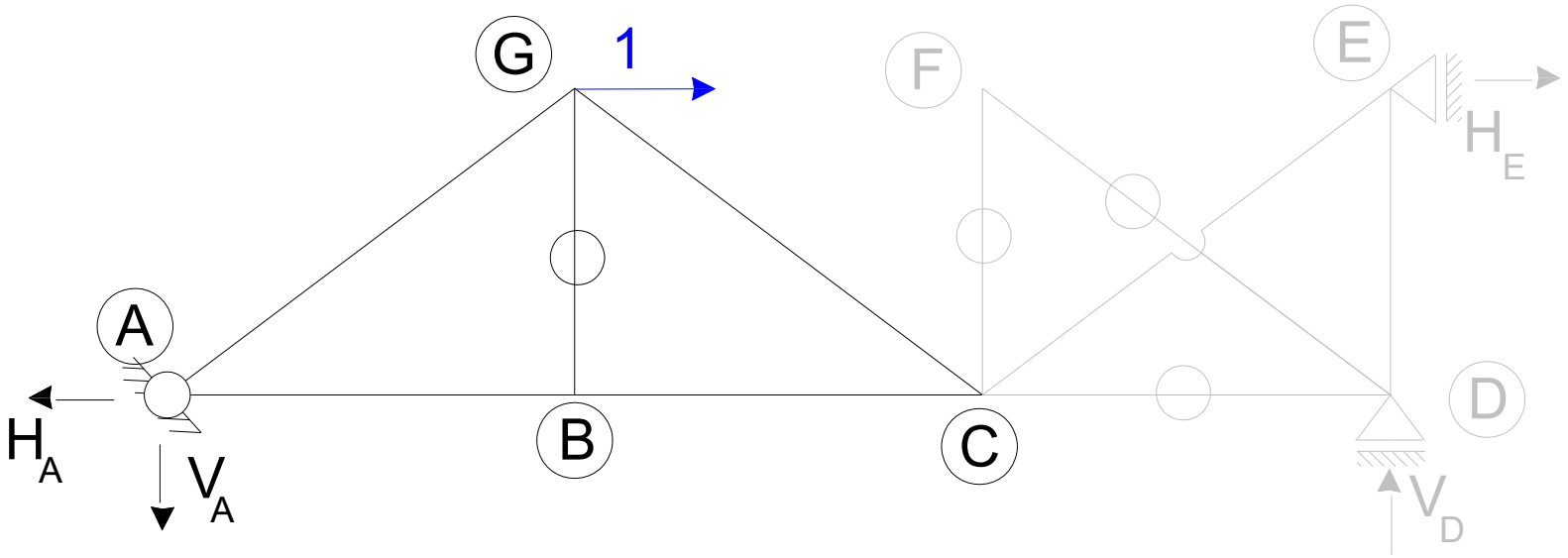
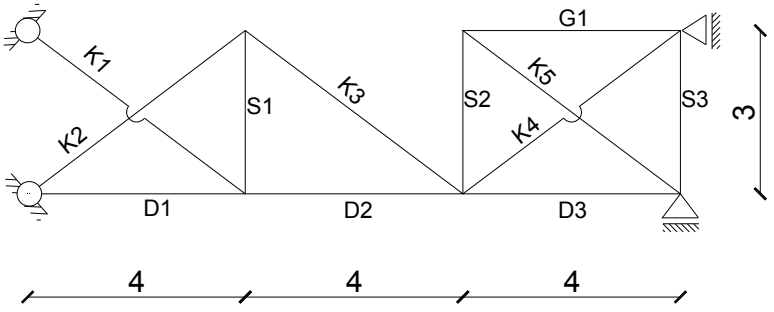
Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:





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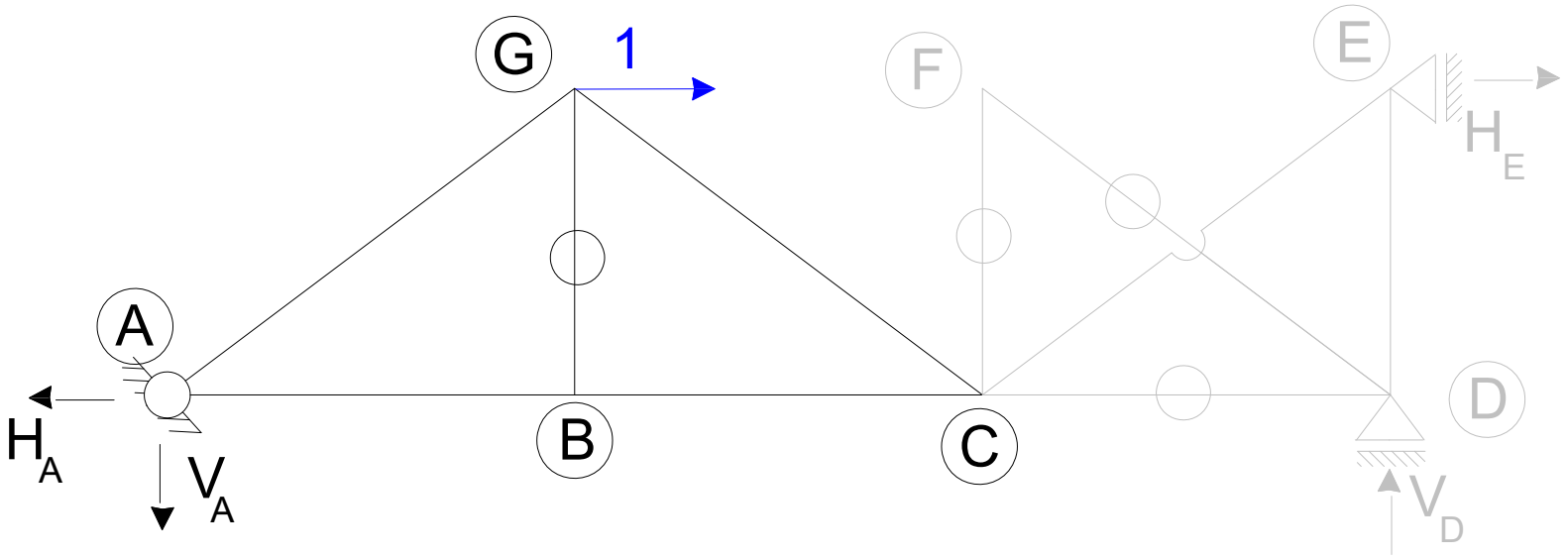
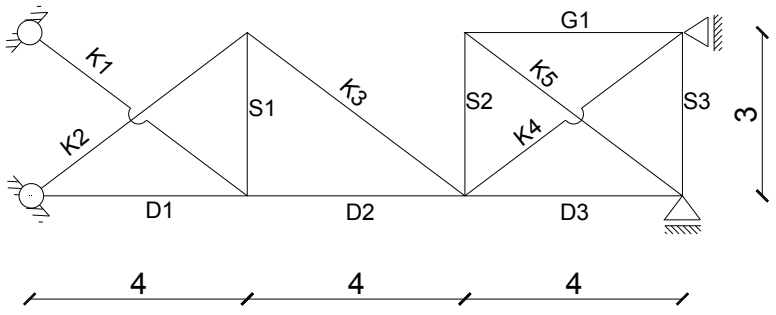
Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:

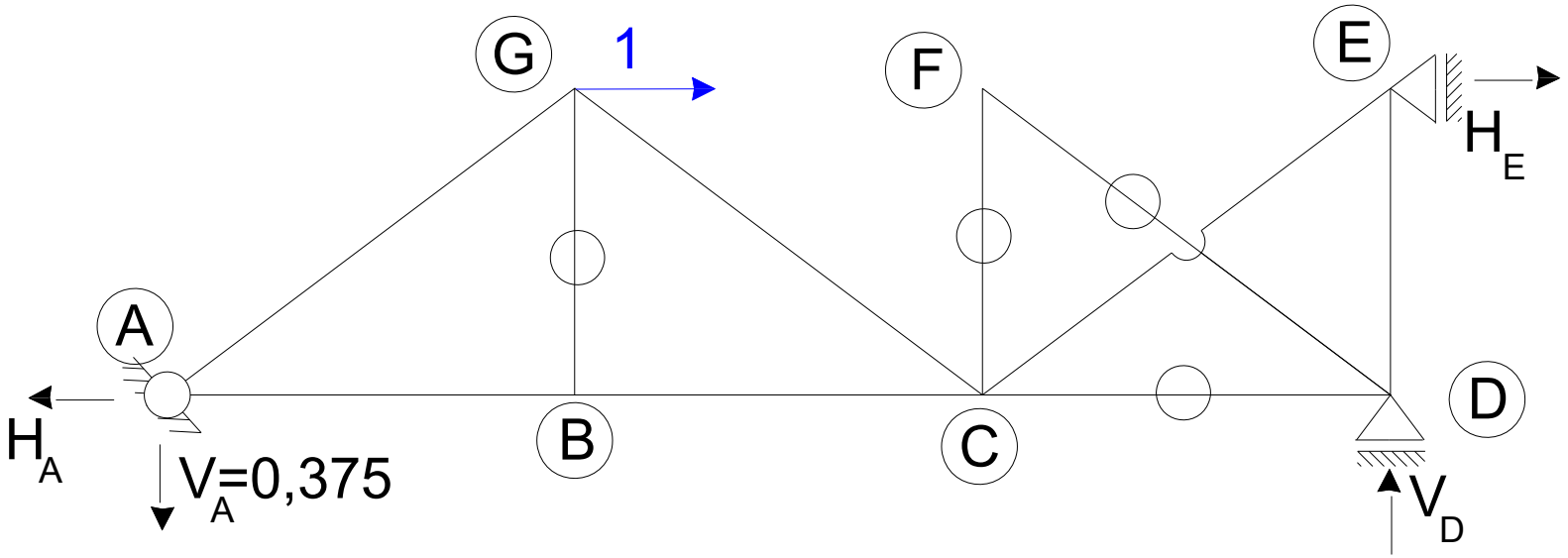


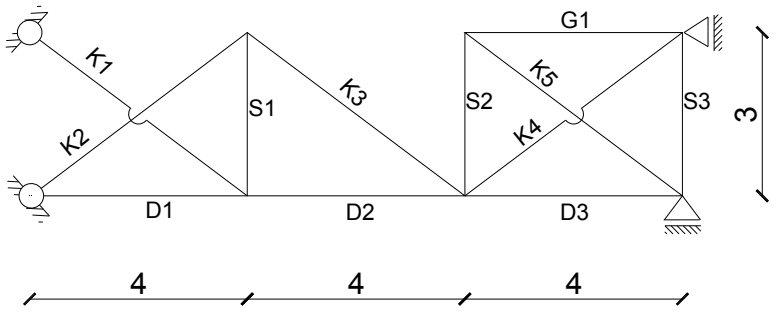


$$\sum M_C^L = 1 \cdot 3 - V_A \cdot 8 = 0 \rightarrow V_A = \frac{3}{8} = 0{,}375$$

dr inż. Hanna Weber

Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:





$$\sum M_C^L = 1 \cdot 3 - V_A \cdot 8 = 0 \rightarrow V_A = \frac{3}{8} = 0{,}375$$

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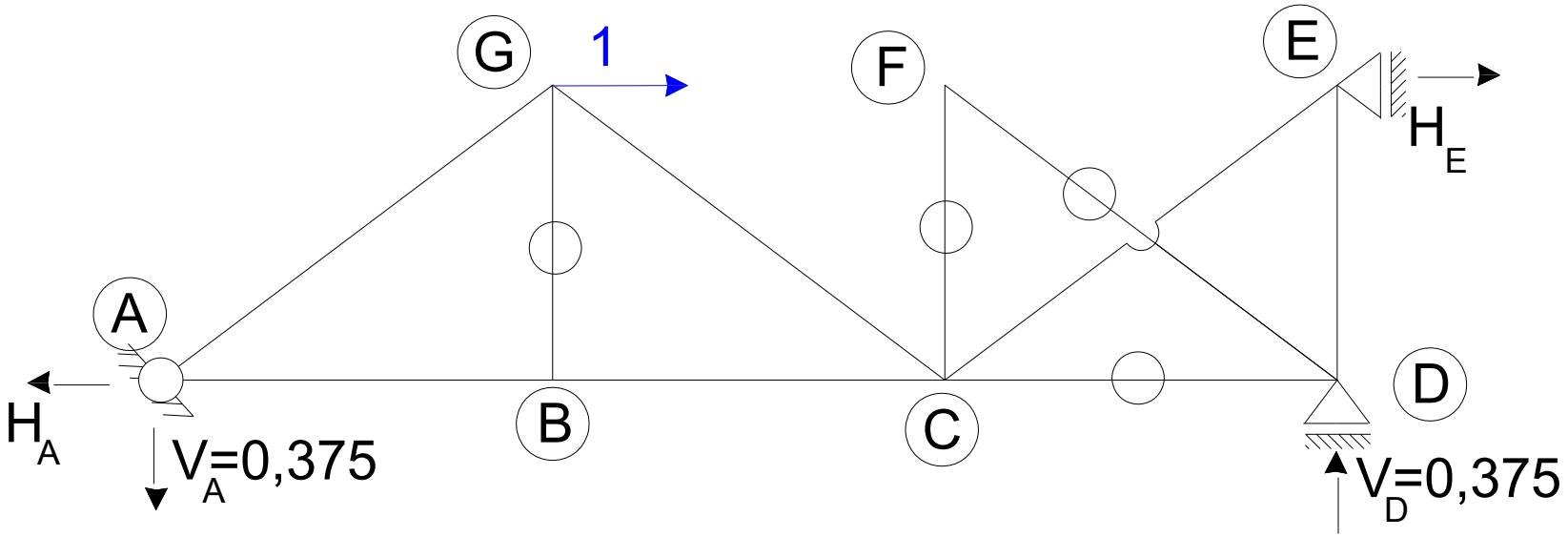
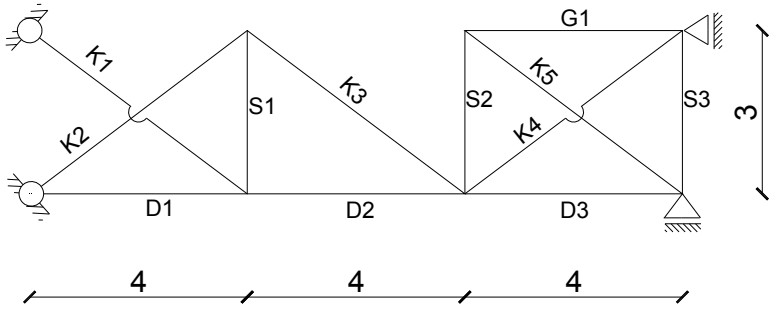
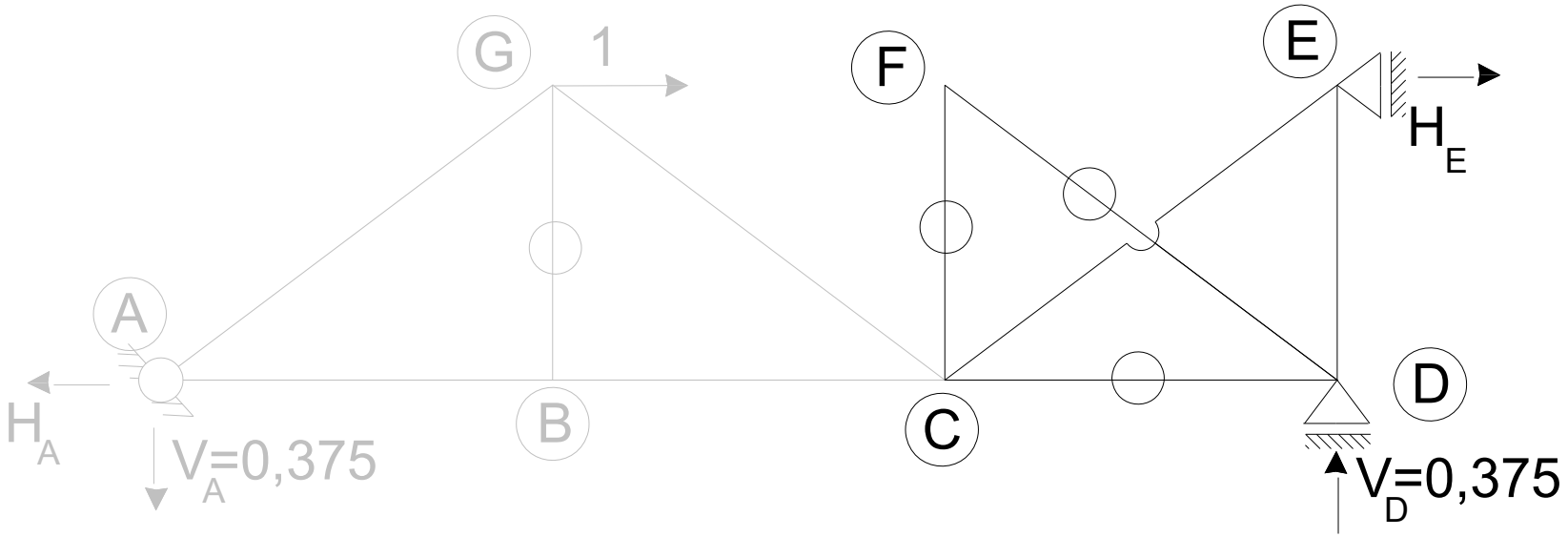


