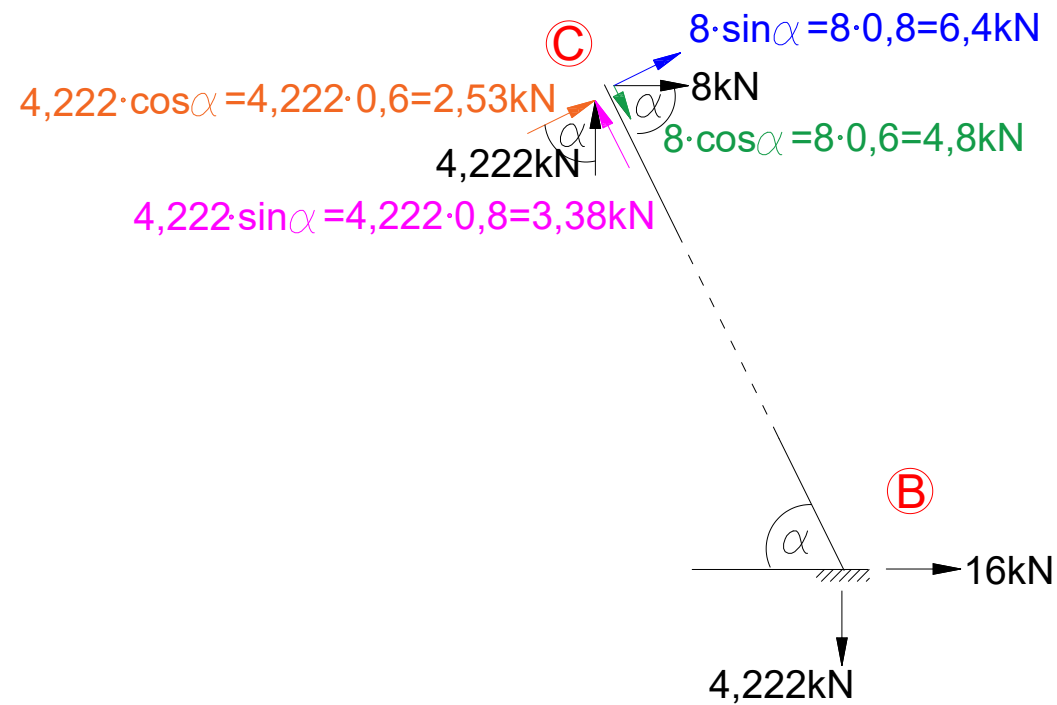
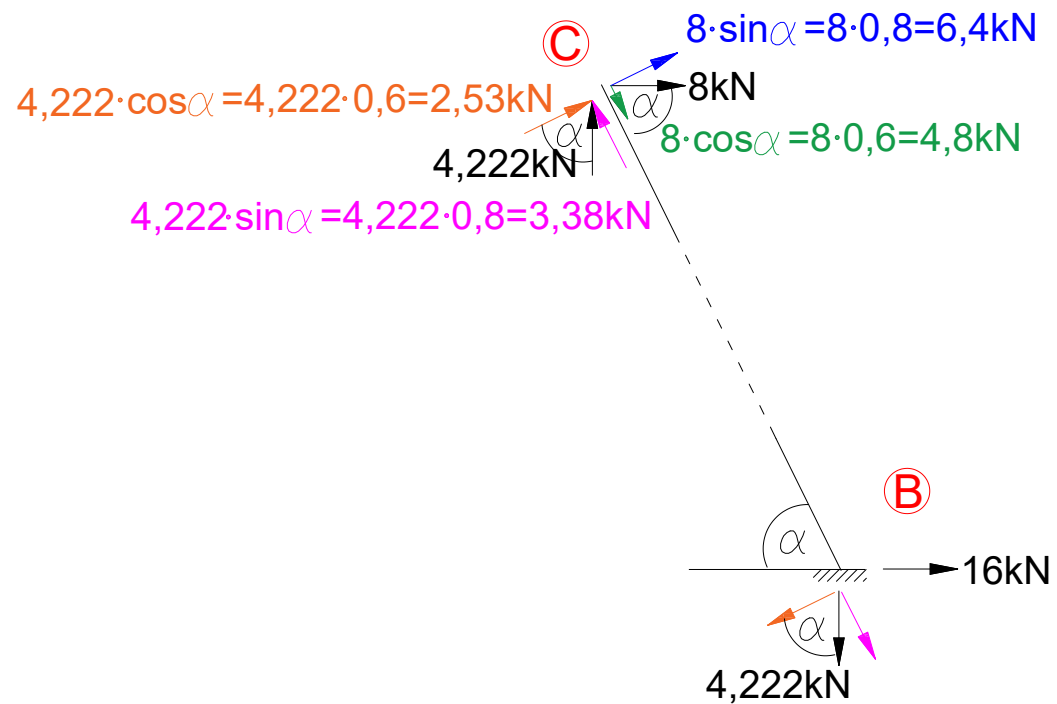