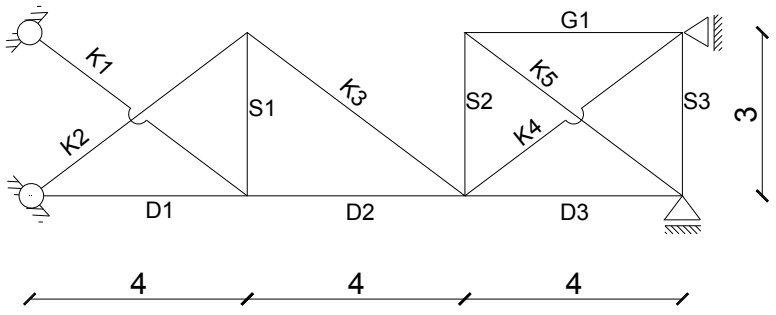


$$\sum M_C^L = 1 \cdot 3 - V_A \cdot 8 = 0 \rightarrow V_A = \frac{3}{8} = 0{,}375$$

dr inż. Hanna Weber

Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:





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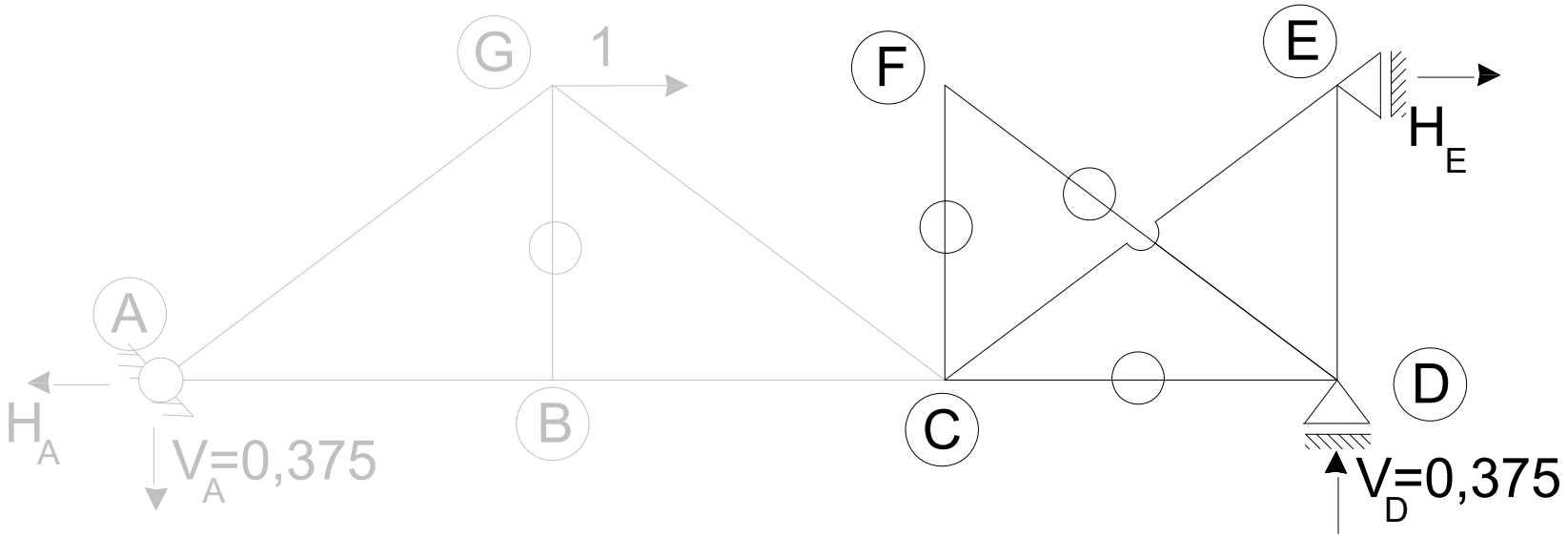
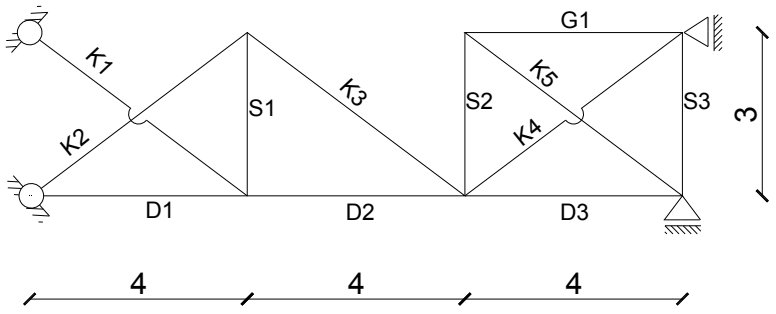


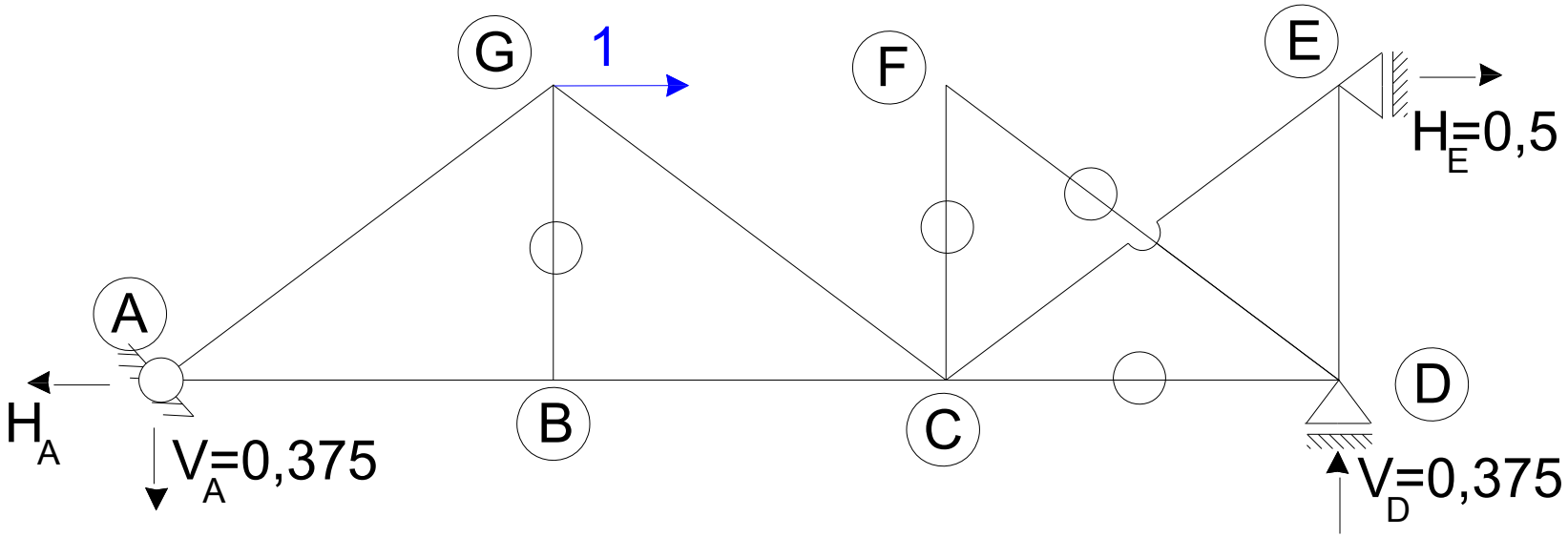


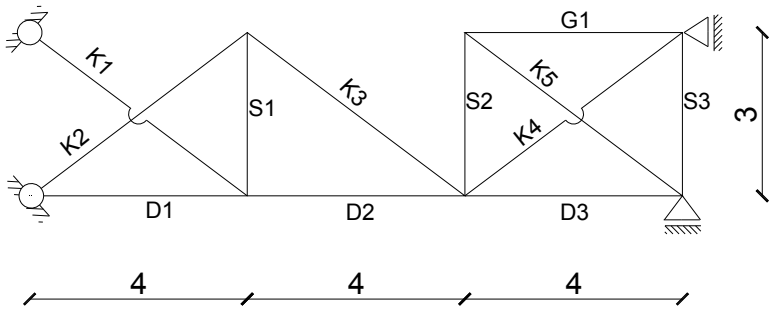
$$\sum M_C^L = 1 \cdot 3 - V_A \cdot 8 = 0 \rightarrow V_A = \frac{3}{8} = 0{,}375$$

$$\sum M_C^P = H_E \cdot 3 - 0{,}375 \cdot 4 = 0 \rightarrow H_E = \frac{0{,}375 \cdot 4}{3} = 0{,}5$$

dr inż. Hanna Weber

Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:





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dr inż. Hanna Weber

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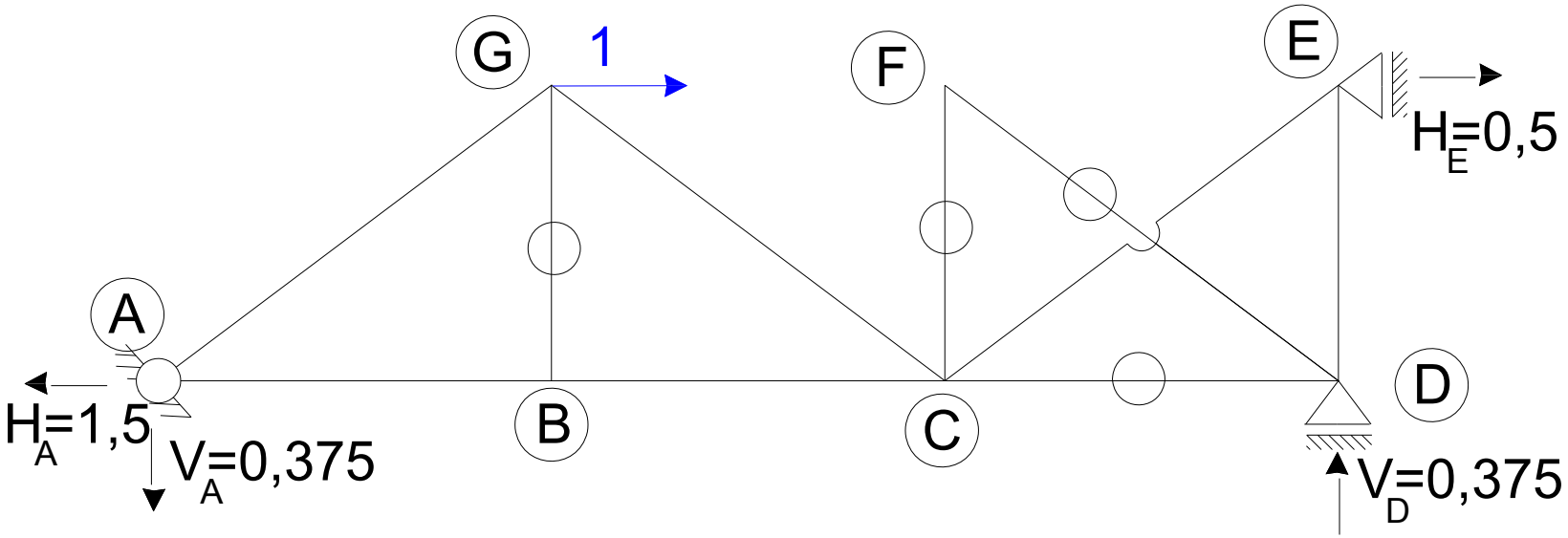