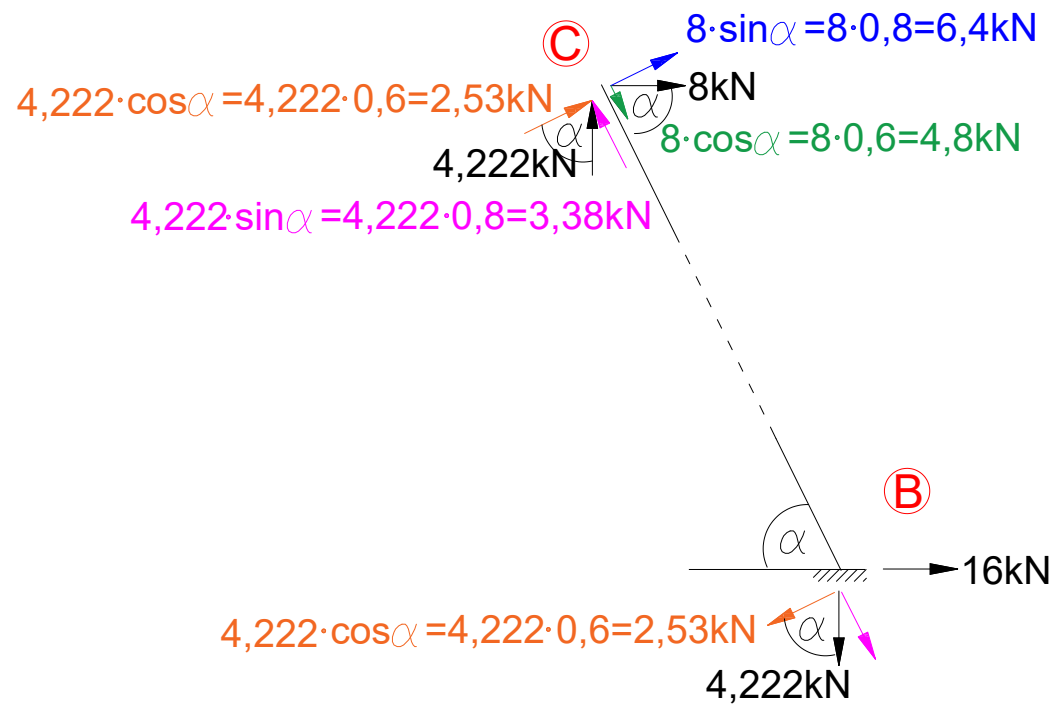
Rama z prętem ukośnym



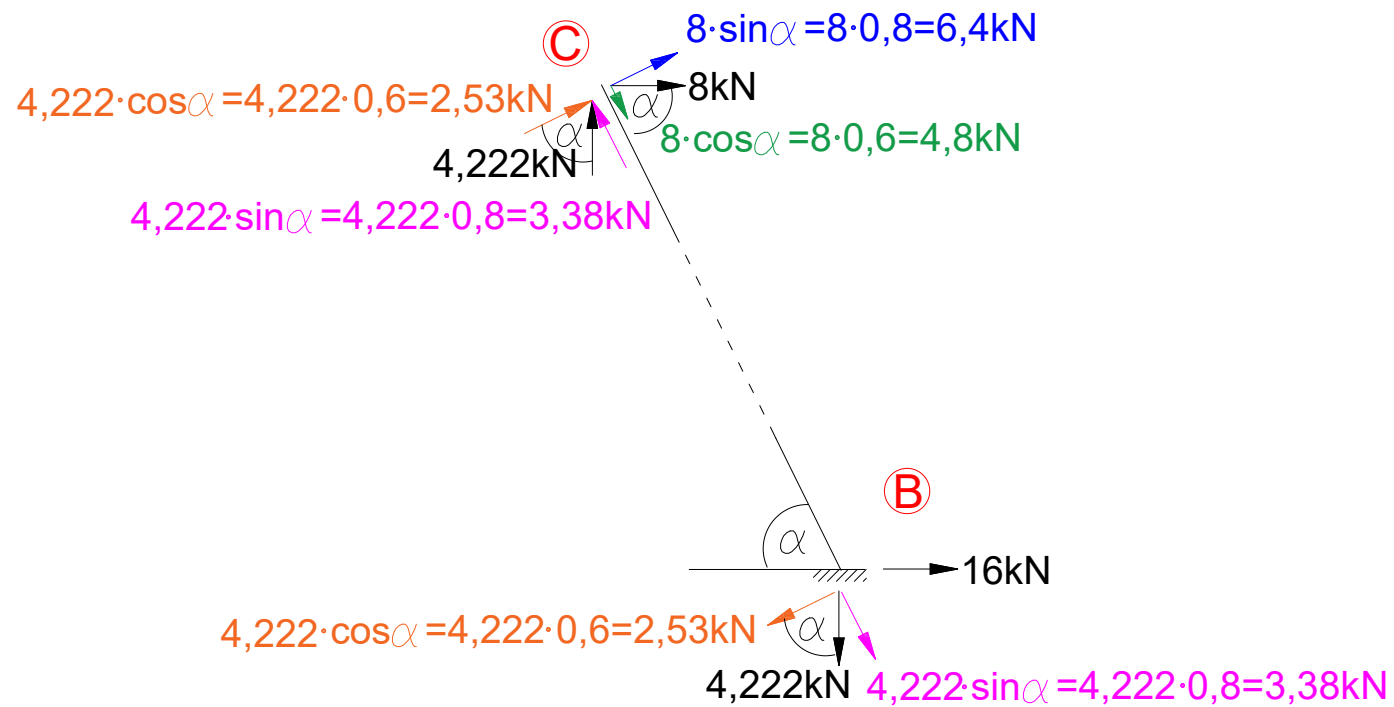
Rama z prętem ukośnym



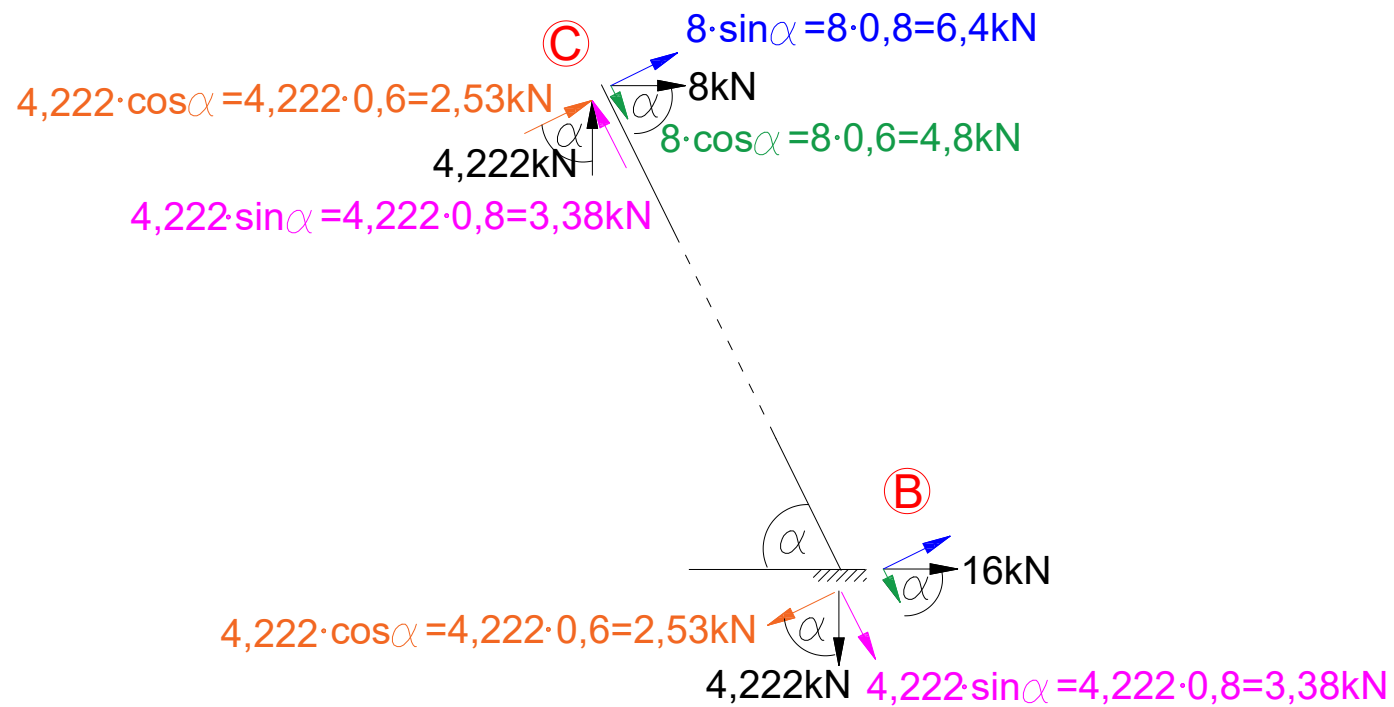
Rama z prętem ukośnym



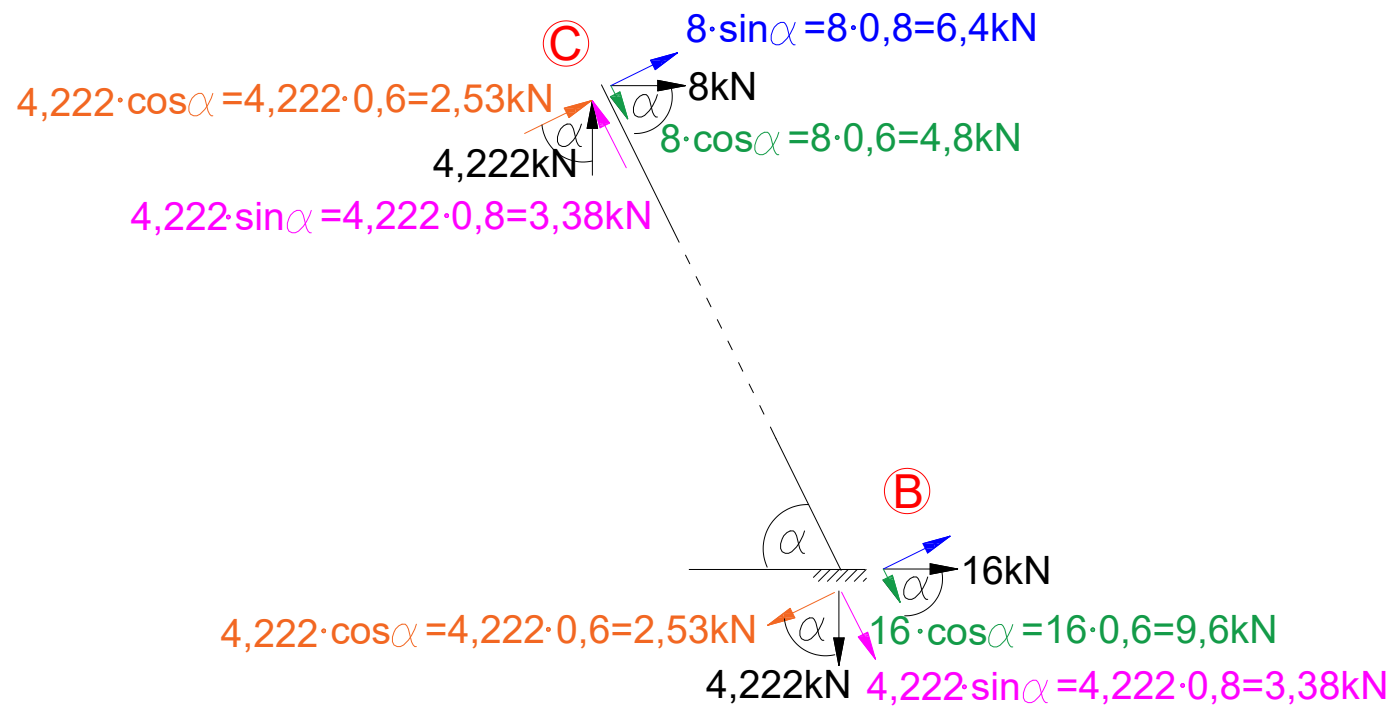
Rama z prętem ukośnym



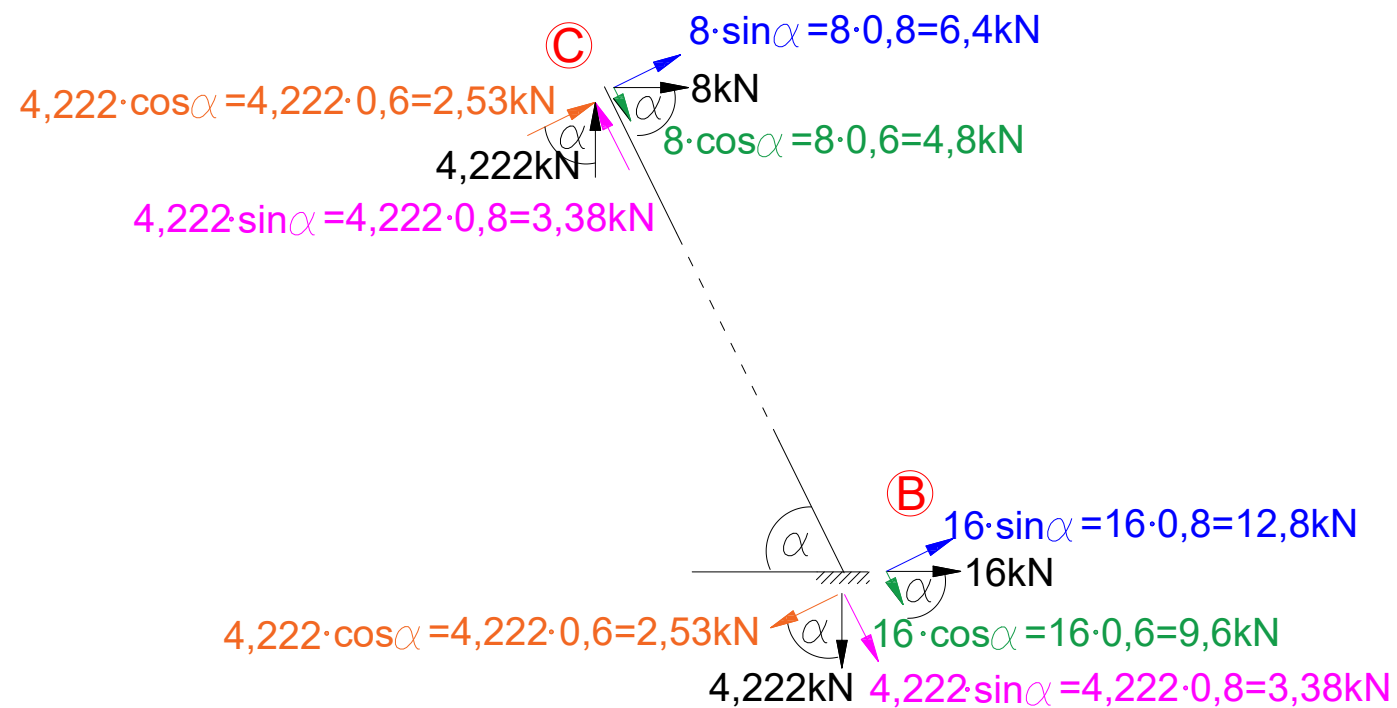
Rama z prętem ukośnym



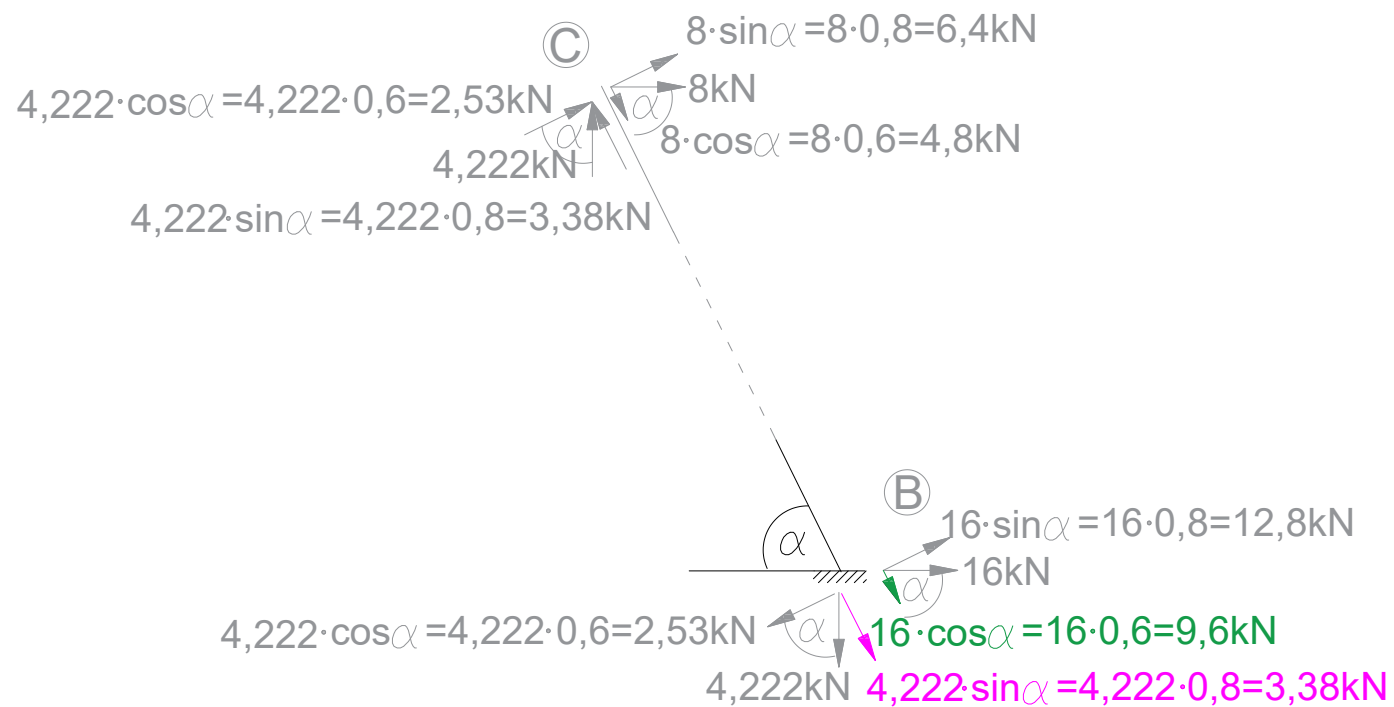
Rama z prętem ukośnym



Rama z prętem ukośnym

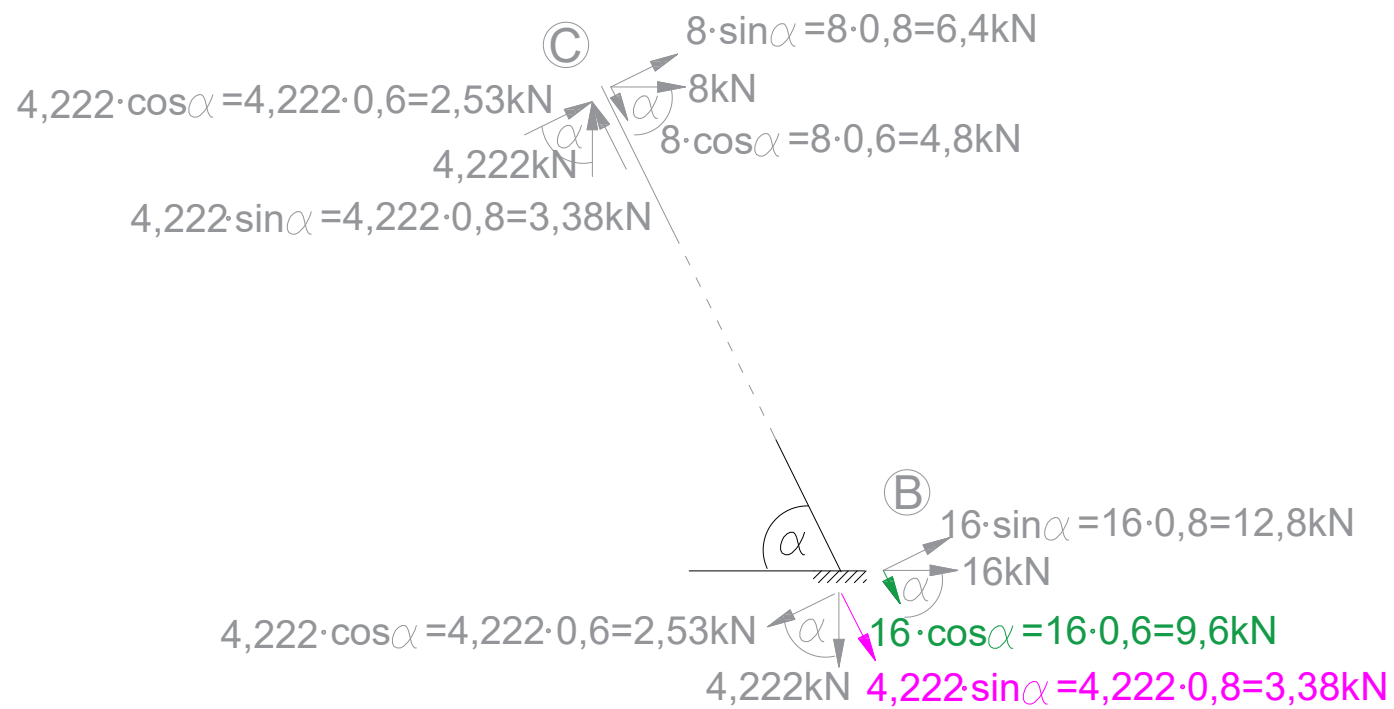


Rama z prętem ukośnym



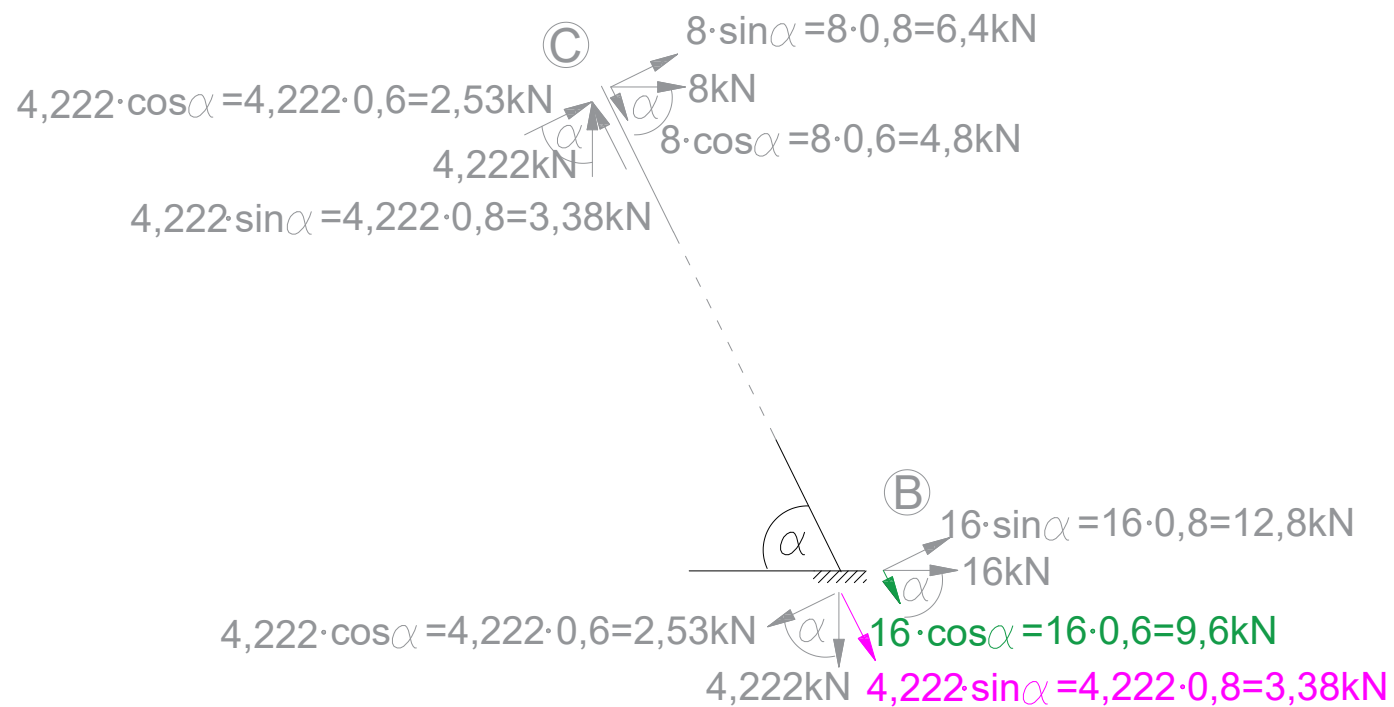
$$N_B =$$

Rama z prętem ukośnym



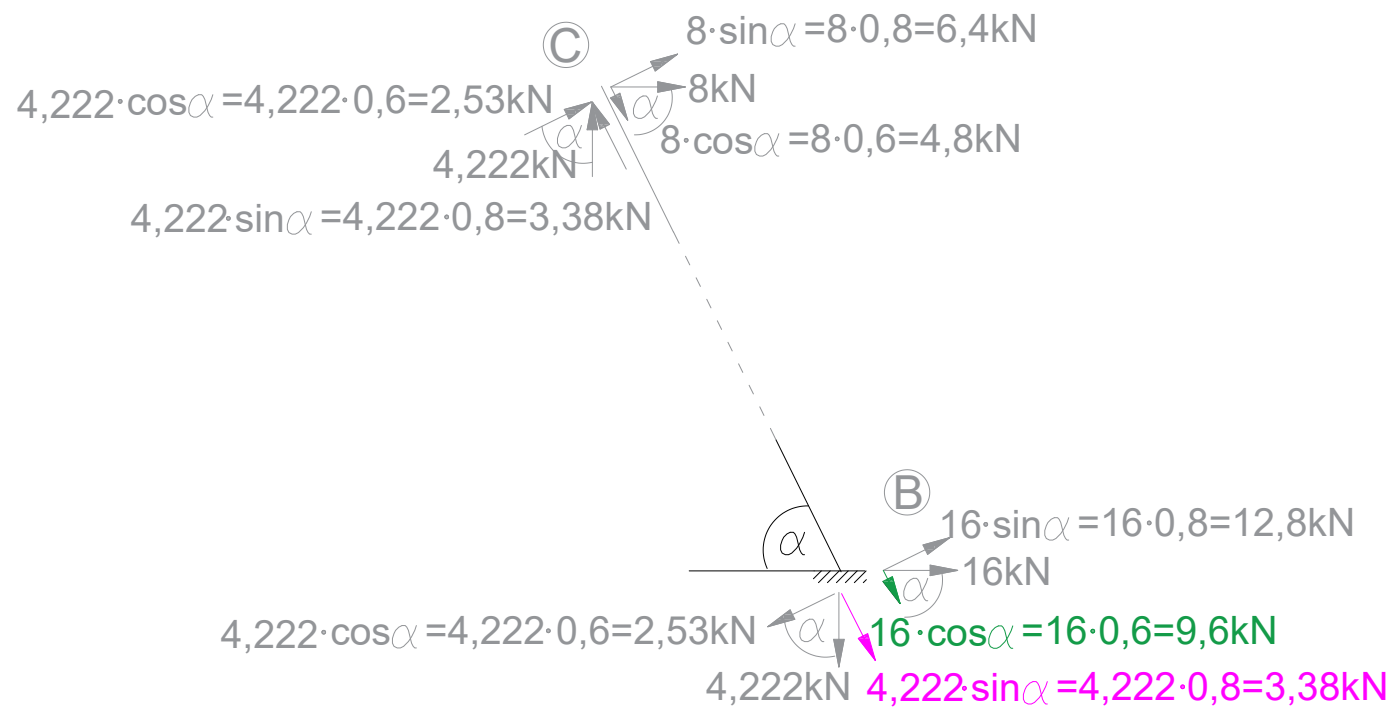
$$N_B = 9,6$$

Rama z prętem ukośnym



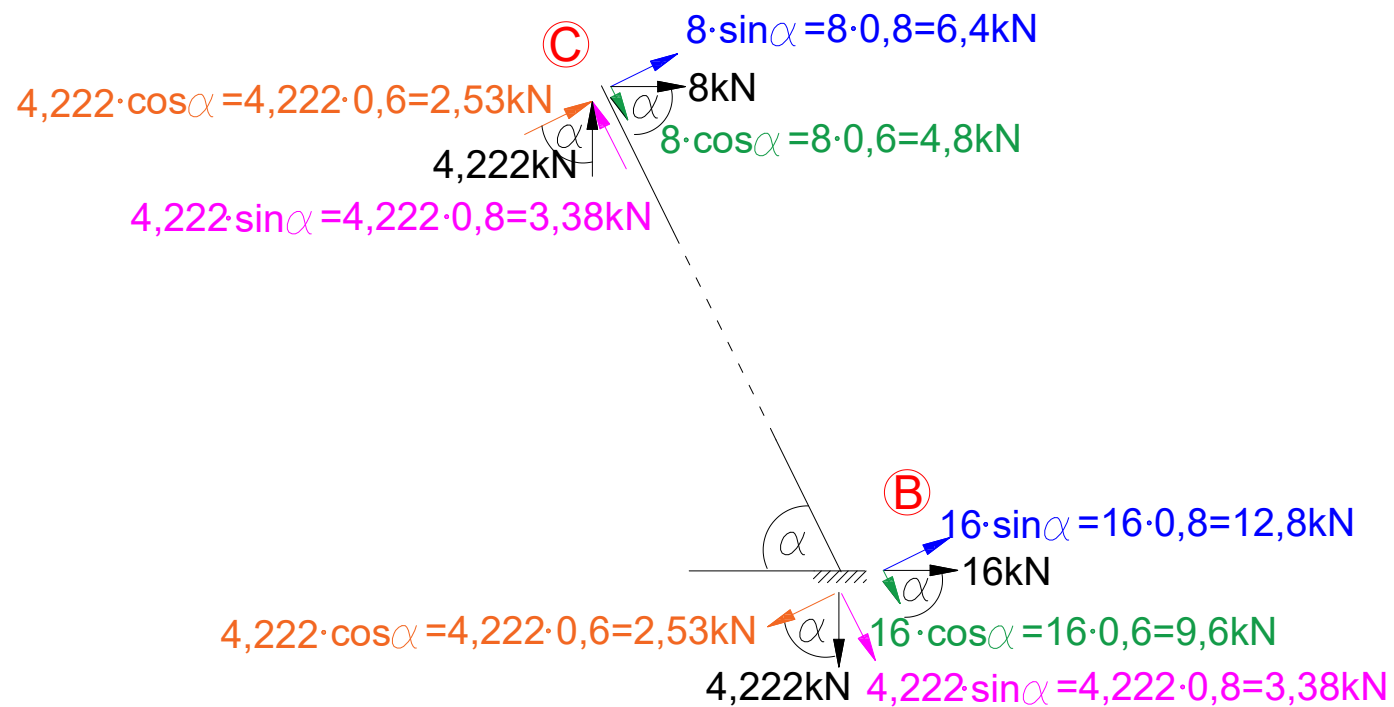
$$N_B = 9,6 + 3,38$$

Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

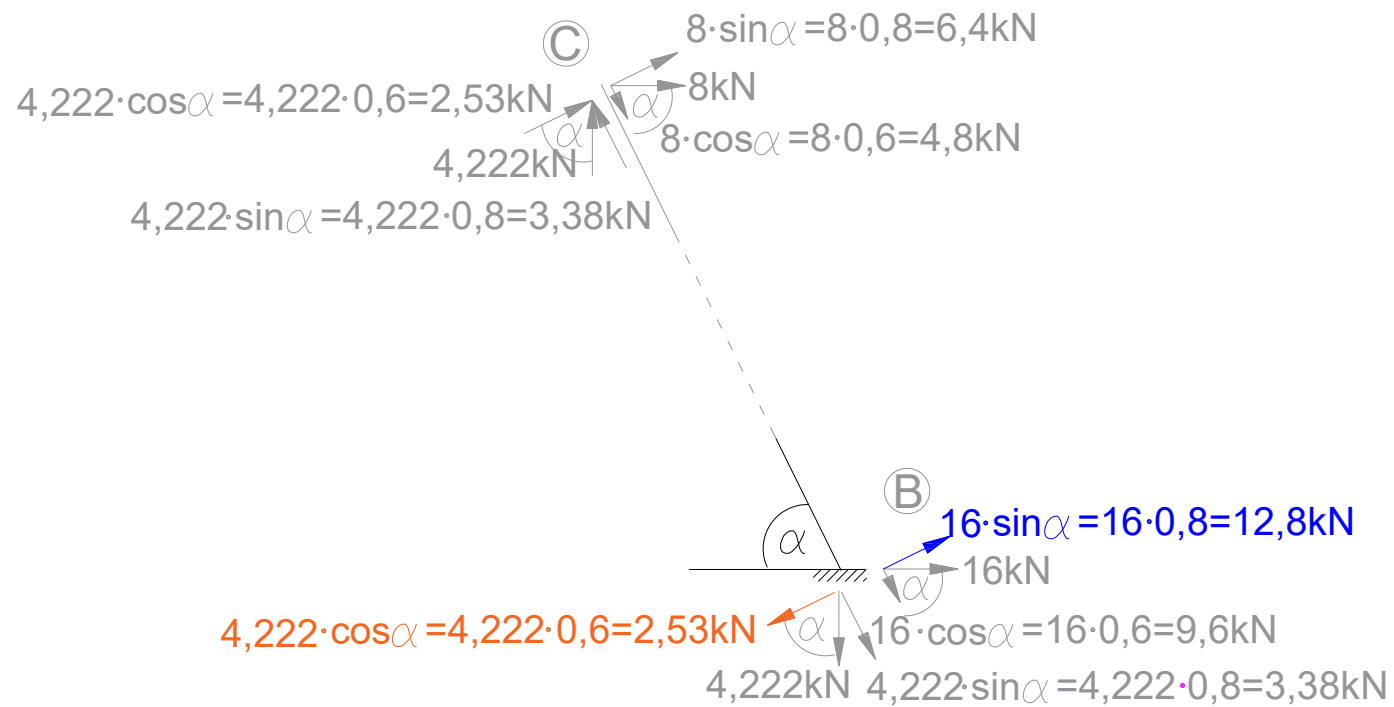
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B =$$

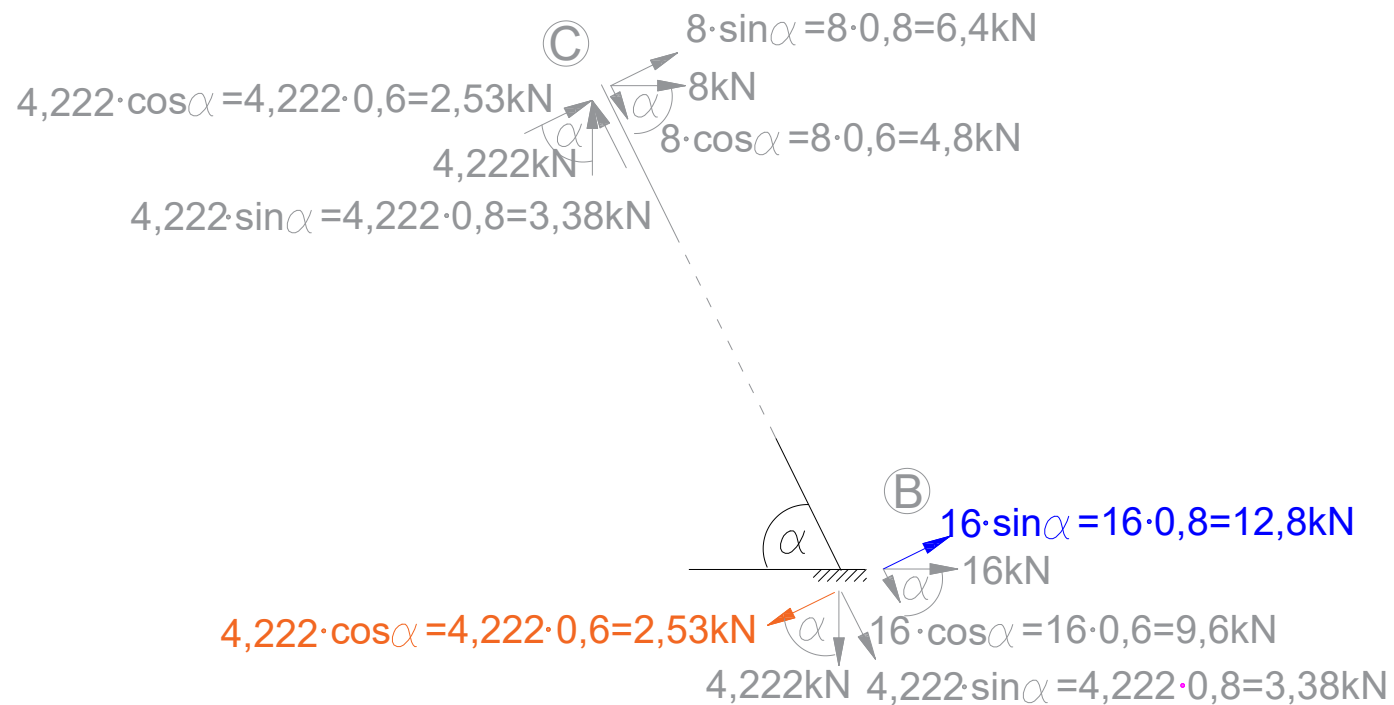
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B =$$

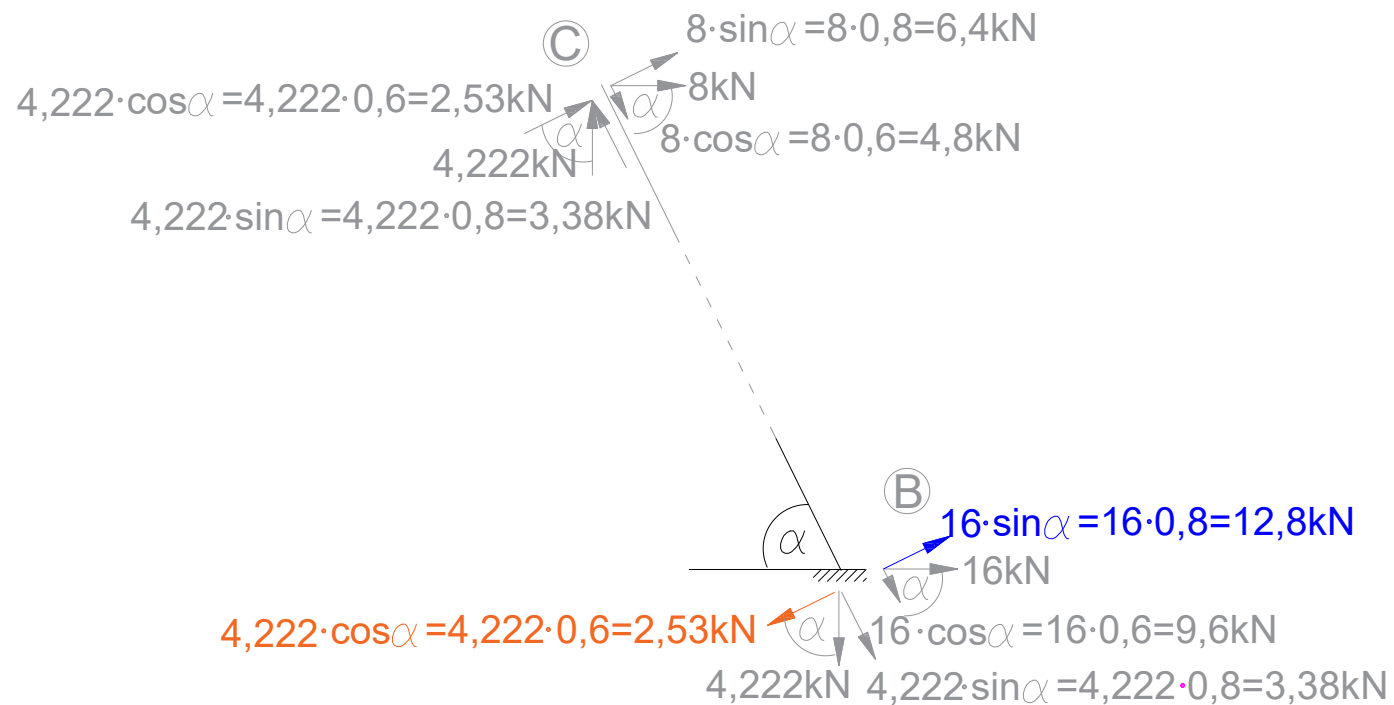
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8$$

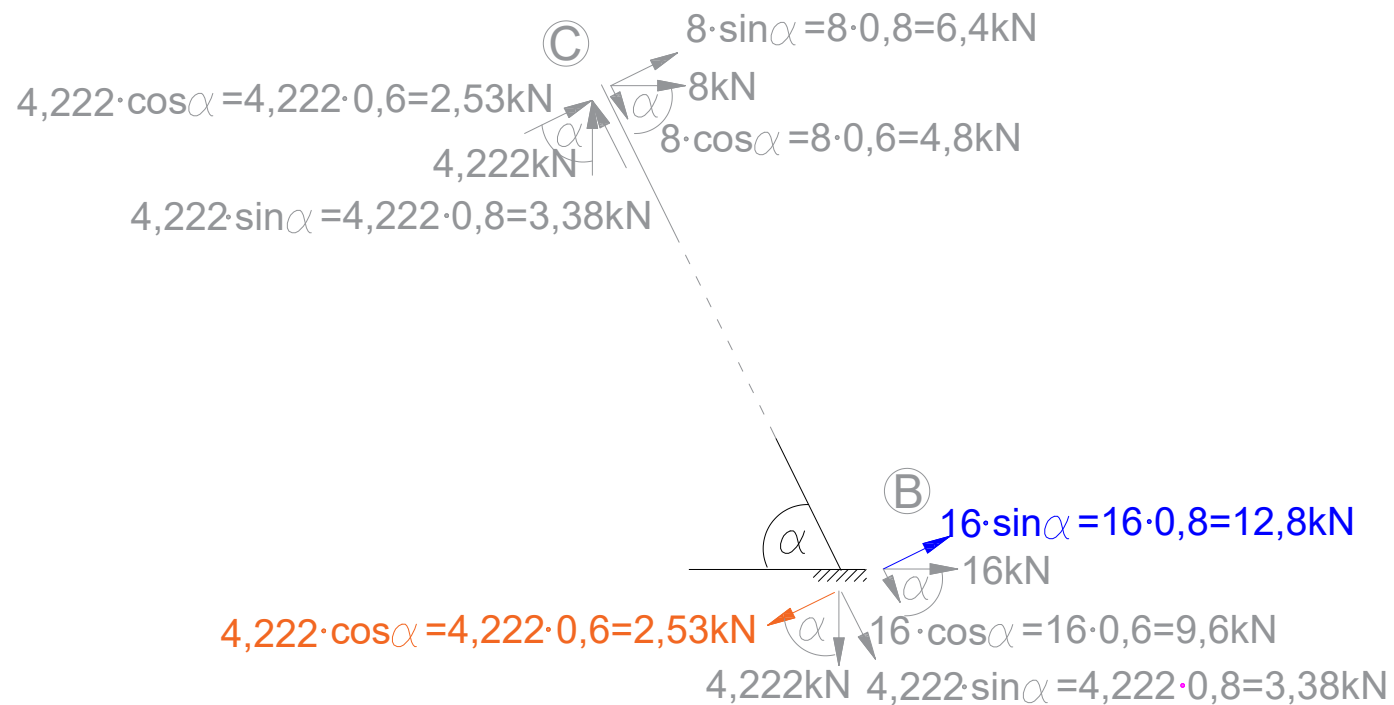
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 =$$

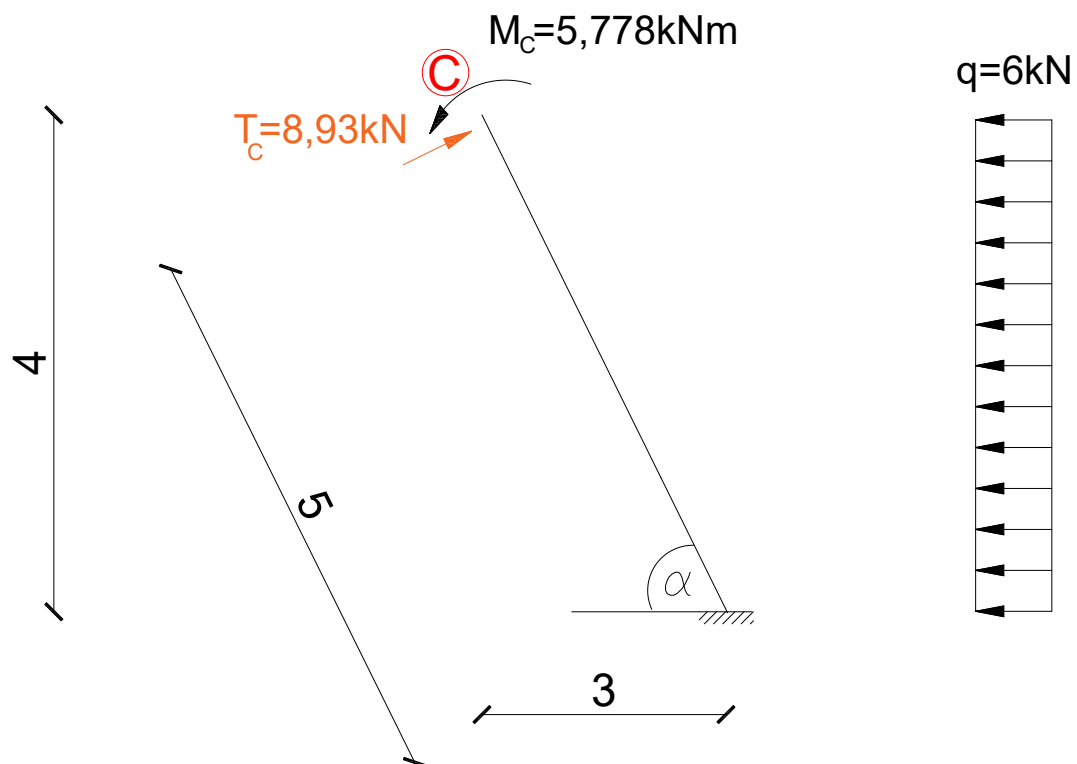
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 = -10,27 \text{ kN}$$

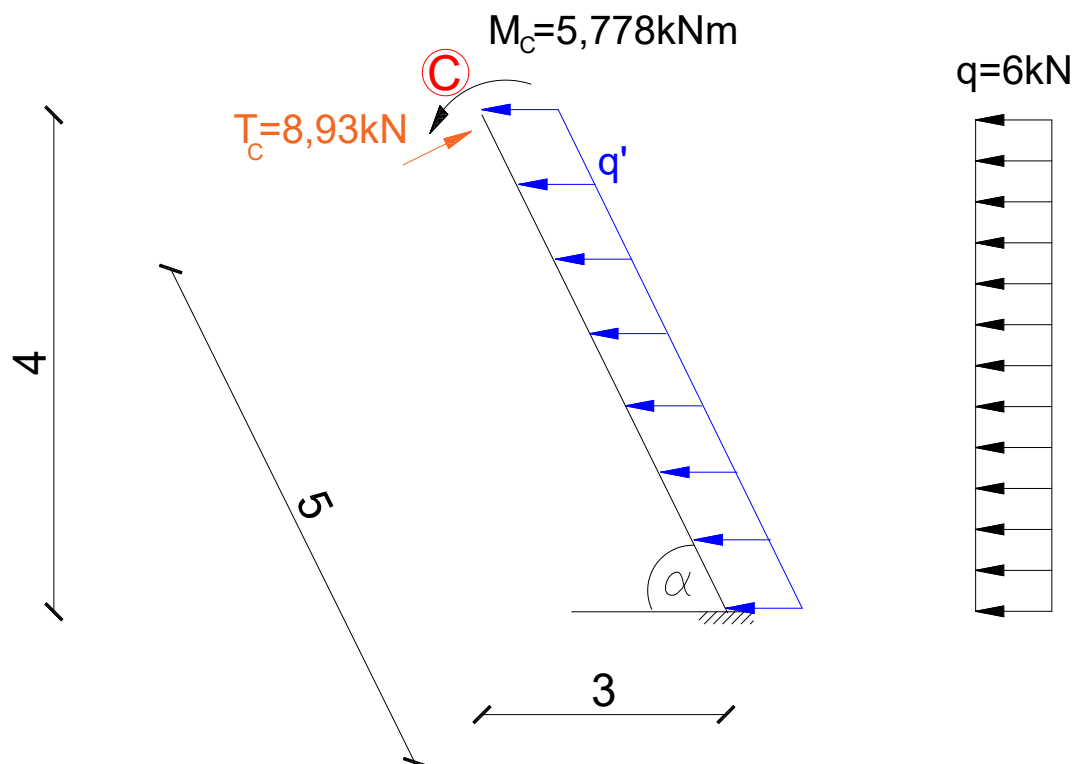
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 = -10,27 \text{ kN}$$

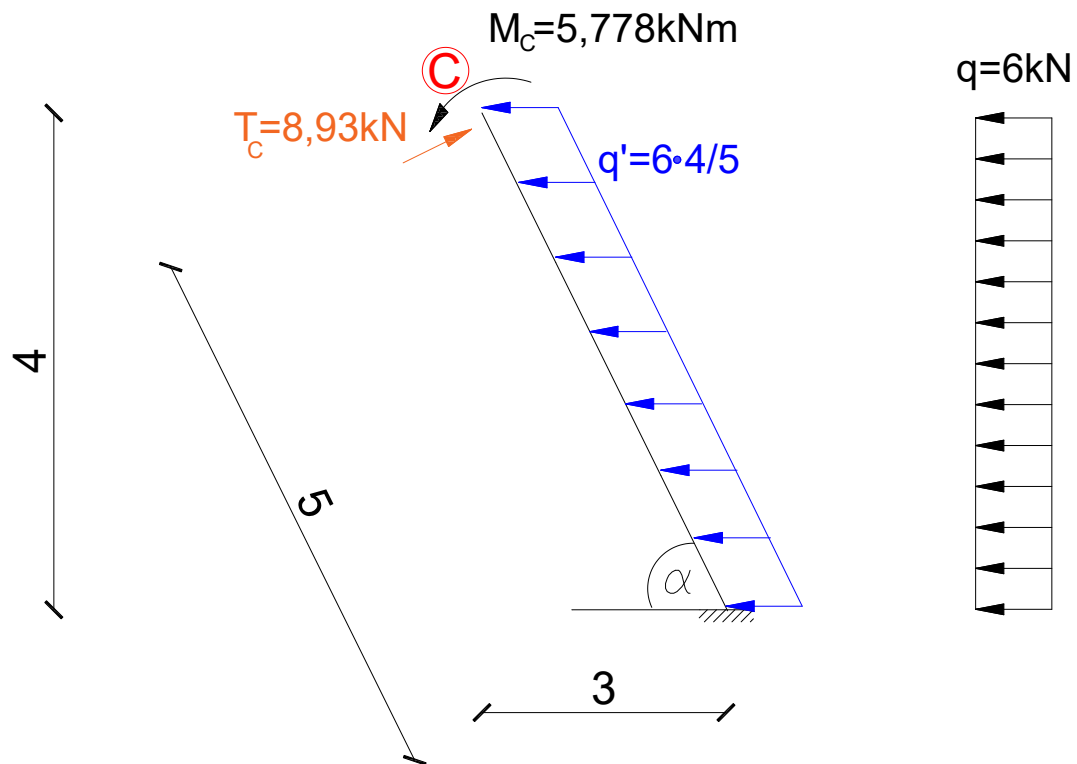
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 = -10,27 \text{ kN}$$

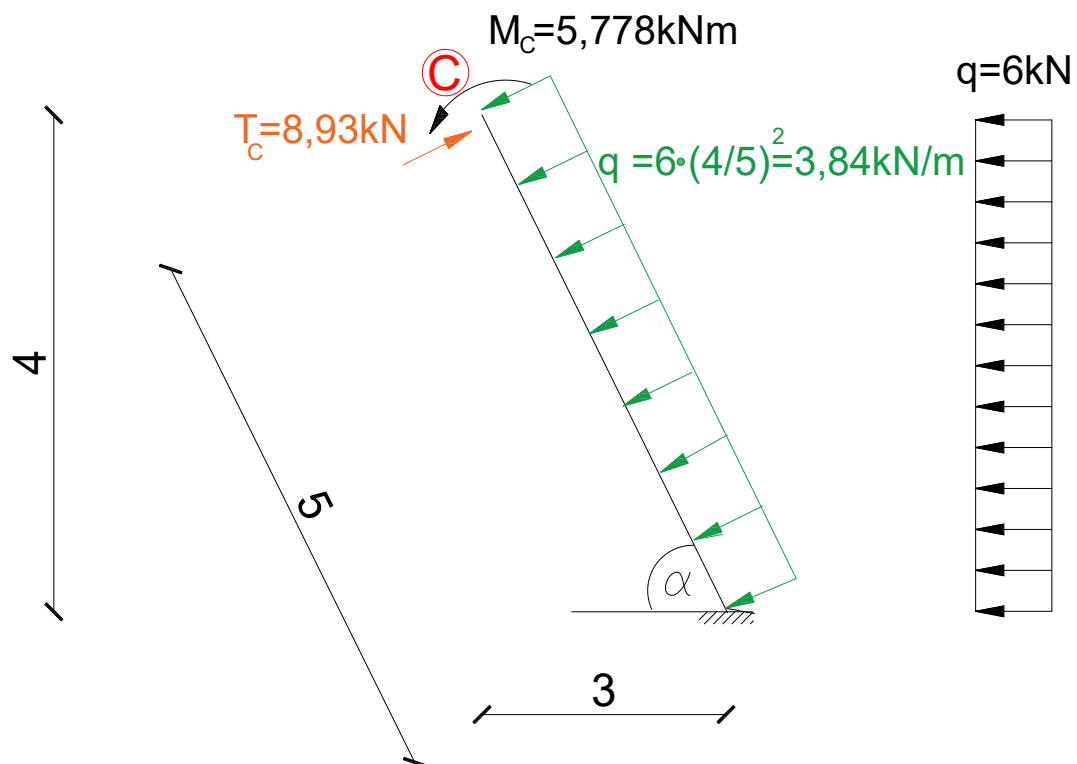
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 = -10,27 \text{ kN}$$

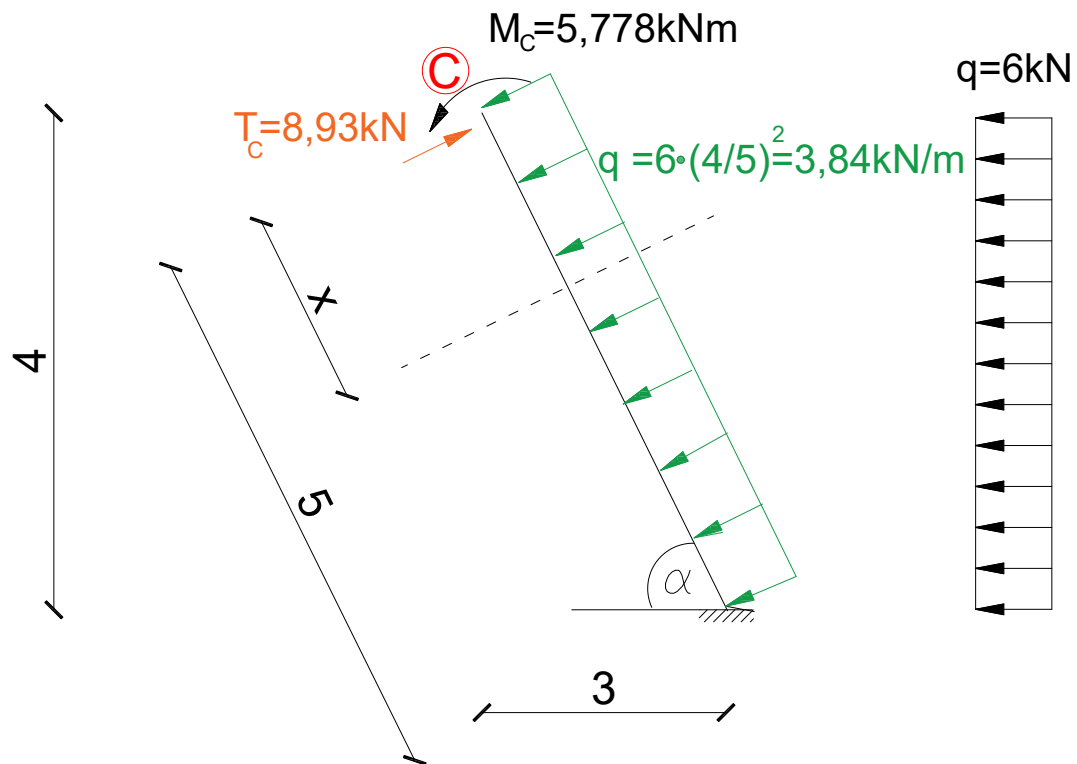
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 = -10,27 \text{ kN}$$

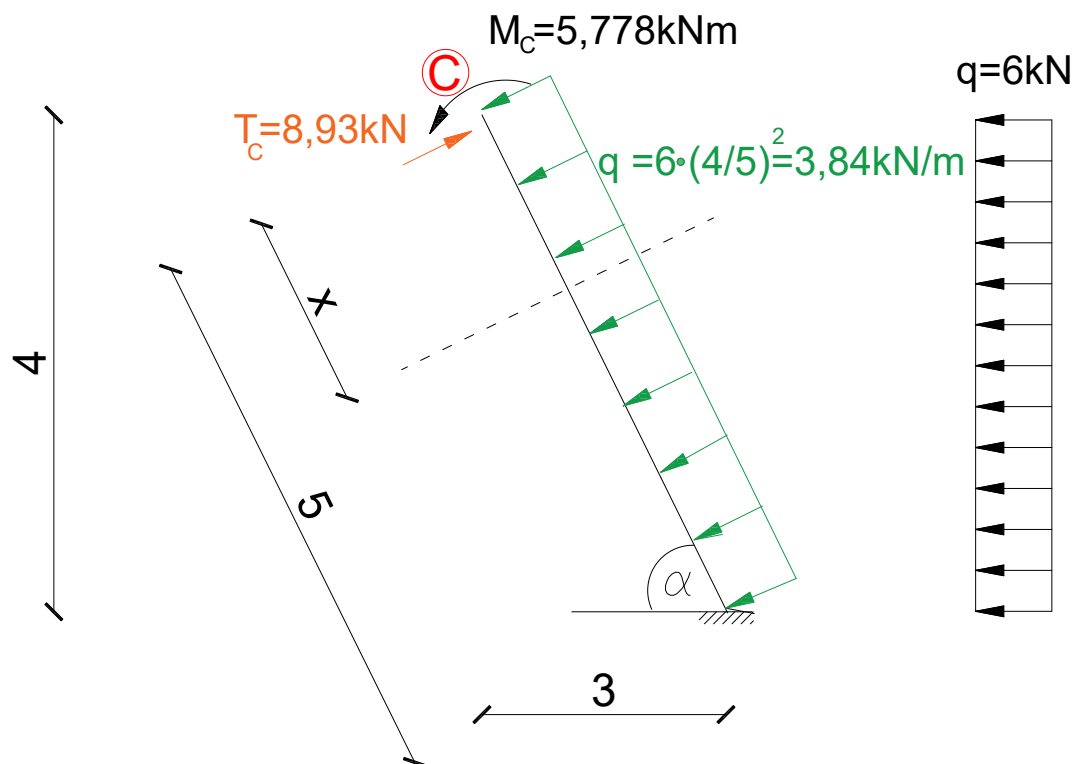
Rama z prętem ukośnym



$$N_B = 9,6 + 3,38 = 12,98 \text{ kN}$$

$$T_B = -12,8 + 2,53 = -10,27 \text{ kN}$$

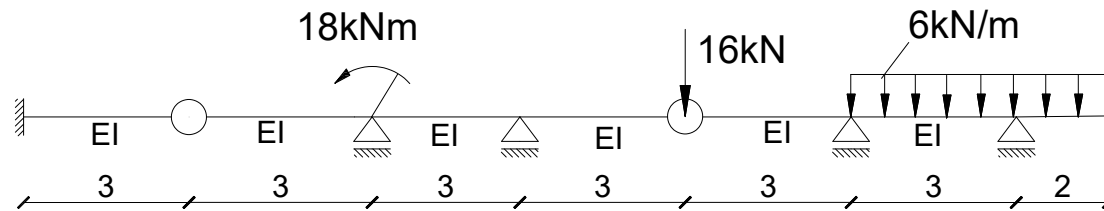
Rama z prętem ukośnym



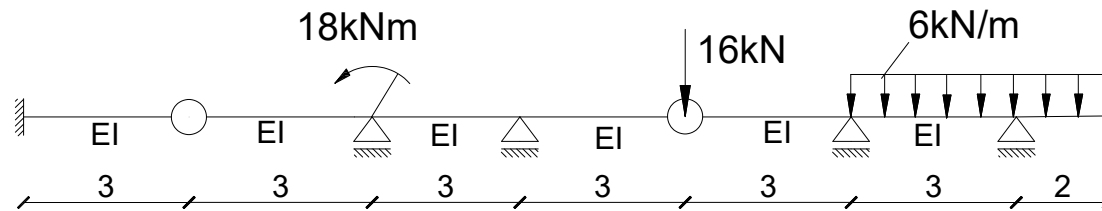
$$T[x] = 8,93 - 3,84x = 0 \rightarrow x = \frac{8,93}{3,84} = 2,33 \text{ m}$$

$$M[x] = -5,775 + 8,93 \cdot 2,33 - 3,84 \cdot \frac{2,33^2}{2} = 4,605 \text{ kNm}$$

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.