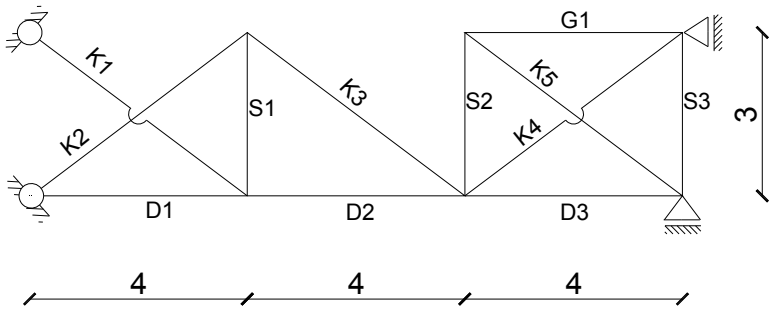

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dr inż. Hanna Weber

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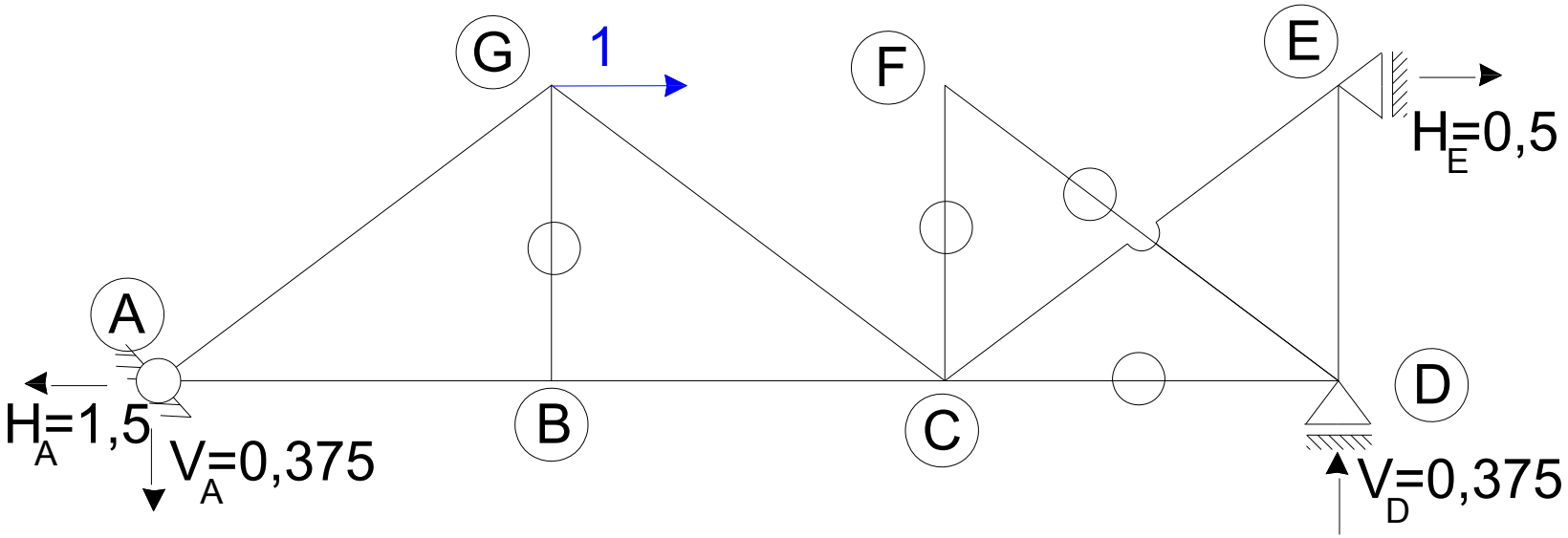
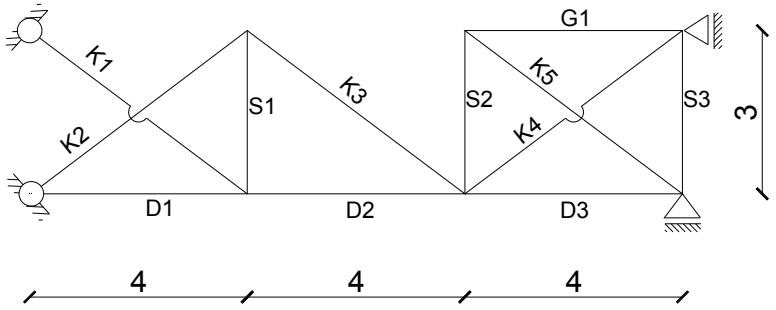
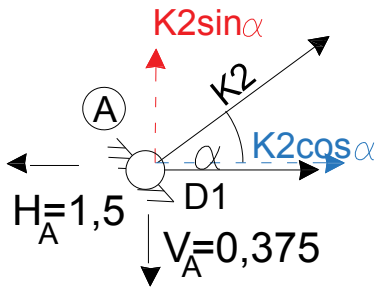






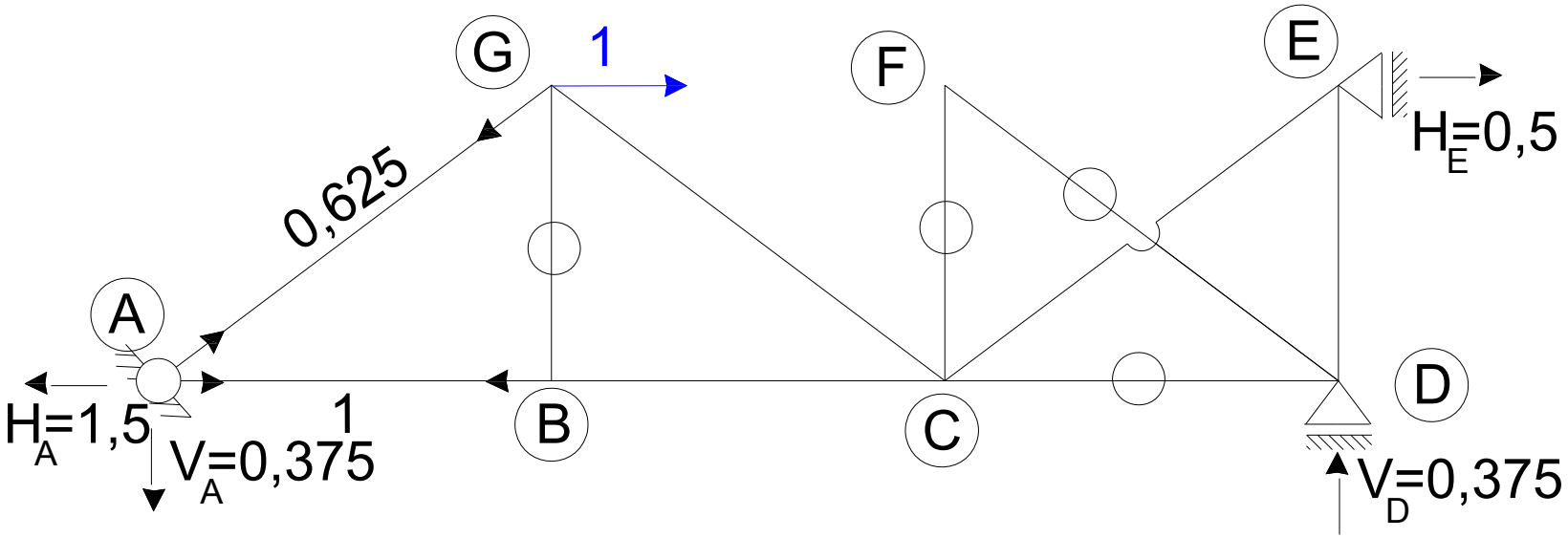
$$\sum R_Y = -0{,}375 + K2\sin\alpha = 0$$