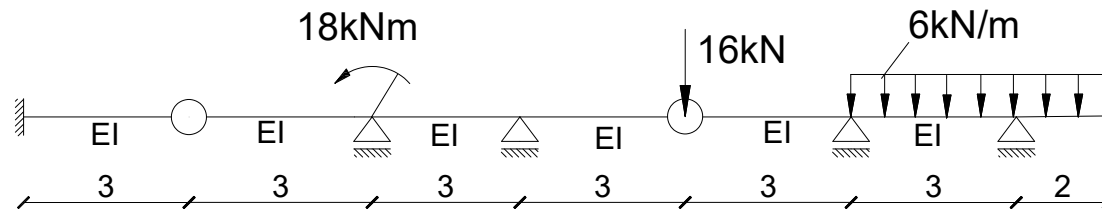


Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



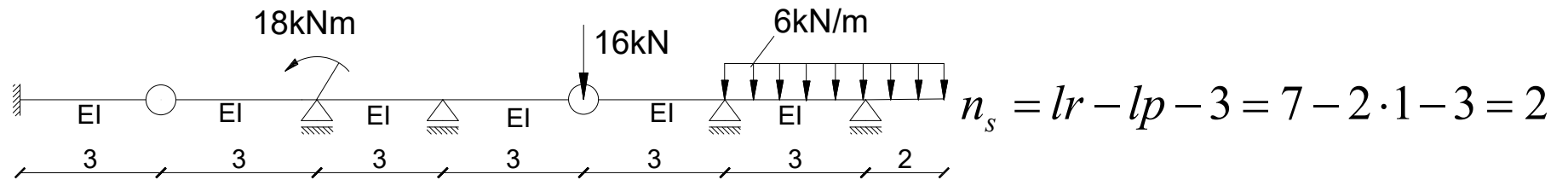
$$n_s = lr - lp - 3$$

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.

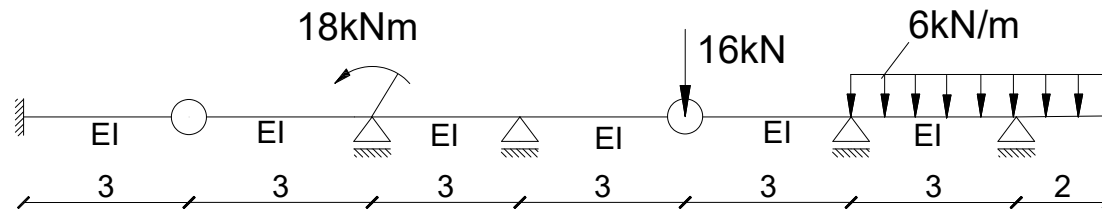


$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3$$

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



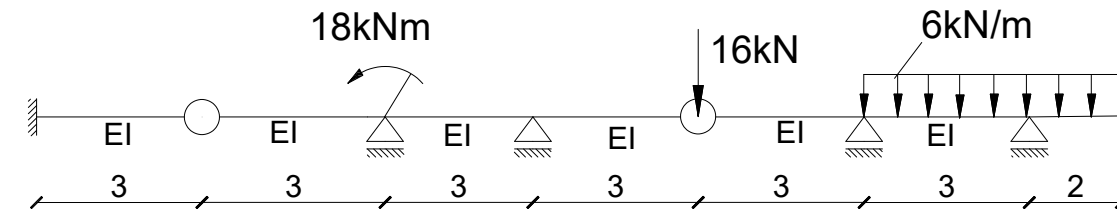
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.

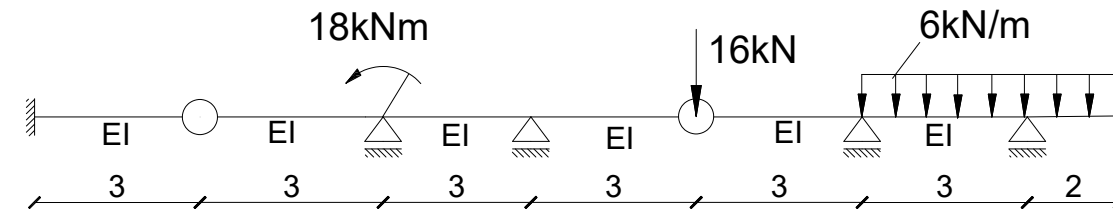


Schematy podstawowe:

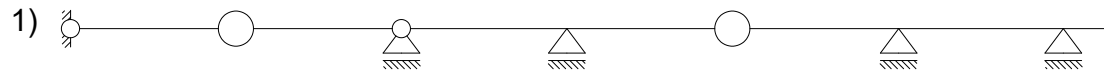
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



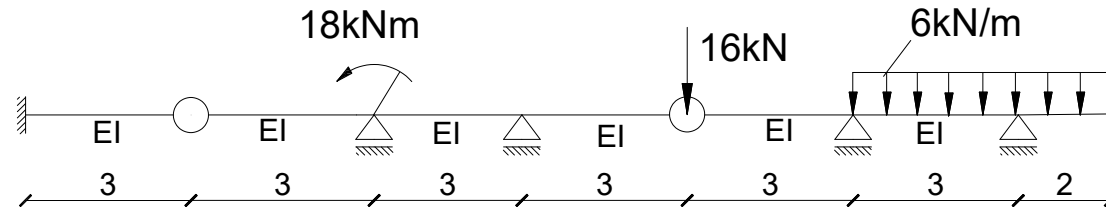
Schematy podstawowe:



$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



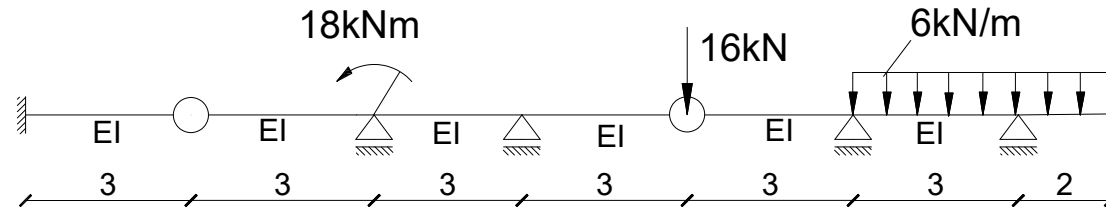
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



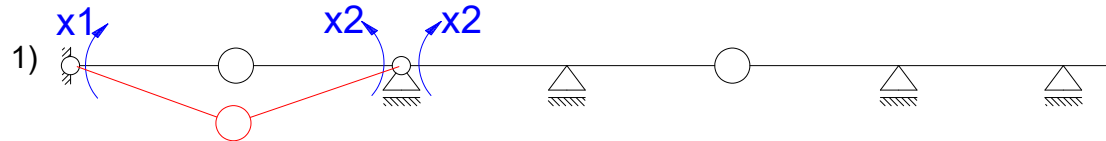
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



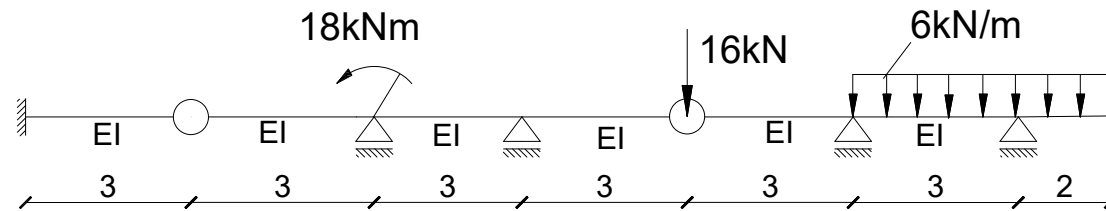
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



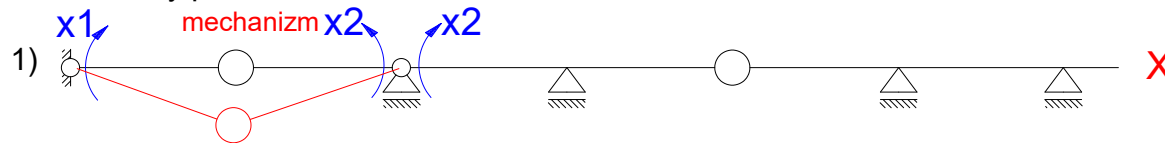
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



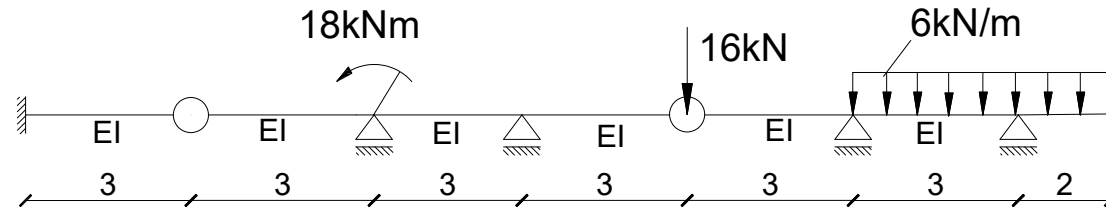
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



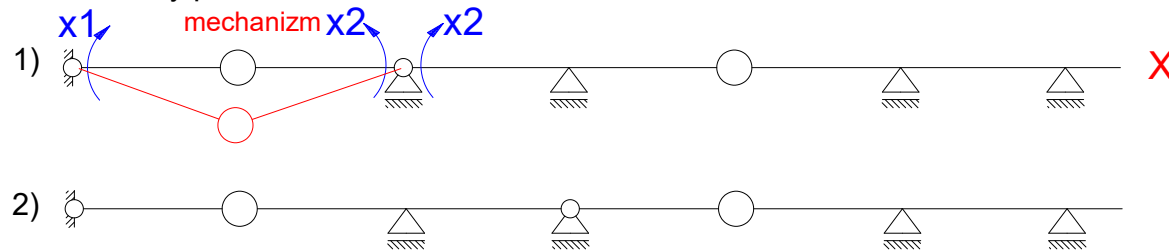
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



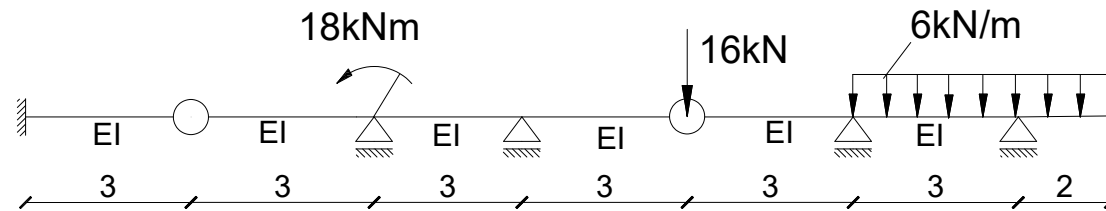
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



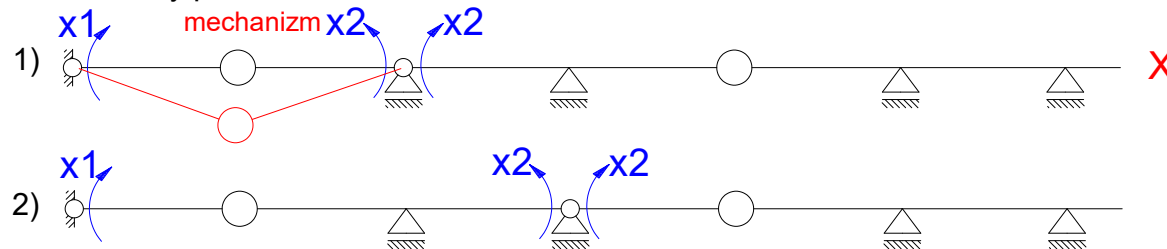
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



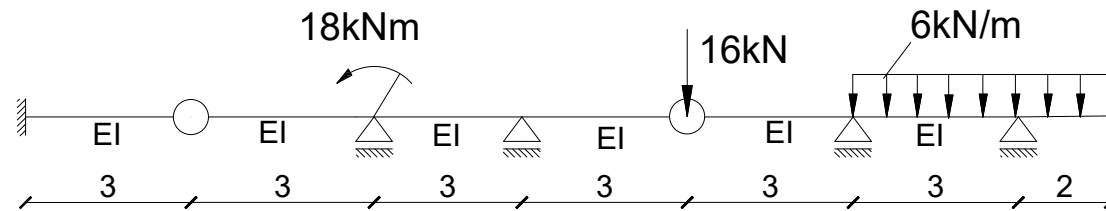
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



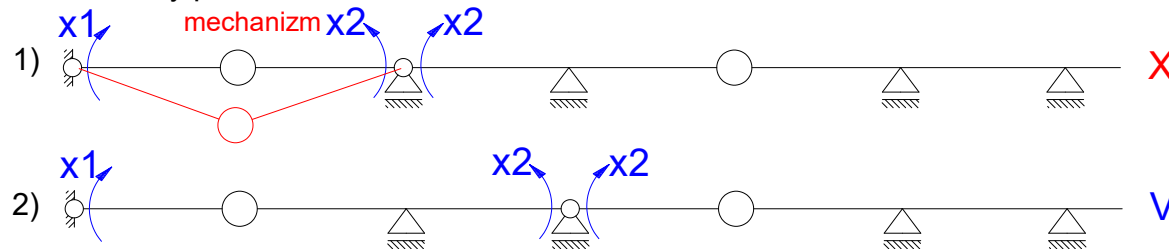
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



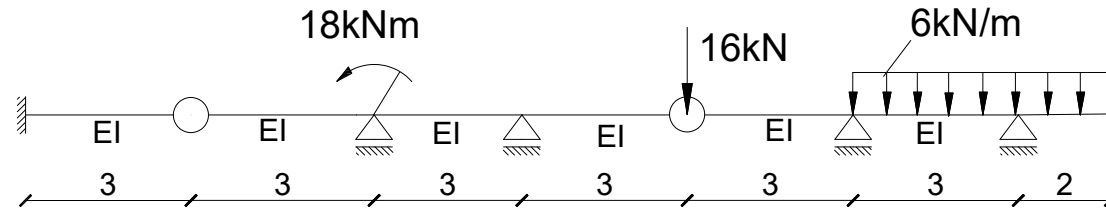
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



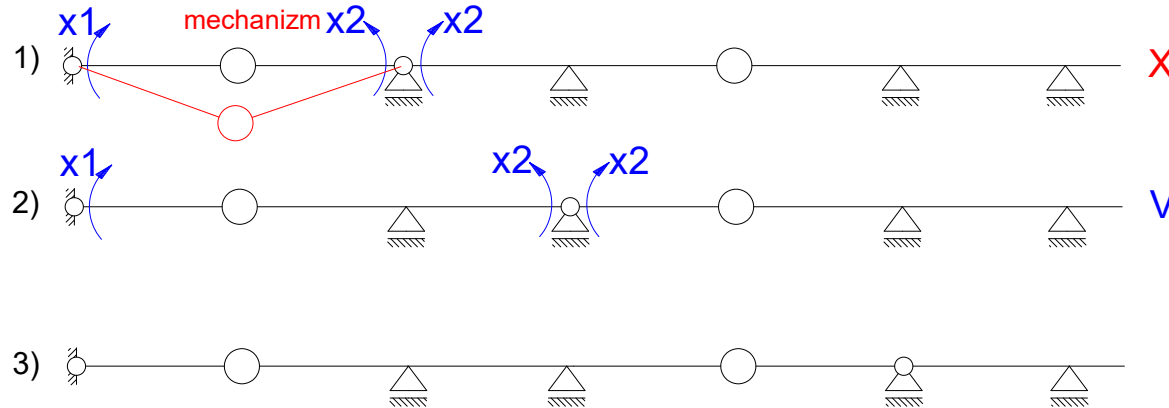
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



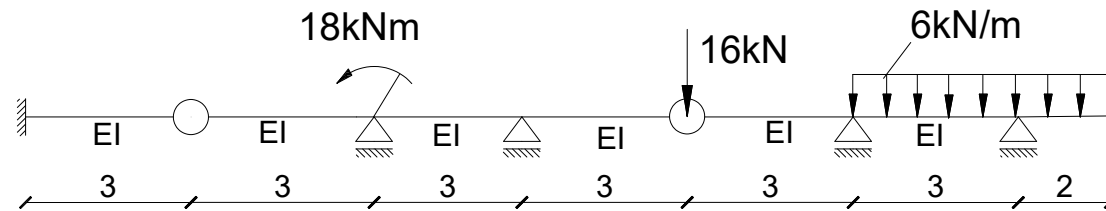
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



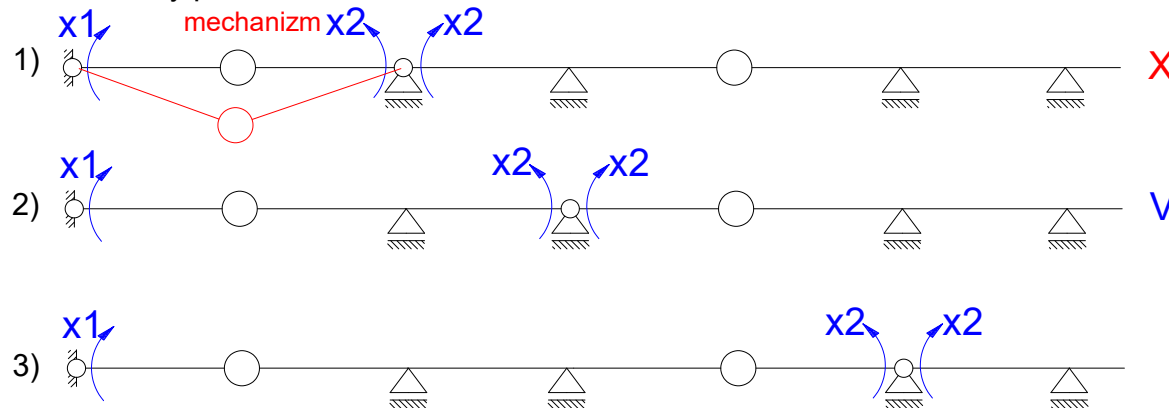
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



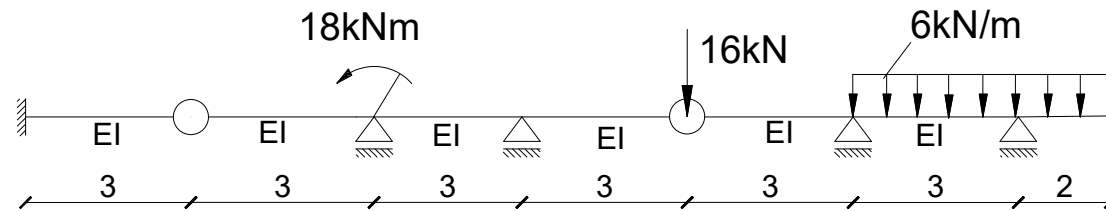
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



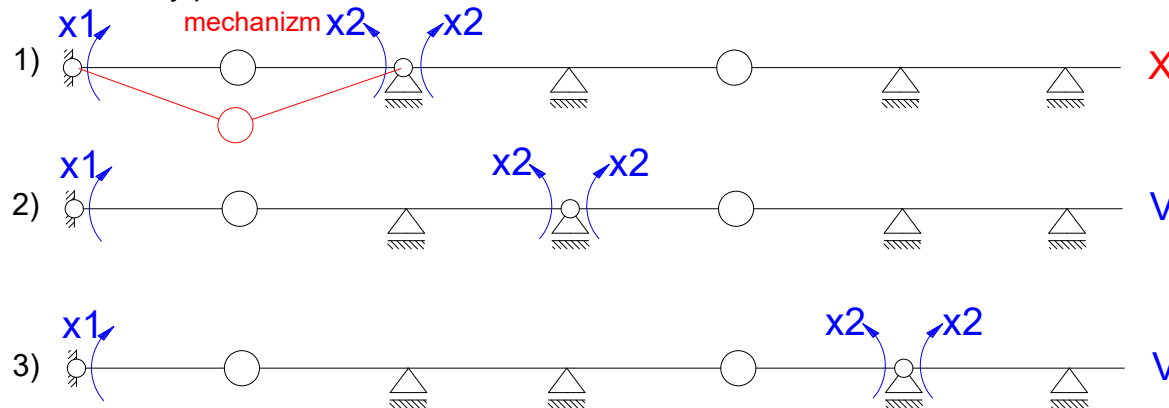
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



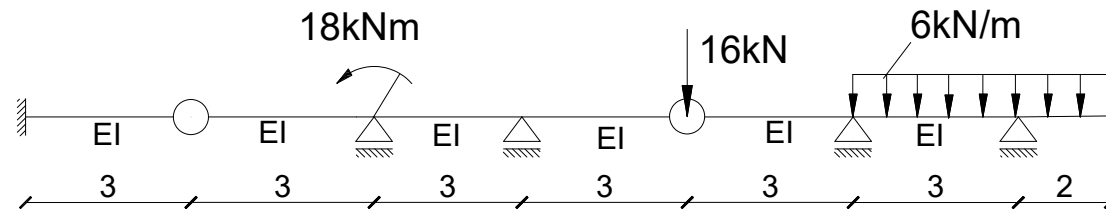
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