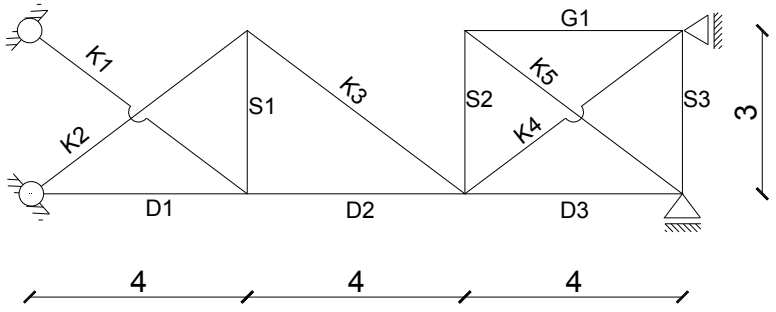
$$K2 = \frac{0{,}375}{\sin\alpha} = 0{,}375 \cdot \frac{5}{3} = 0{,}625$$

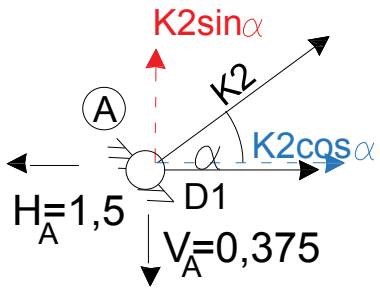
$$\sum R_X = -1{,}5 + K2\cos\alpha + D1 = 0$$

$$D1 = 1{,}5 - K2\cos\alpha = 1{,}5 - (0{,}625) \cdot \frac{4}{5} = 1$$

Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:







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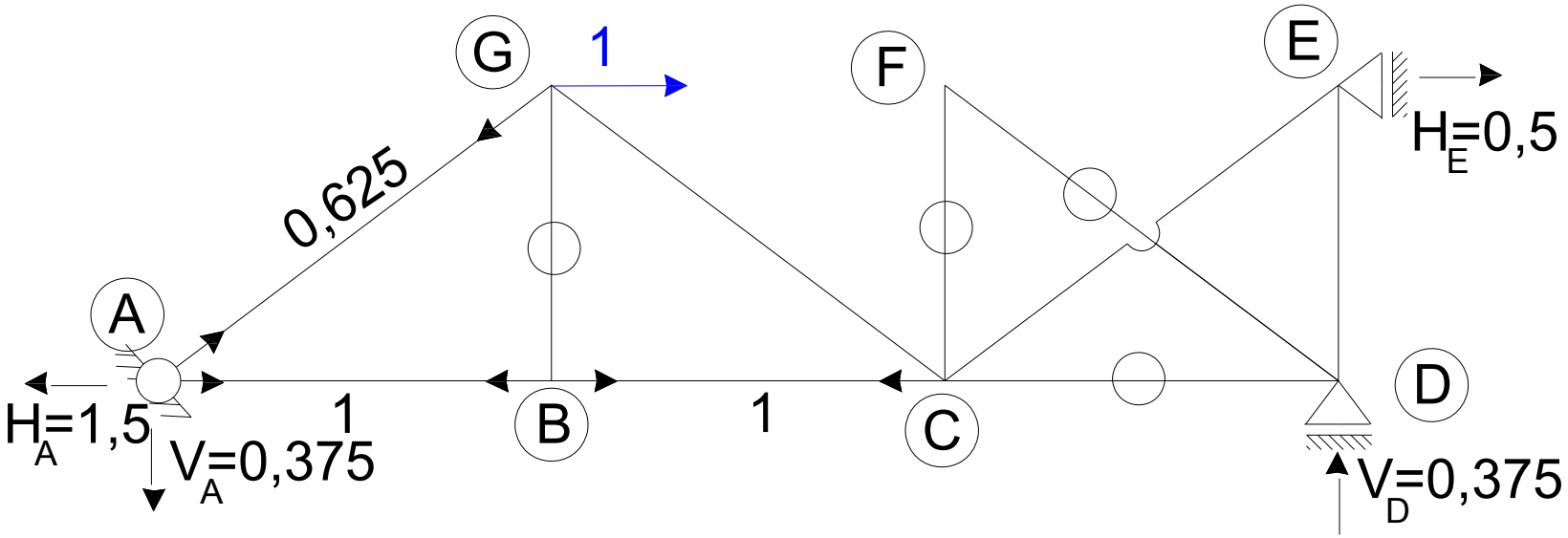

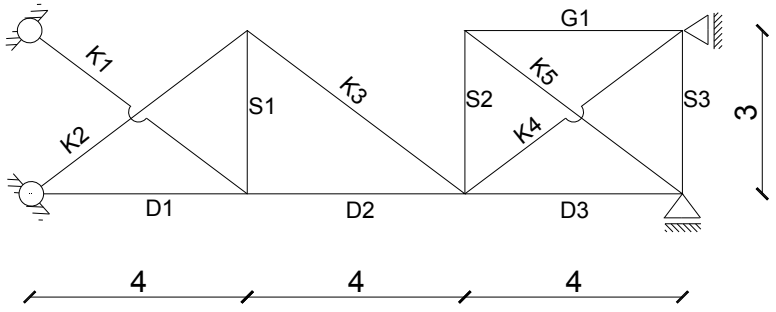

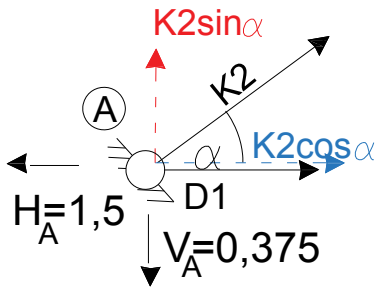

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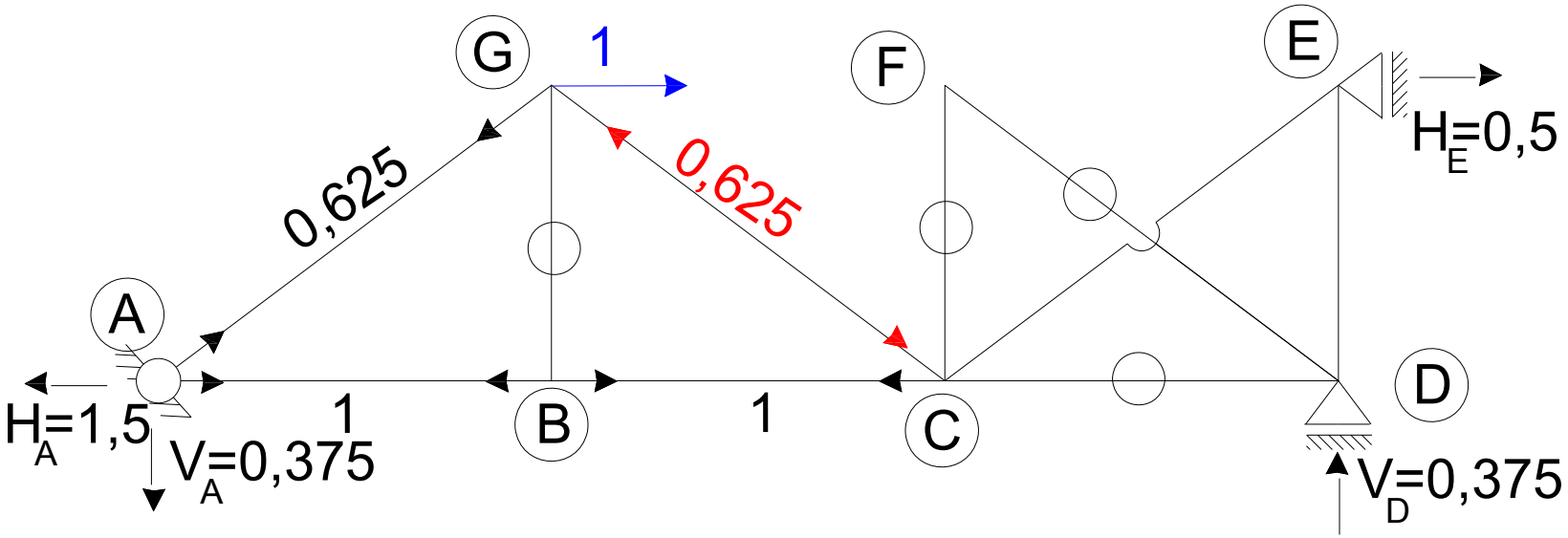