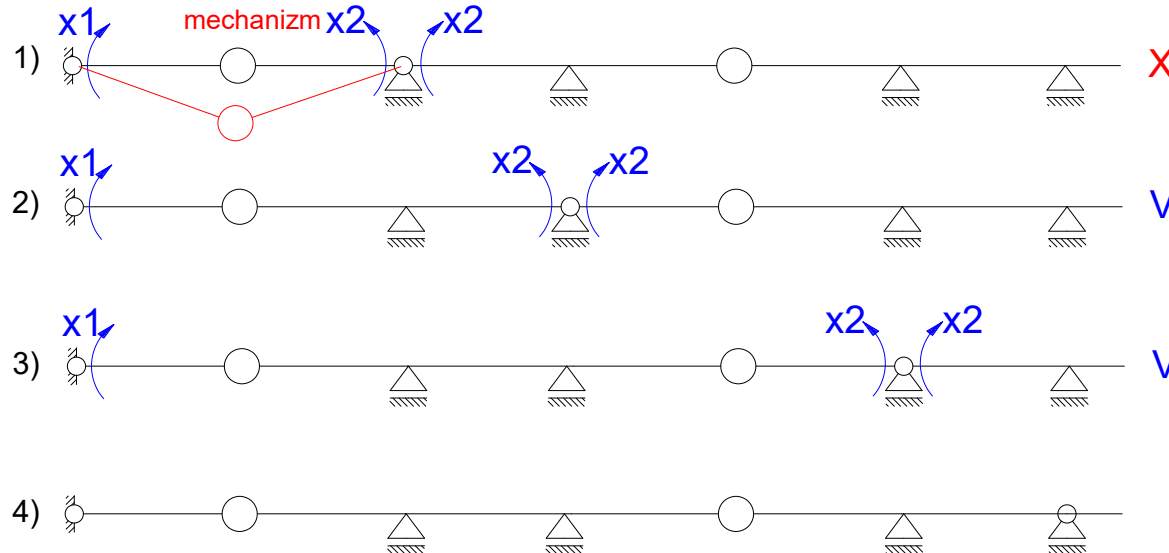
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



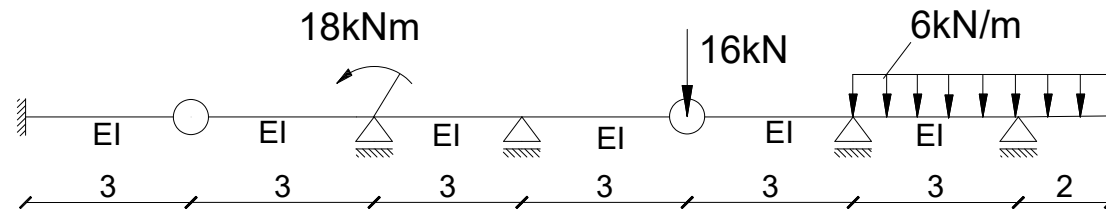
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



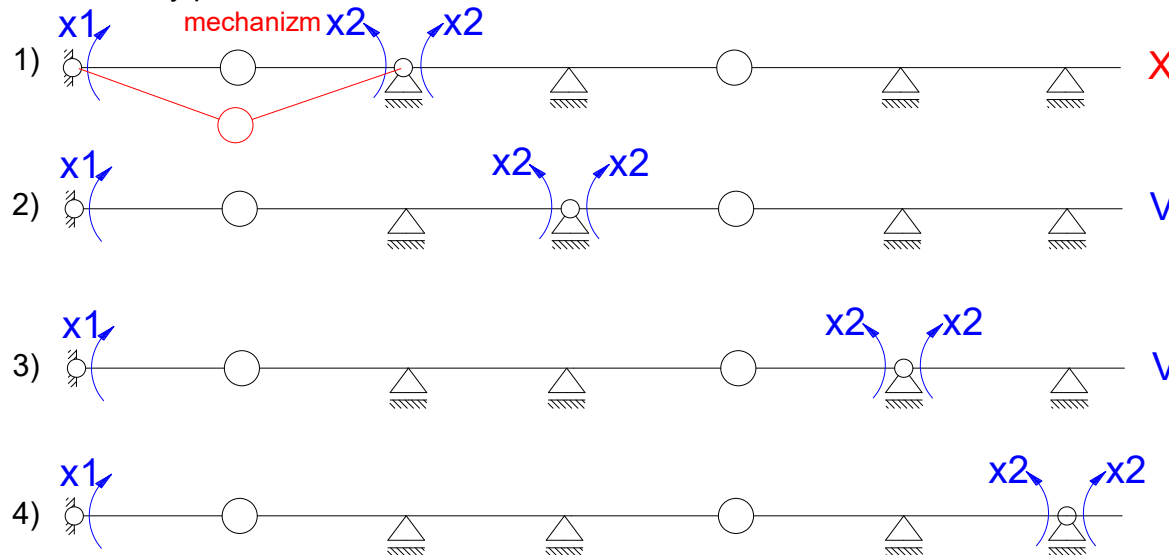
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



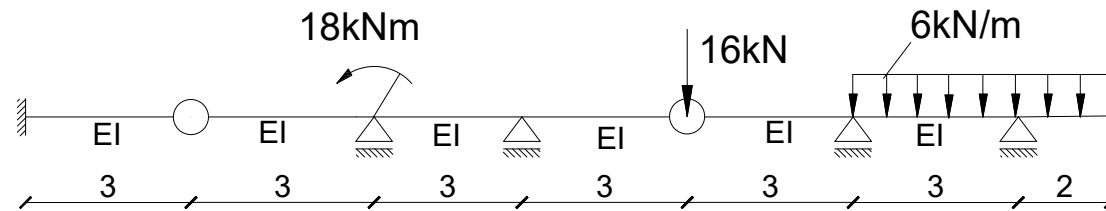
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



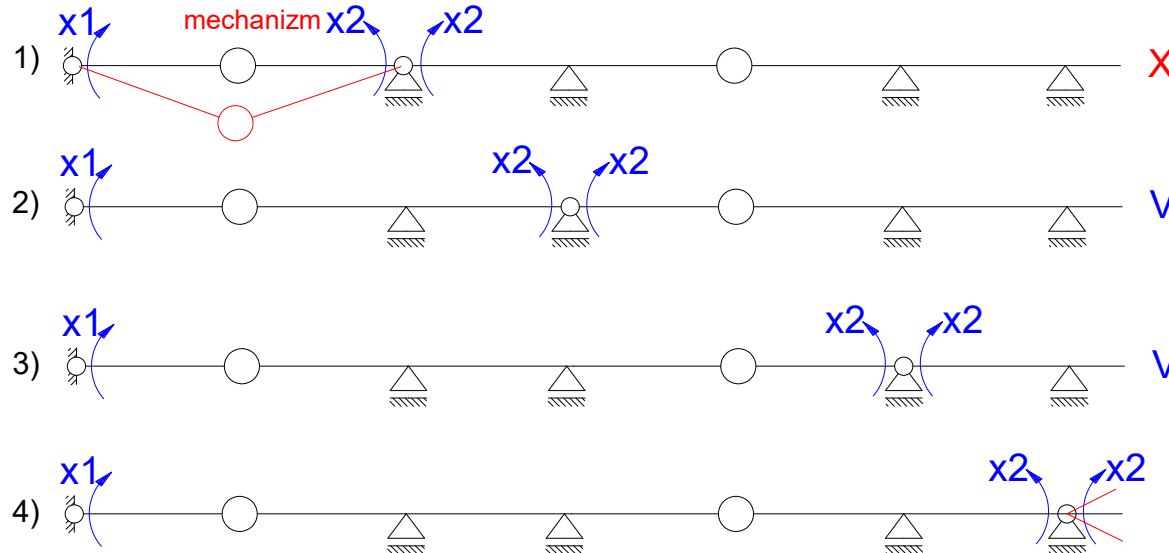
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



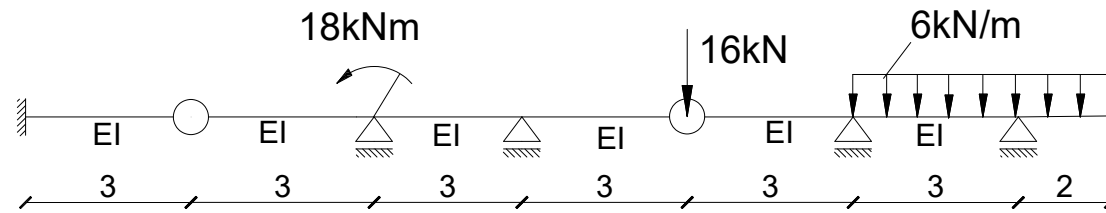
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



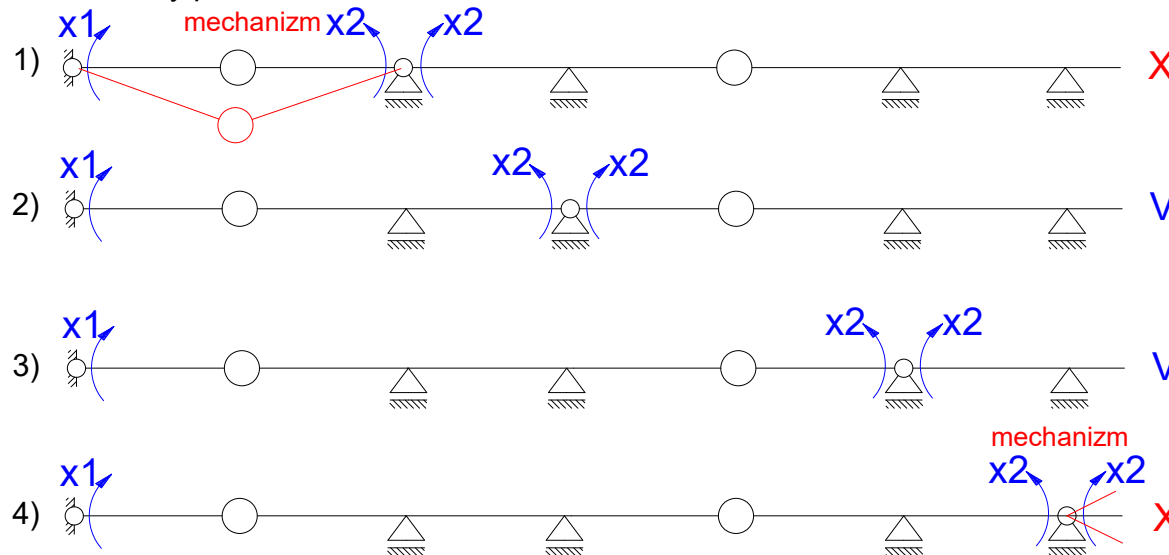
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



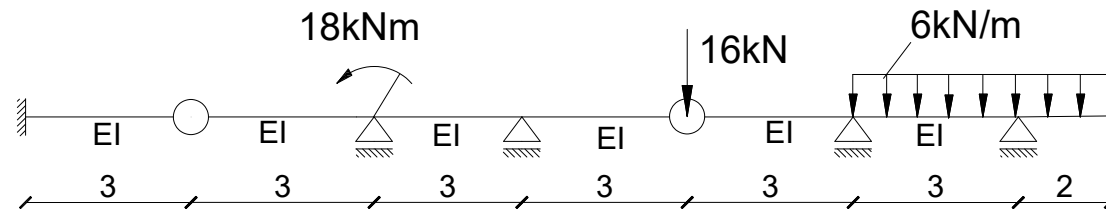
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



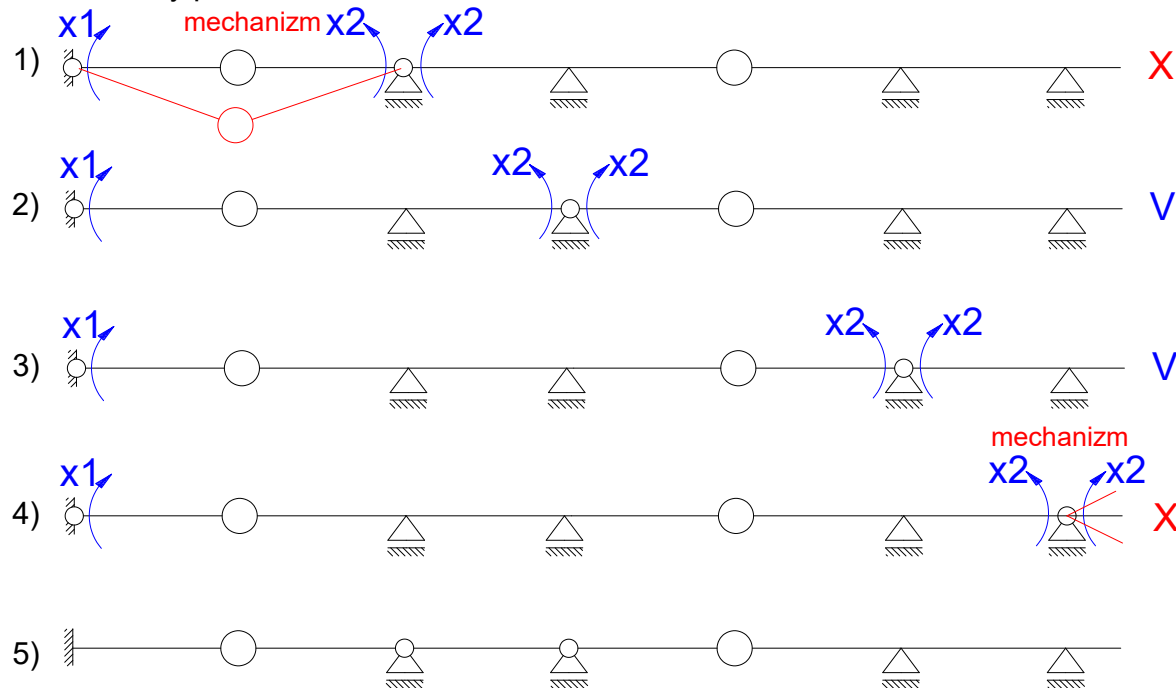
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



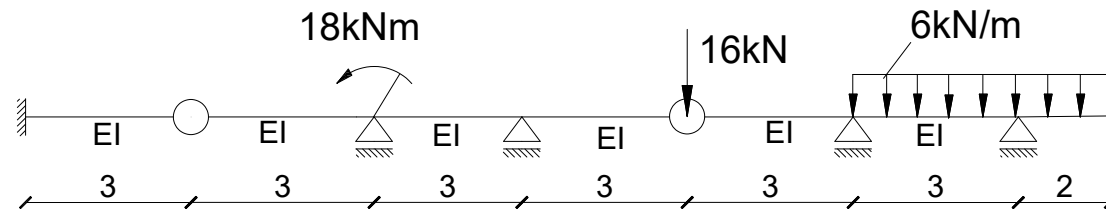
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



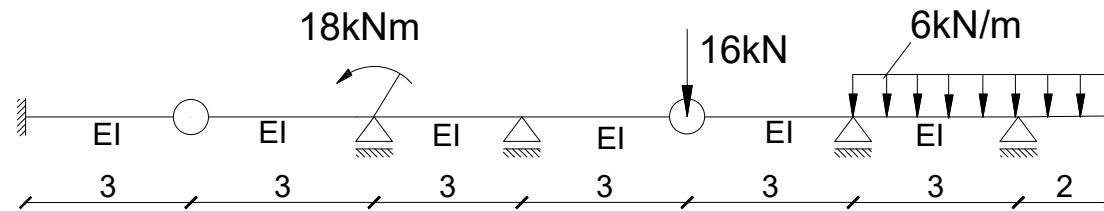
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:

- 1) X
- 2) V
- 3) V
- 4) X
- 5) V

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



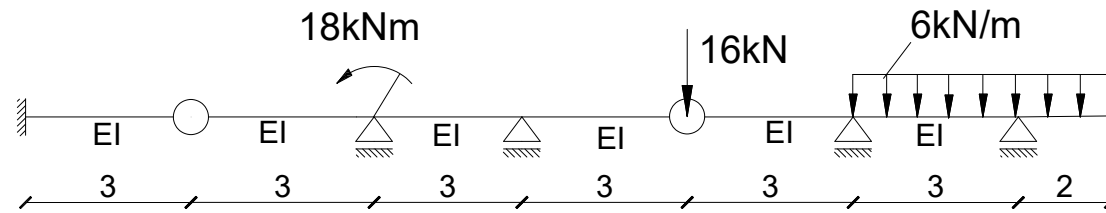
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:

- 1) X
- 2) V
- 3) V
- 4) X
- 5) V

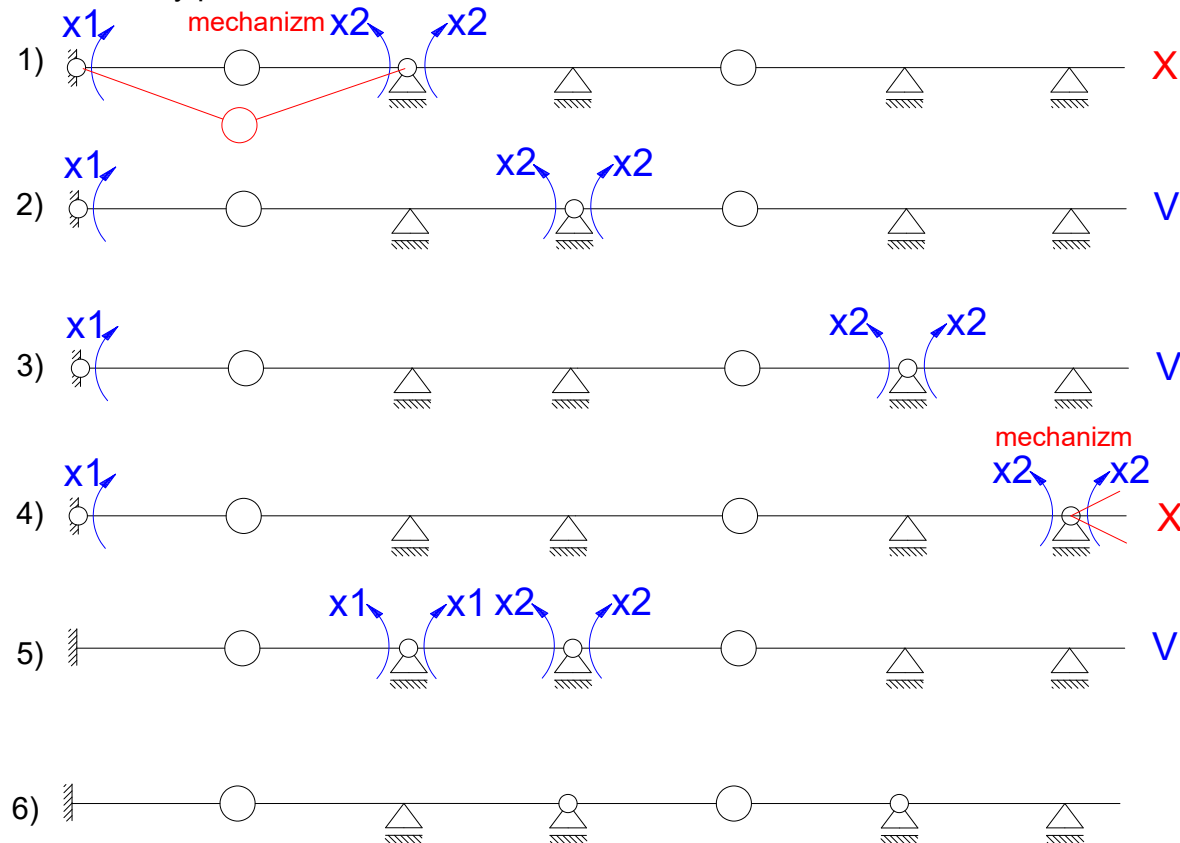
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



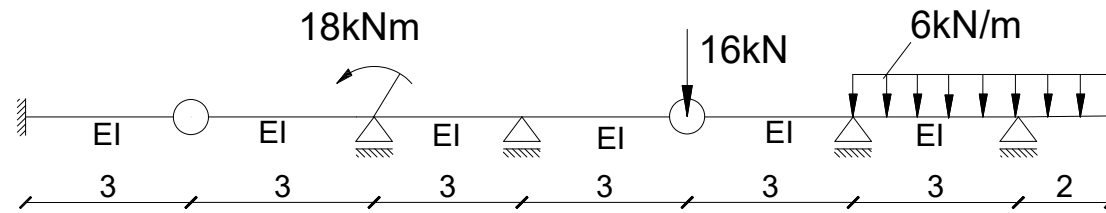
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



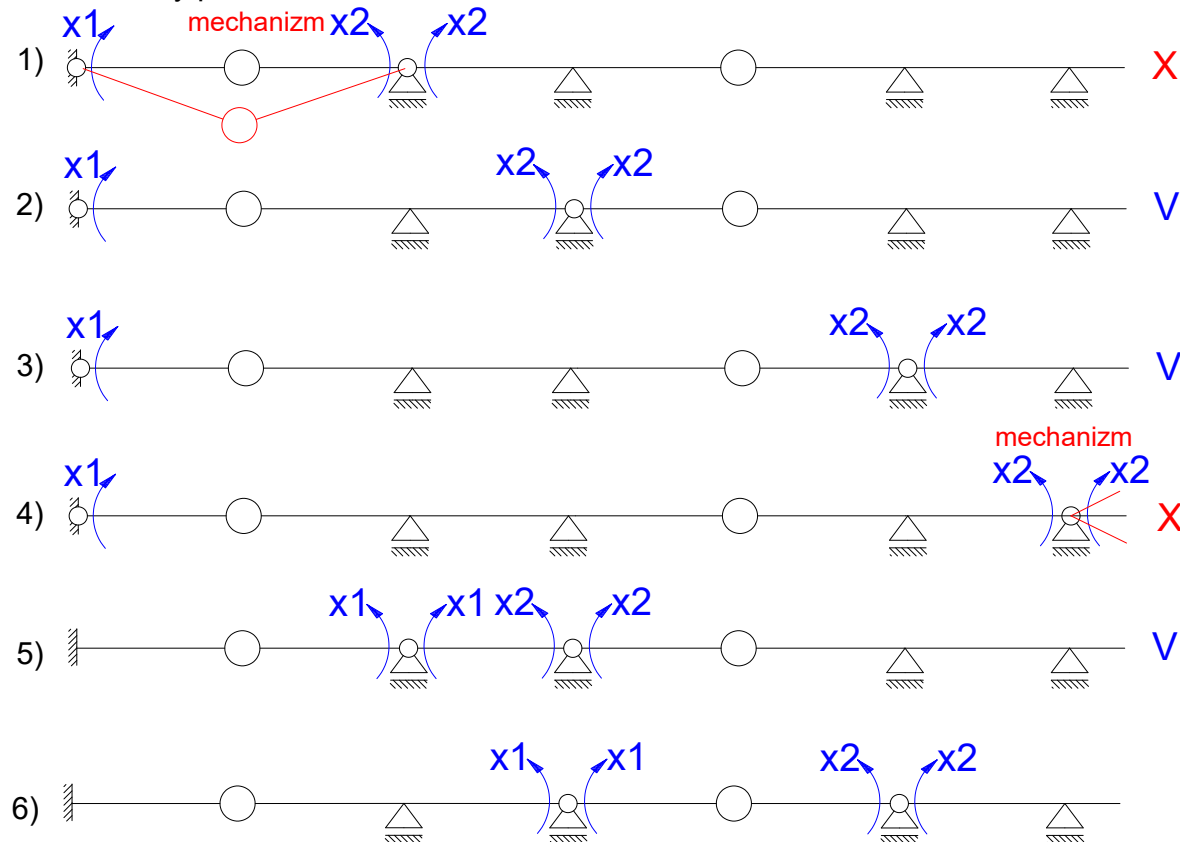
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



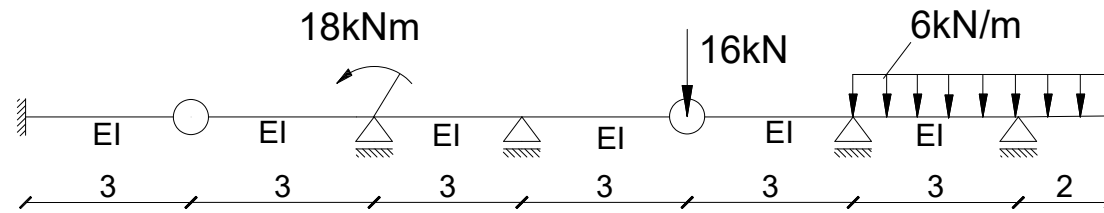
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



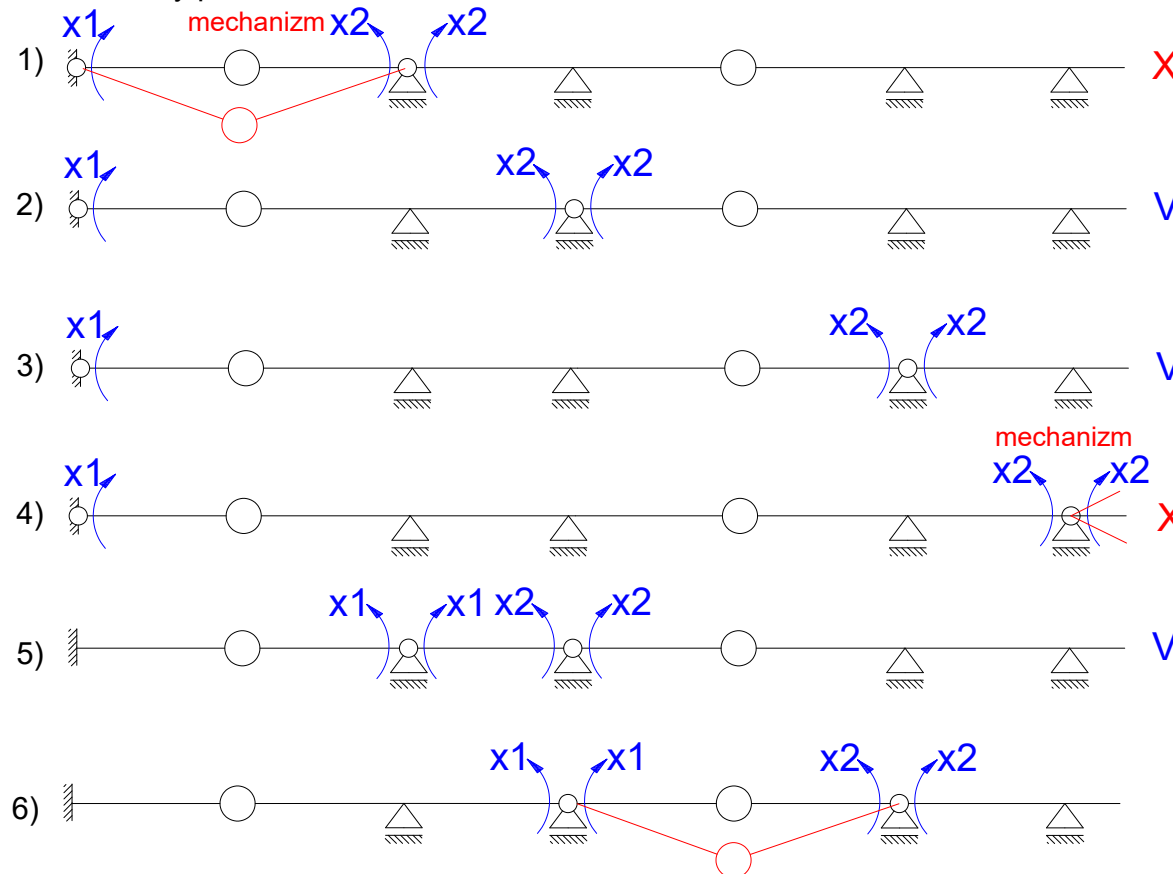
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



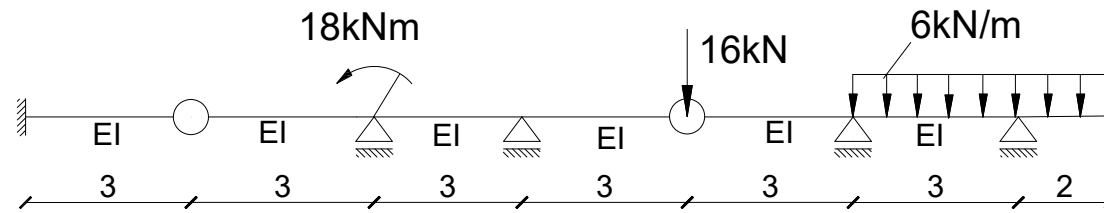
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



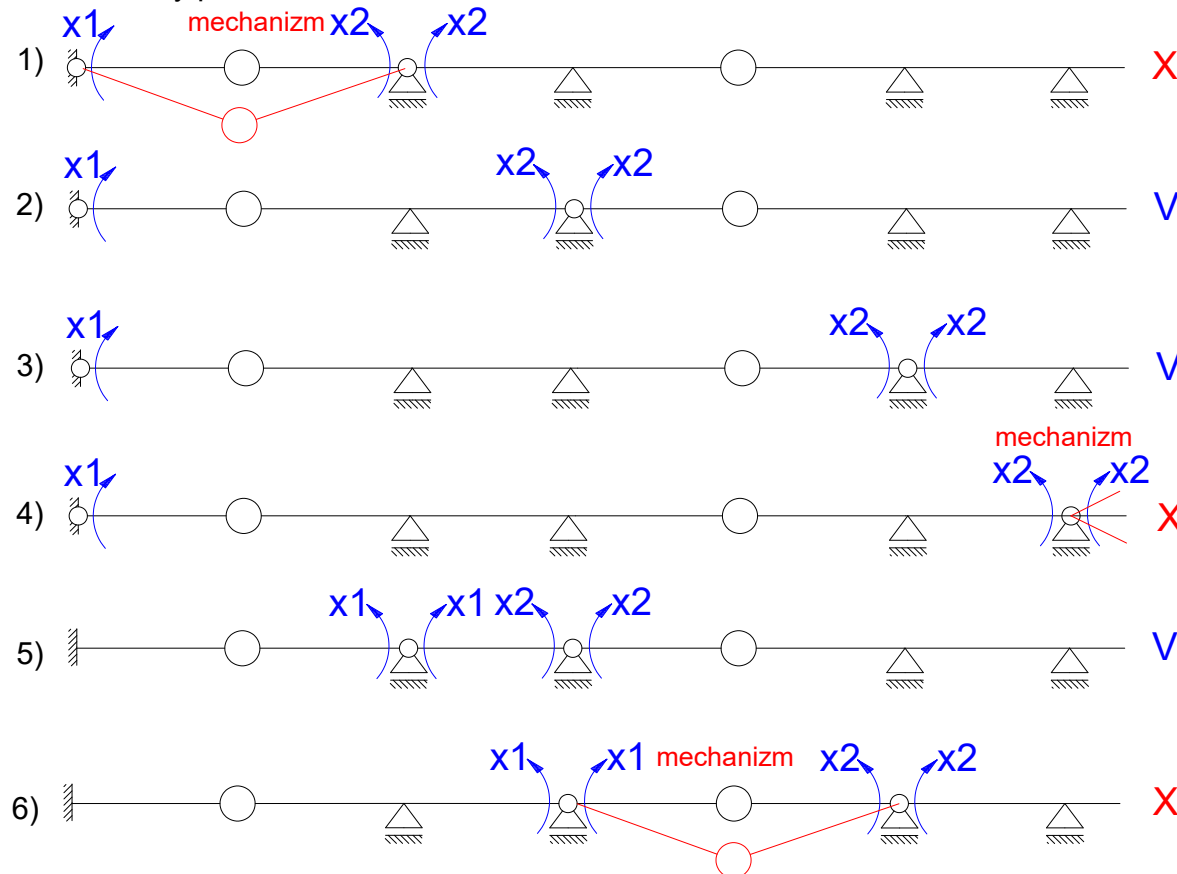
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



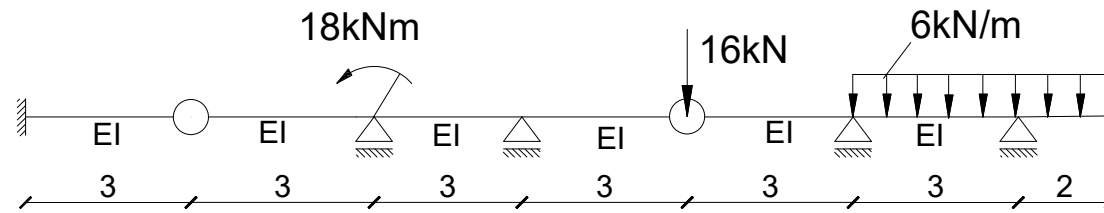
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:



Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



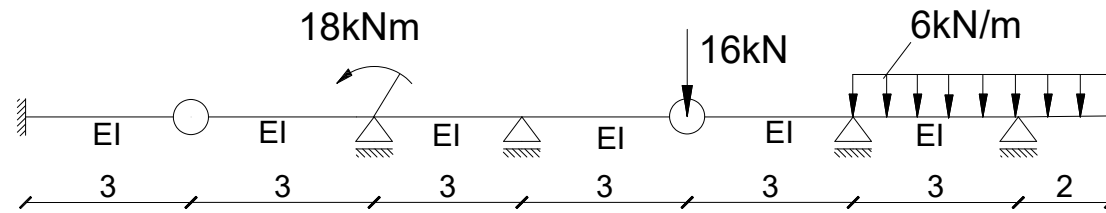
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:

- 1) X
- 2) V
- 3) V
- 4) X
- 5) V
- 6) X
- 7)

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



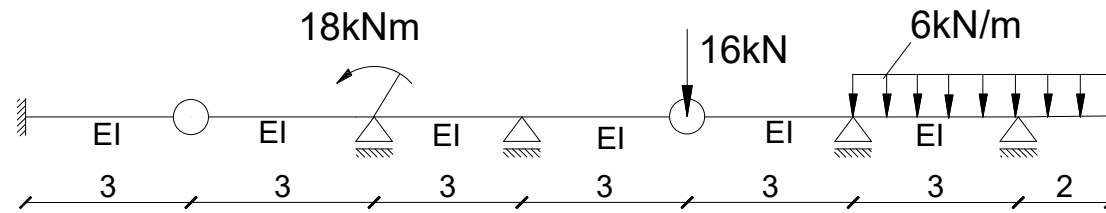
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:

- 1) X
- 2) V
- 3) V
- 4) X
- 5) V
- 6) X
- 7) V

Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.



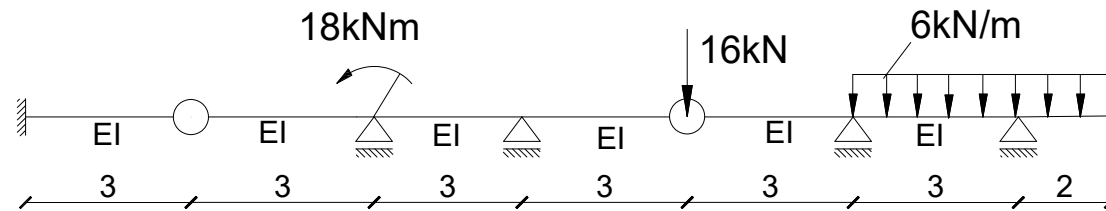
$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

Schematy podstawowe:

- 1) X
- 2) V
- 3) V
- 4) X
- 5) V
- 6) X
- 7) V

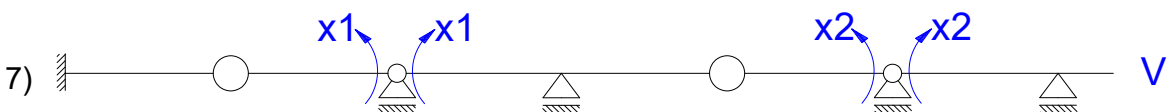
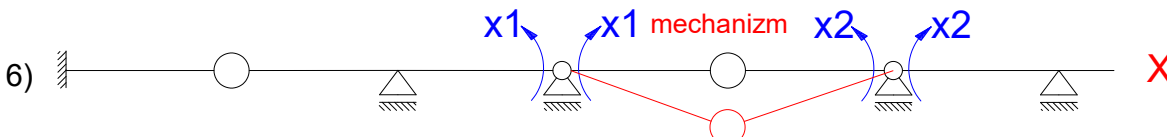
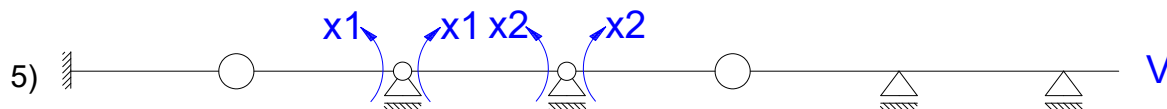
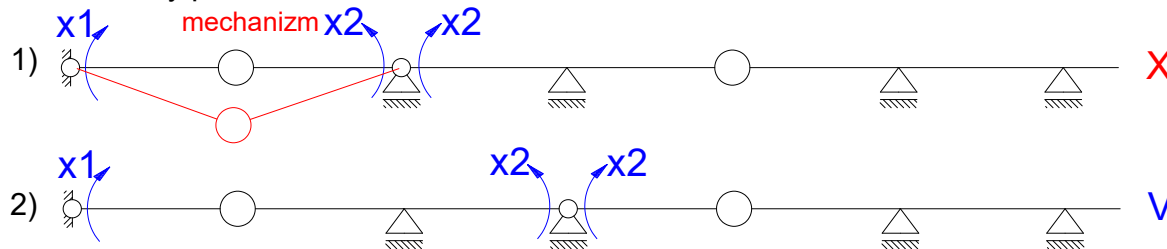
Zadanie: Narysuj wykresy sił wewnętrznych. Zadanie rozwiąż metodą sił.

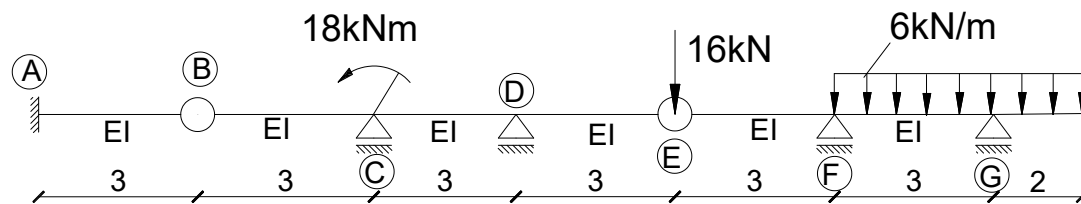


$$n_s = lr - lp - 3 = 7 - 2 \cdot 1 - 3 = 2$$

Belka dwukrotnie statycznie niewyznaczalna

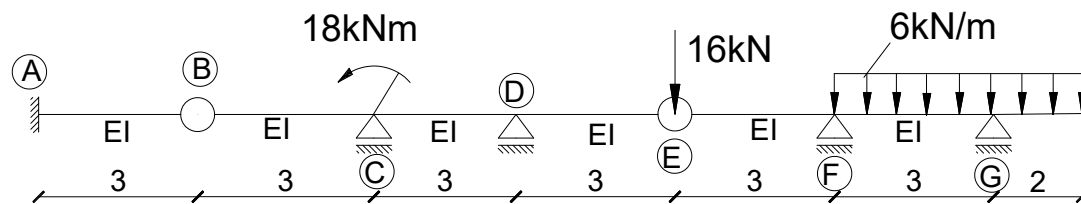
Schematy podstawowe:





Schemat podstawowy:



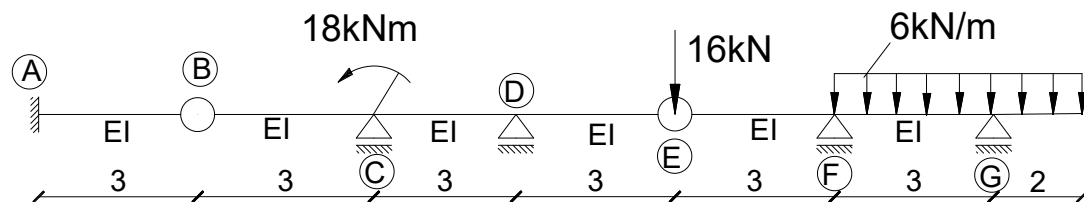


Schemat podstawowy:



Stan $X_1=1$

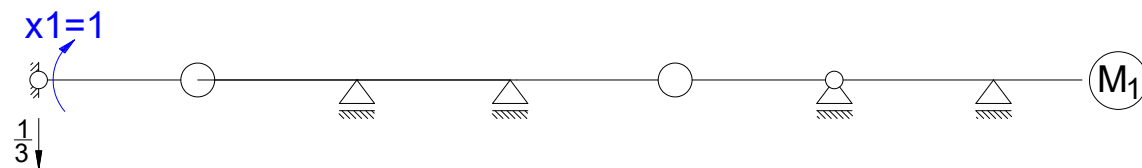


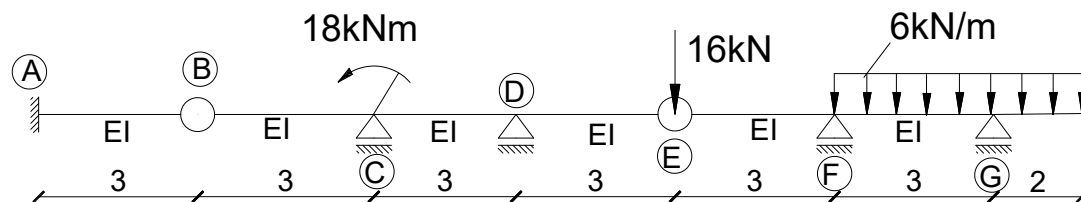


Schemat podstawowy:



Stan $X_1=1$

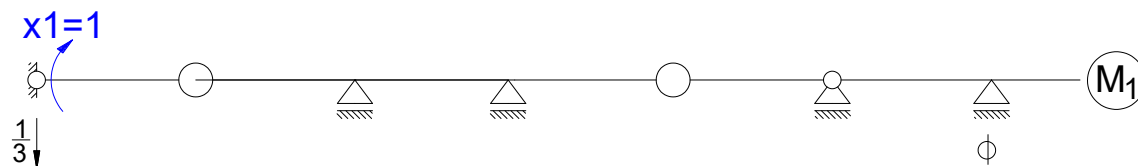


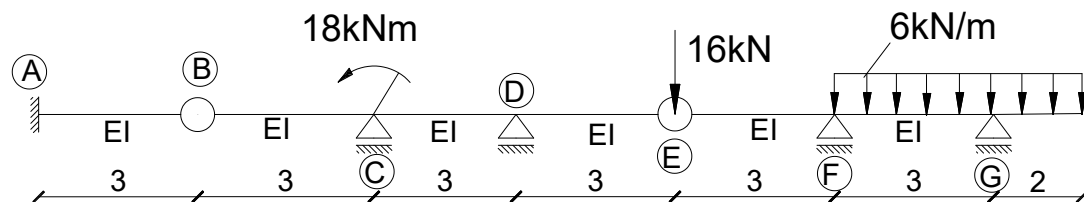


Schemat podstawowy:



Stan $X_1=1$

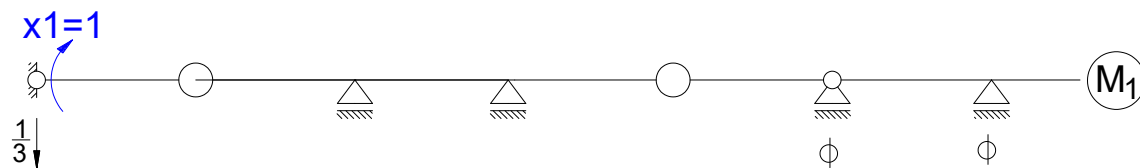


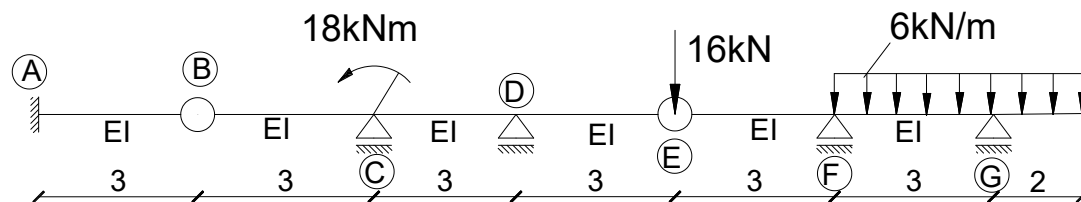


Schemat podstawowy:



Stan $X_1=1$

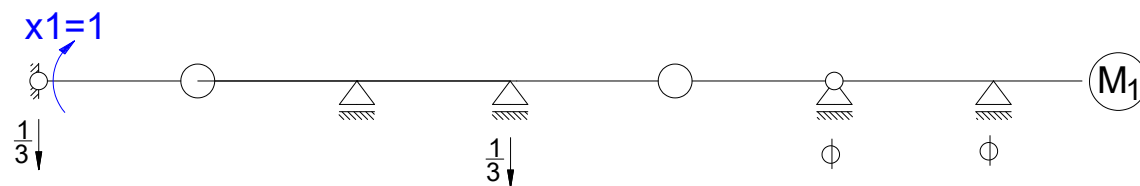


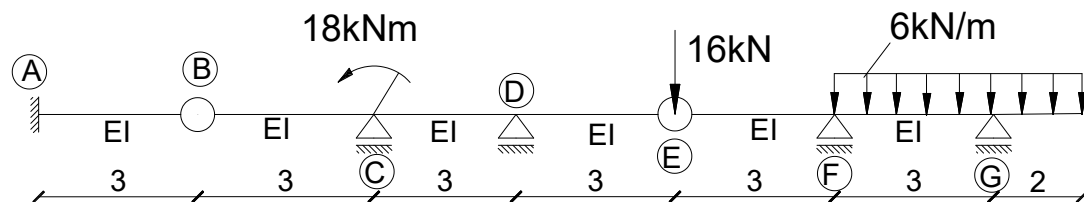


Schemat podstawowy:



Stan $X_1=1$

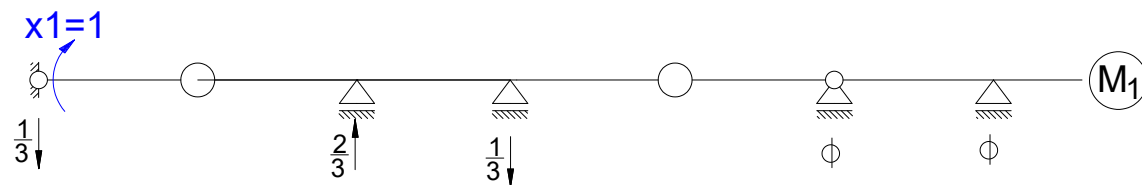


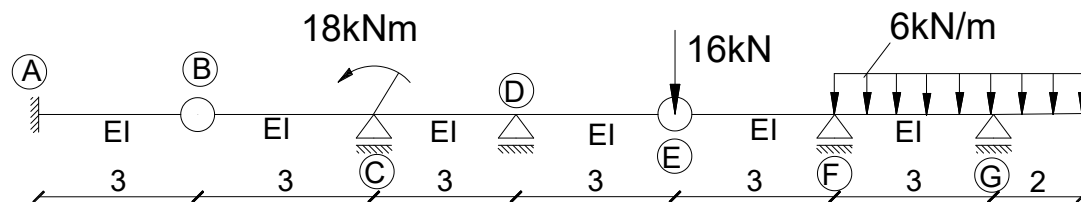


Schemat podstawowy:



Stan $X_1=1$

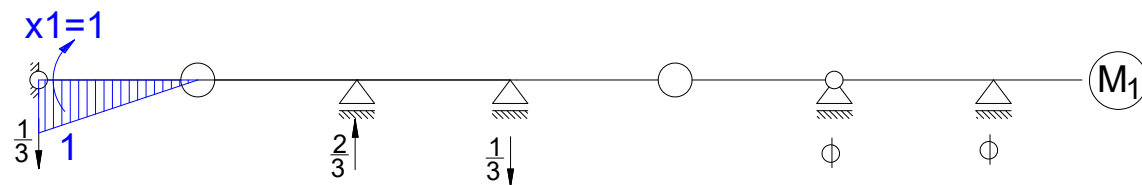


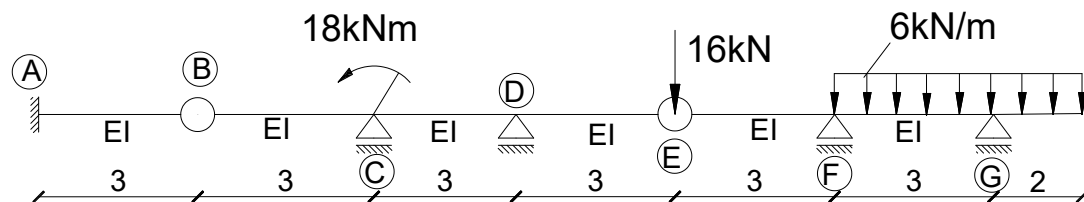


Schemat podstawowy:



Stan $X_1=1$

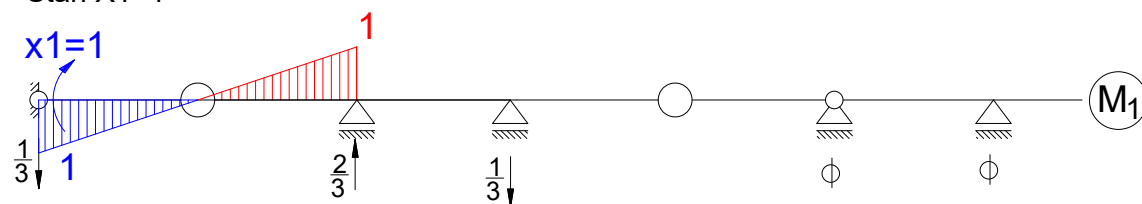


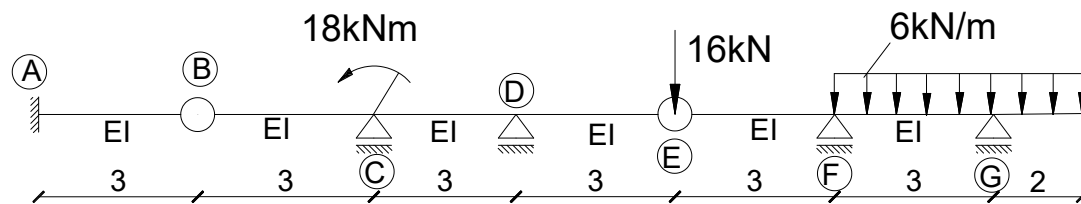


Schemat podstawowy:



Stan $X_1=1$

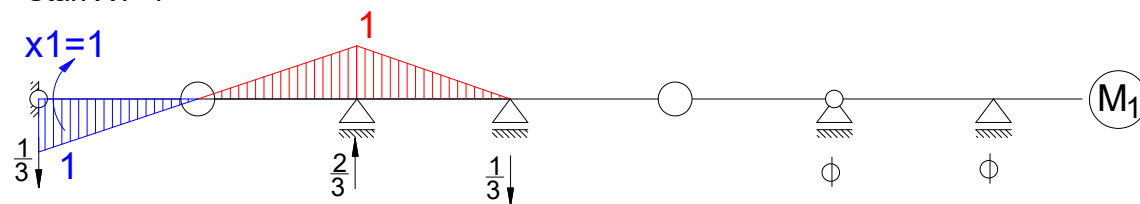


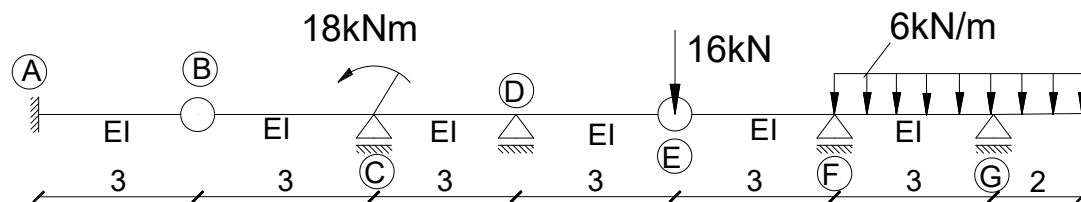


Schemat podstawowy:



Stan $X_1=1$

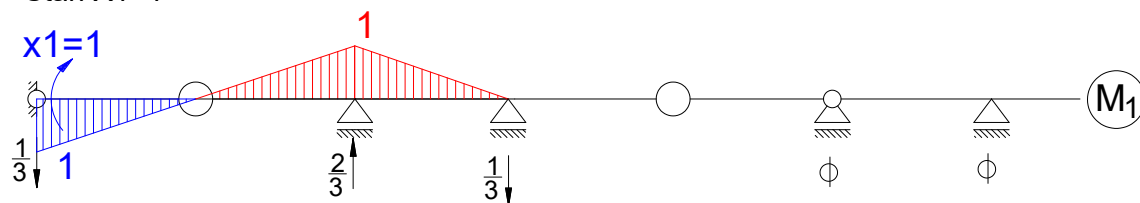




Schemat podstawowy:

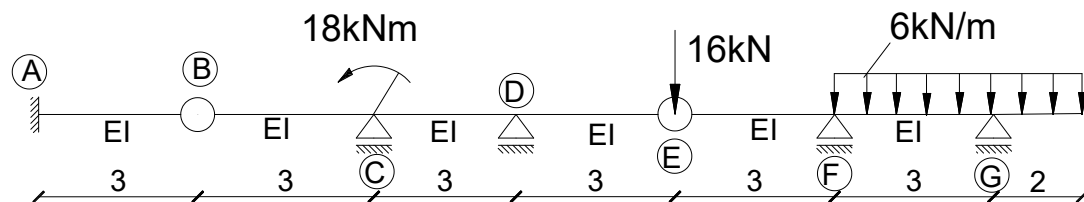


Stan $X_1=1$



Stan $X_2=1$

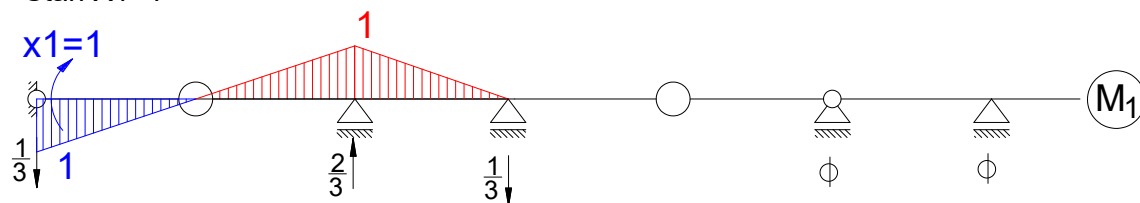




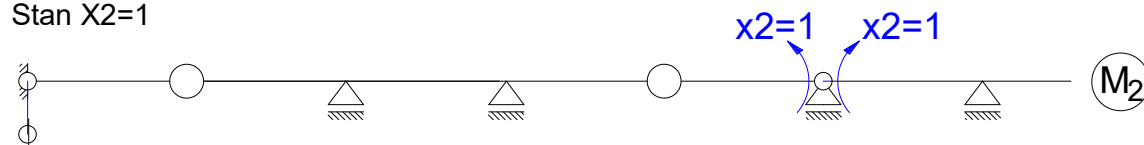
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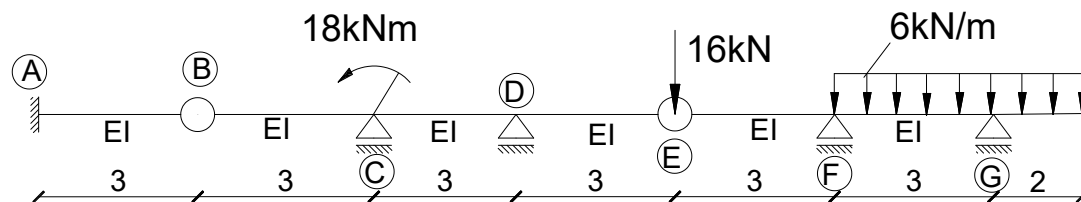


Stan $X_1=1$



Stan $X_2=1$

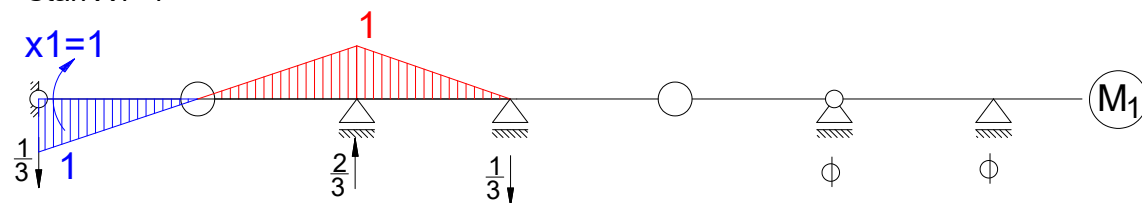




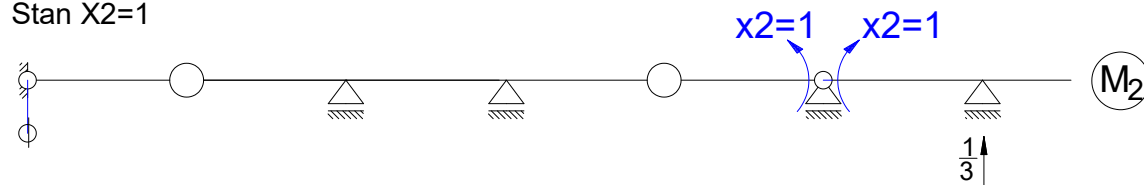
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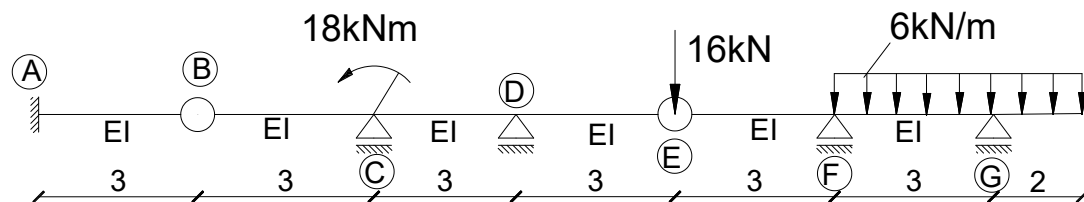


Stan $X_1=1$



Stan $X_2=1$

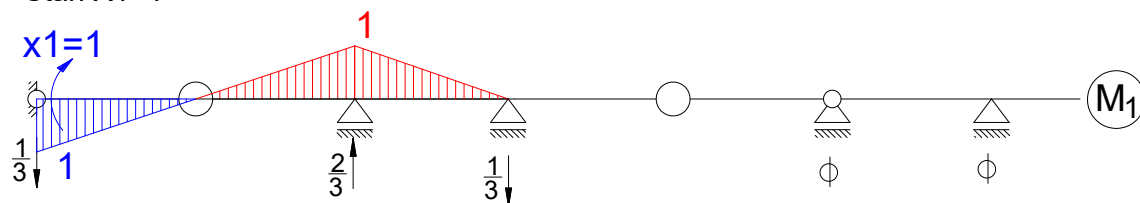




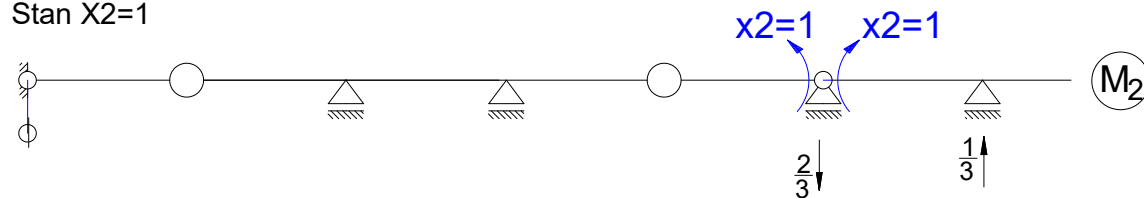
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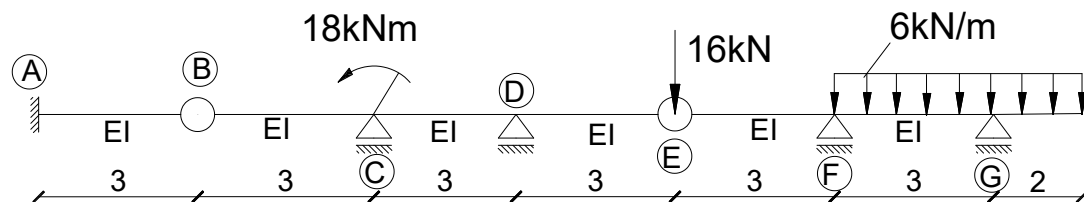


Stan $X_1=1$



Stan $X_2=1$

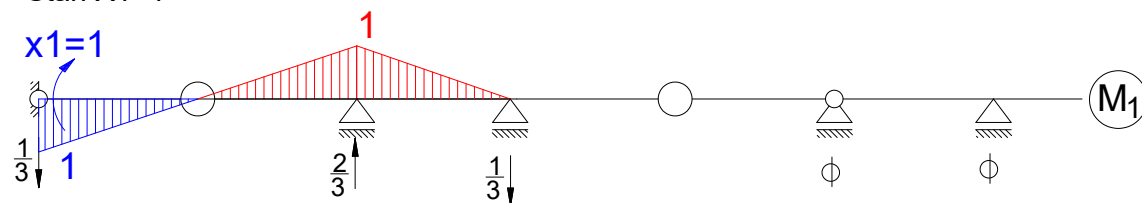




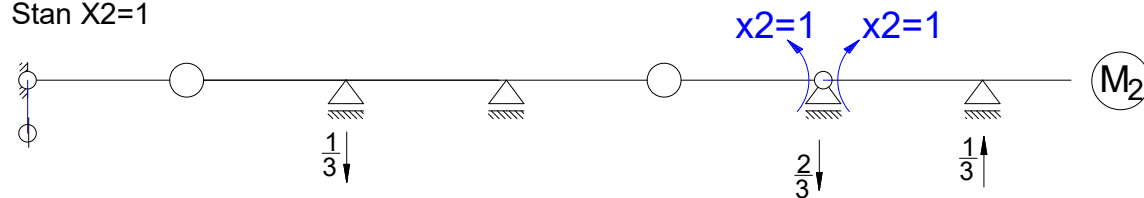
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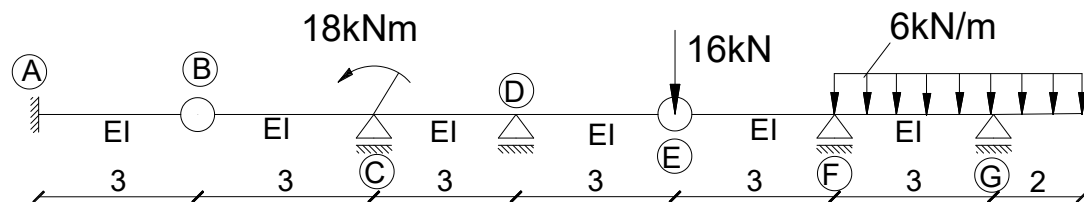


Stan $X_1=1$



Stan $X_2=1$

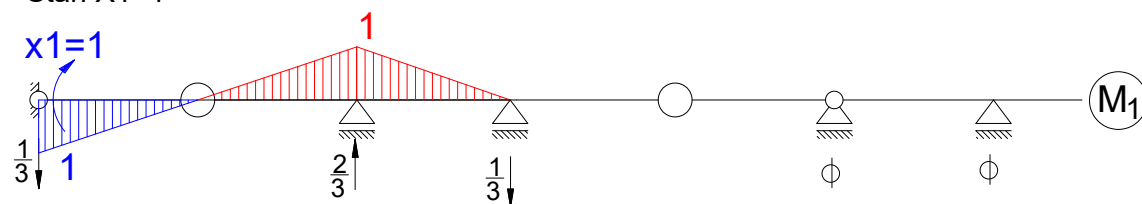




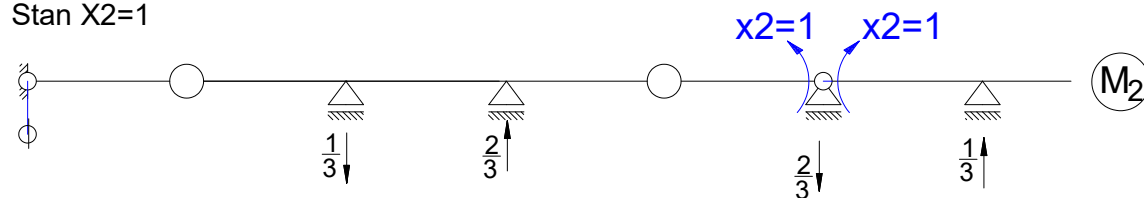
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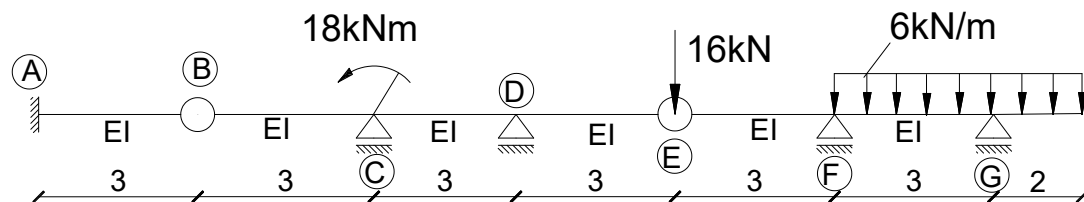