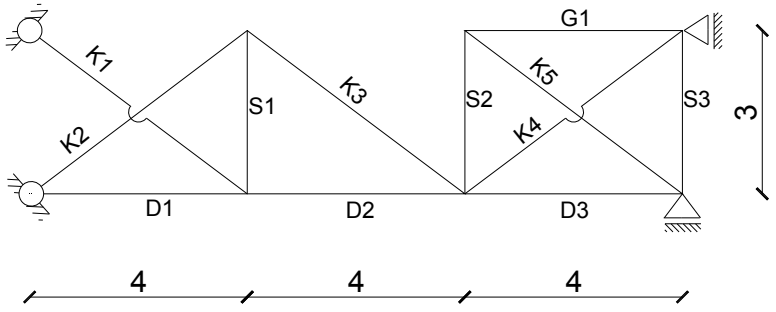

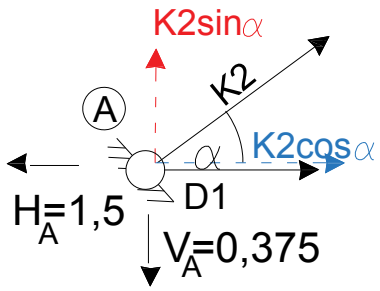

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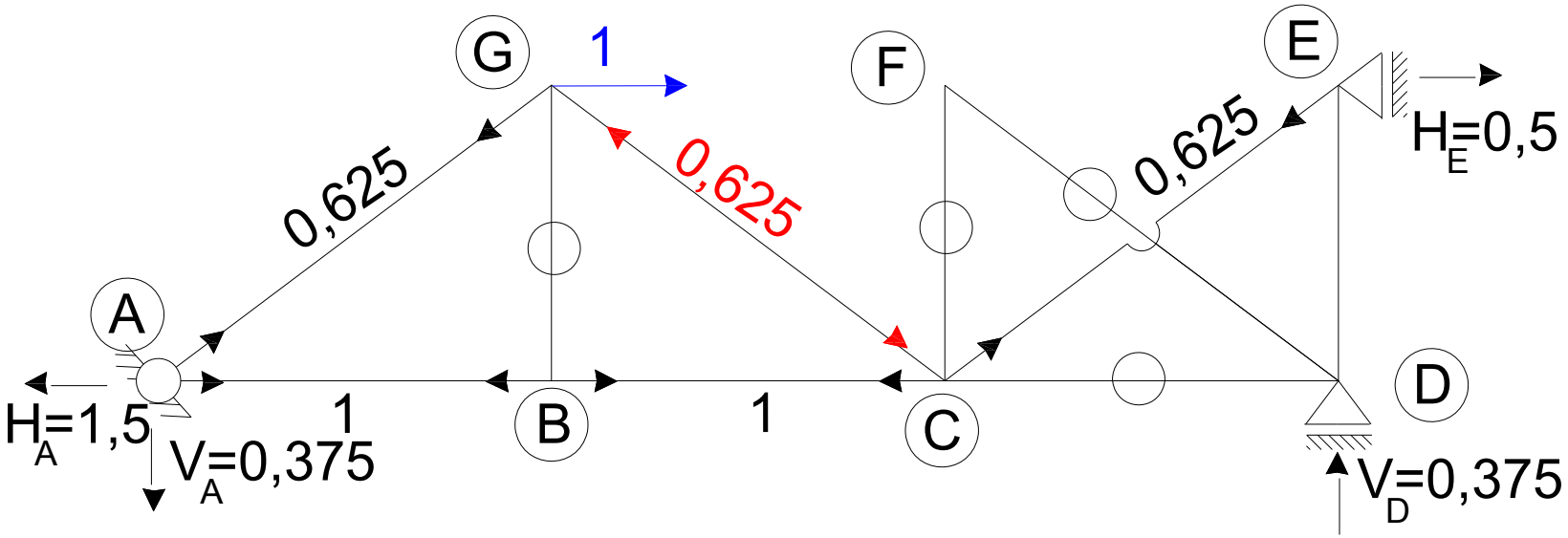

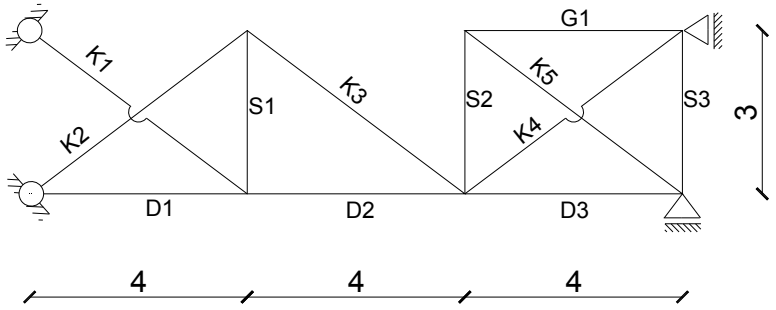

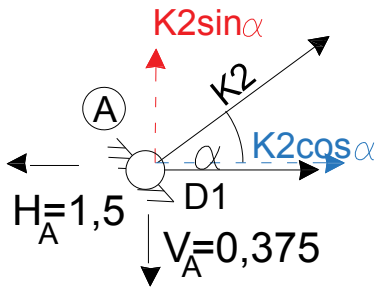

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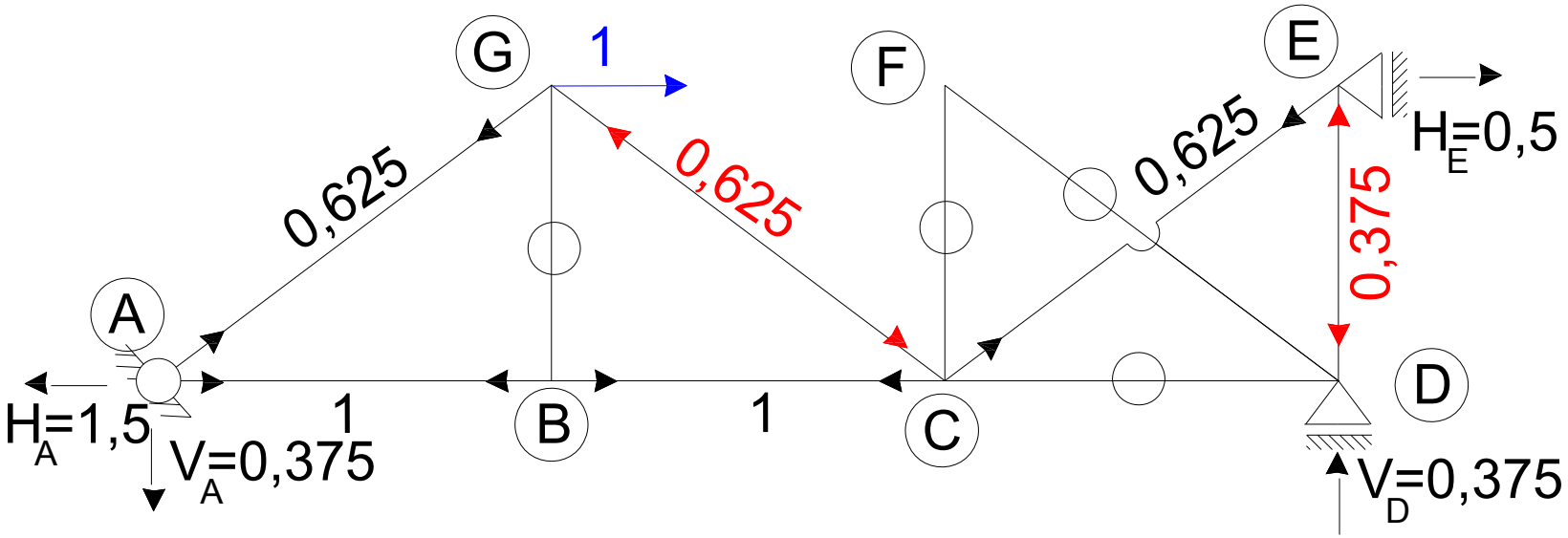

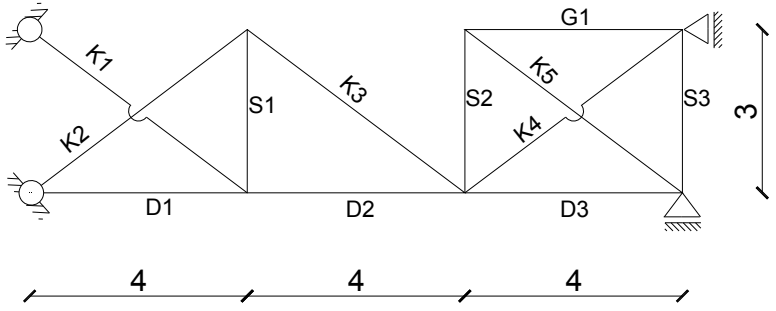

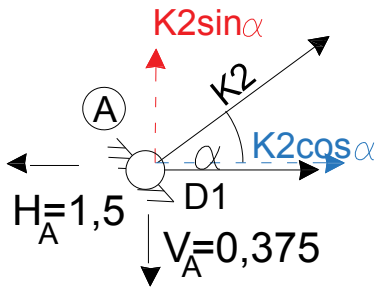

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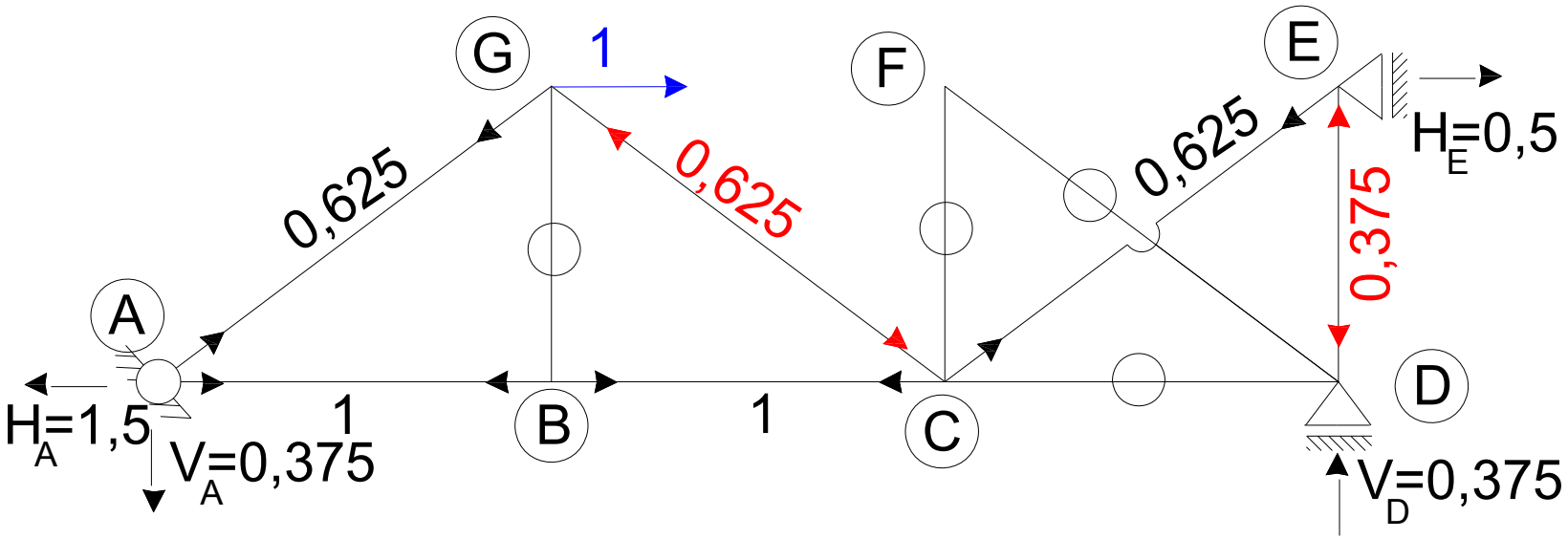
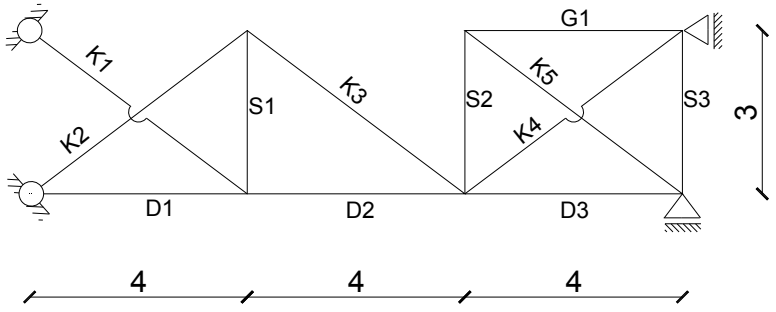


pręt	L/EA	N
D1	4	1
D2	4	1
D3	4	0
G1	4	0
S1	3	0
S2	3	0
S3	3	-0,375
K1	5	0
K2	5	0,625
K3	5	-0,625
K4	5	0,625
K5	5	0



dr inż. Hanna Weber

Obliczenie przemieszczenia poziomego węzła G z twierdzenia redukcyjnego:

Pręt	L/EA	$\bar{N}$	N	$\bar{N}$*N*L/EA
D1	4	1	-0,476	-1,903
D2	4	1	7,762	31,048
D3	4	0	2,366	0,000
G1	4	0	2,366	0,000
S1	3	0	-6,178	0,000
S2	3	0	1,774	0,000
S3	3	-0,375	-13,137	14,779
K1	5	0	10,297	0,000
K2	5	0,625	-4,851	-15,160
K3	5	-0,625	-4,851	15,160
K4	5	0,625	1,894	5,920
K5	5	0	-2,957	0,000
				49,843

Przemieszenie poziome węzła G wynosi u_G =49,843/EA

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