Stan $X_1=1$



Stan $X_2=1$

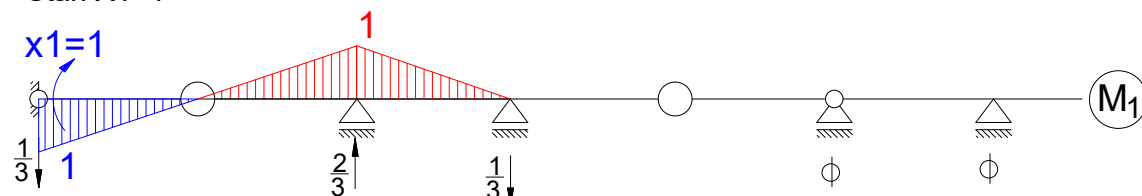




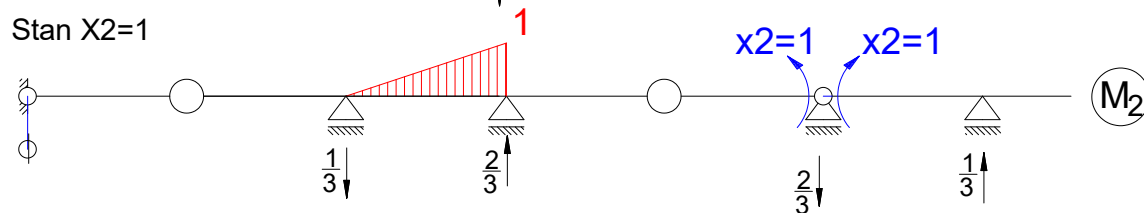
Schemat podstawowy:

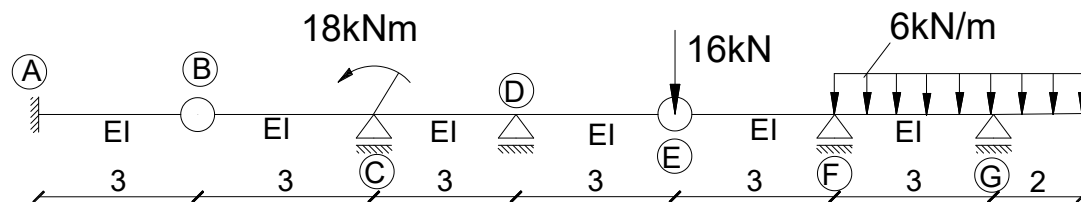


Stan $X_1=1$



Stan $X_2=1$

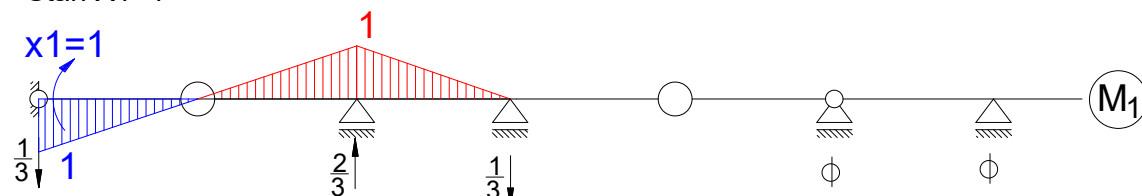




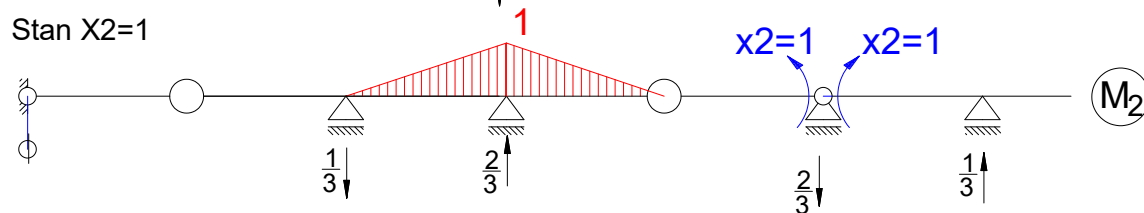
Schemat podstawowy:

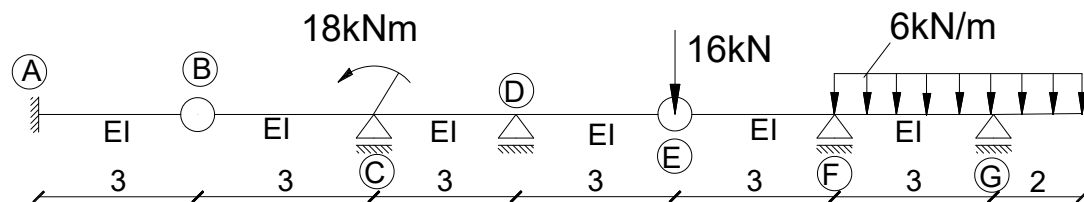


Stan $X_1=1$



Stan $X_2=1$

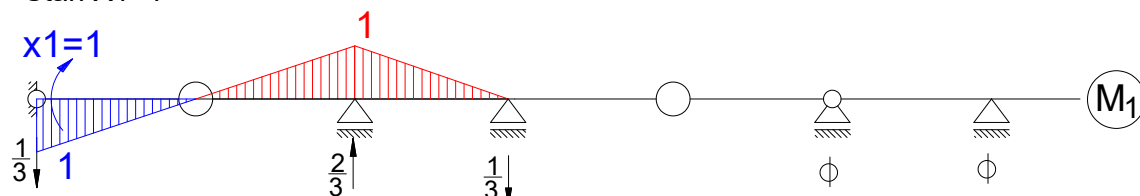




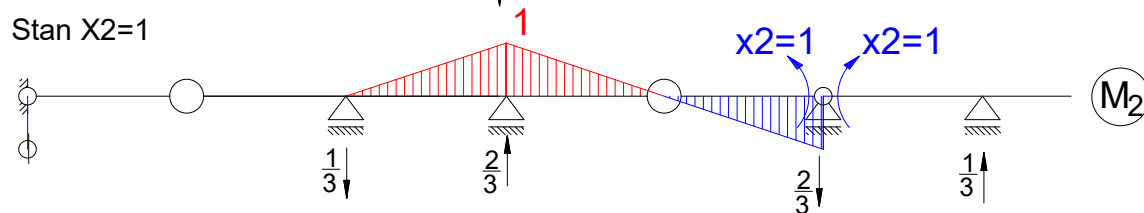
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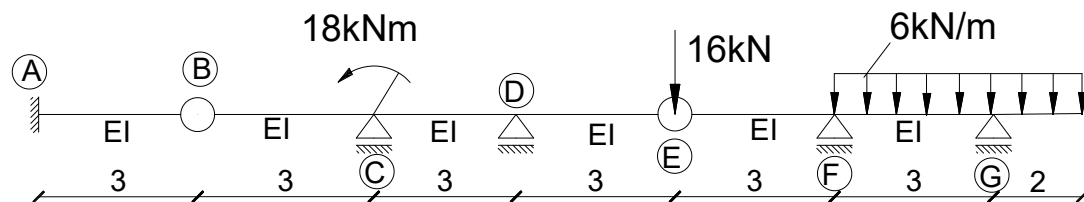


Stan $X_1=1$



Stan $X_2=1$

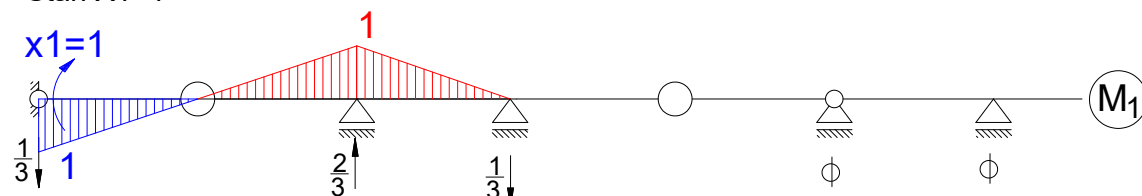




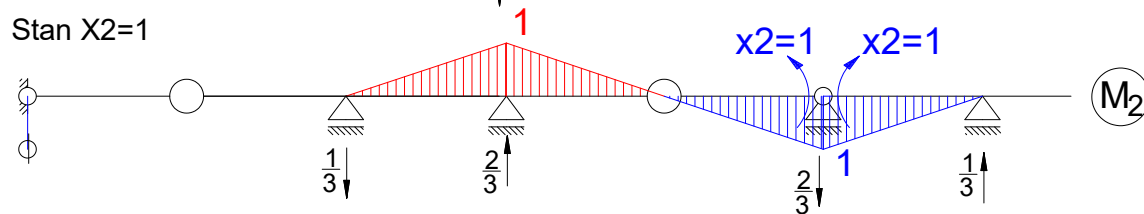
Schemat podstawowy:

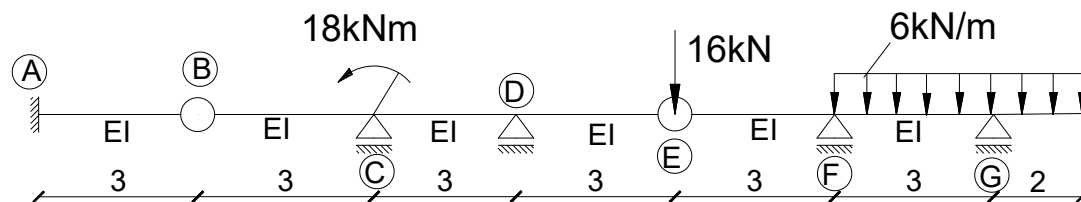


Stan $X_1=1$



Stan $X_2=1$

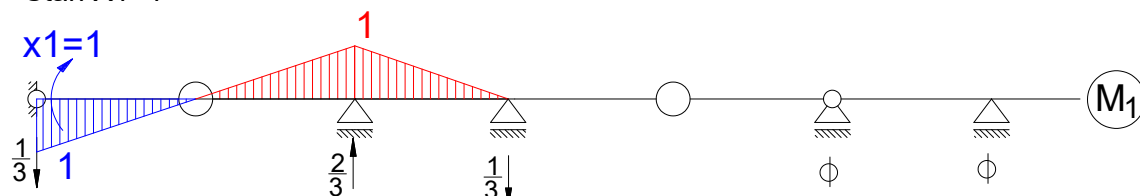




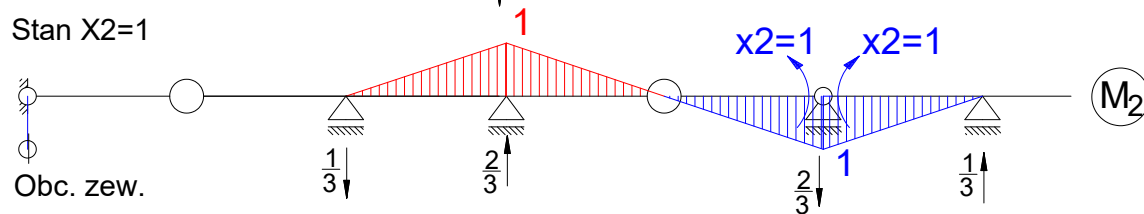
Schemat podstawowy:



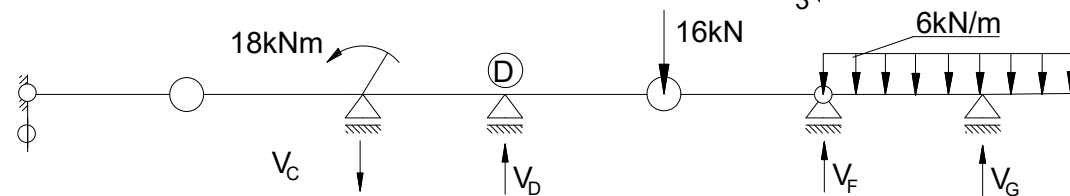
Stan $X_1=1$

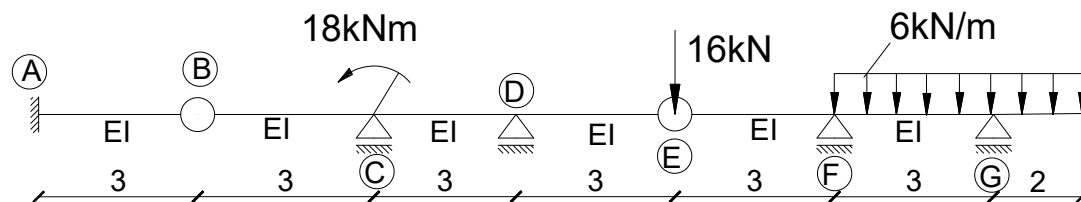


Stan $X_2=1$



Obc. zew.

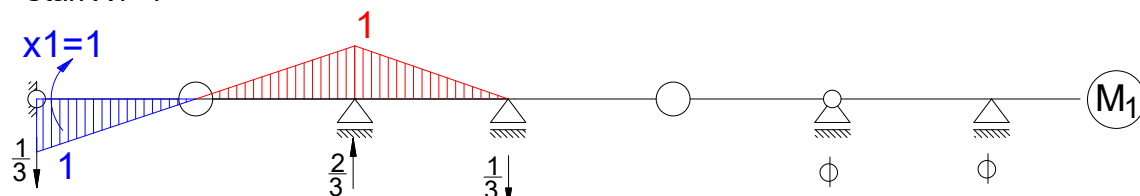




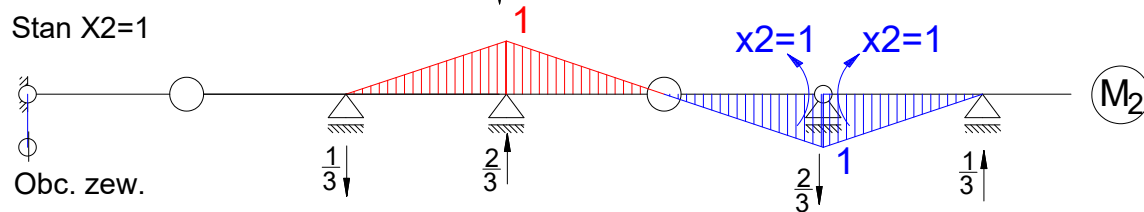
Schemat podstawowy:



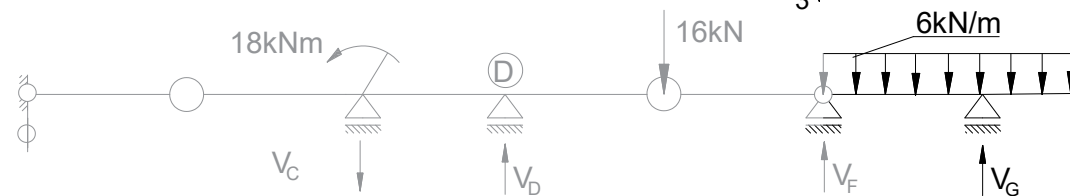
Stan $X_1=1$

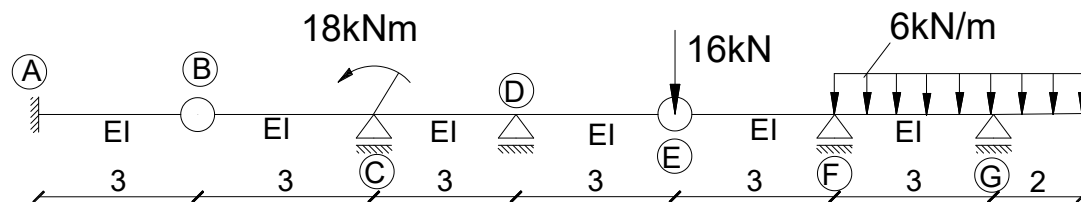


Stan $X_2=1$



Obc. zew.



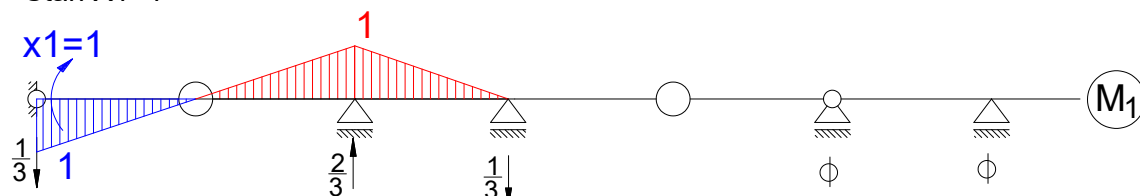


$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

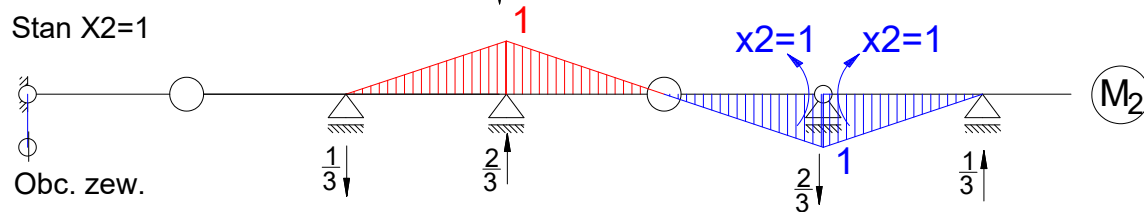
Schemat podstawowy:



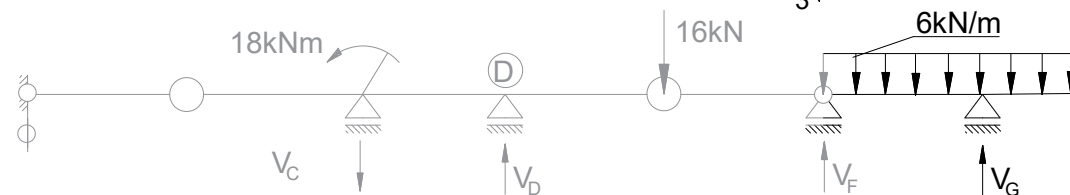
Stan X1=1

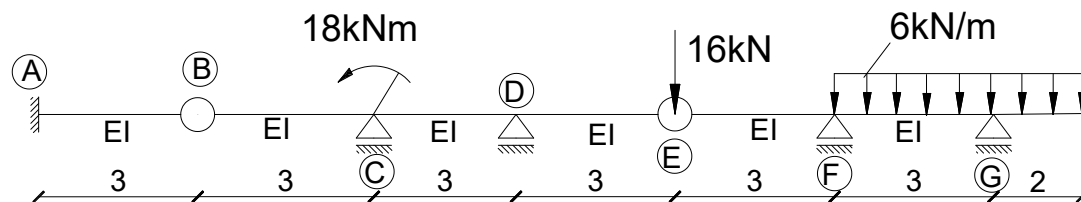


Stan X2=1



Obc. zew.





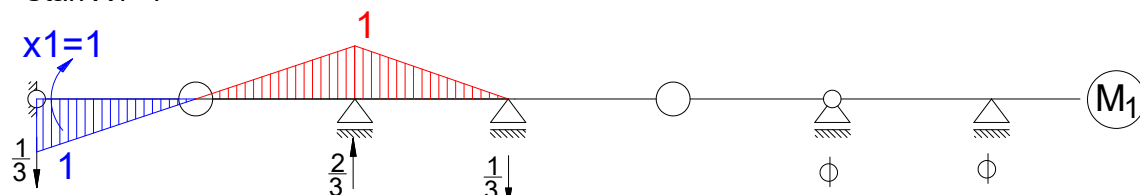
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

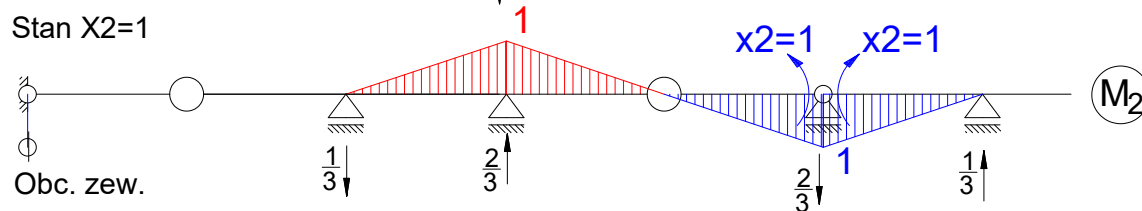
Schemat podstawowy:



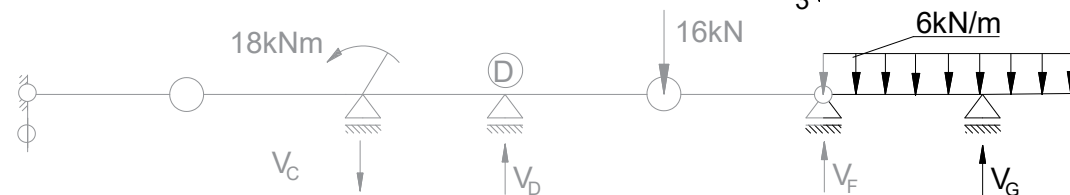
Stan X1=1

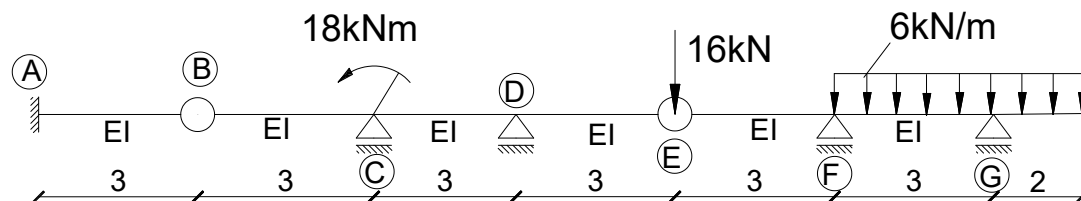


Stan X2=1



Obc. zew.

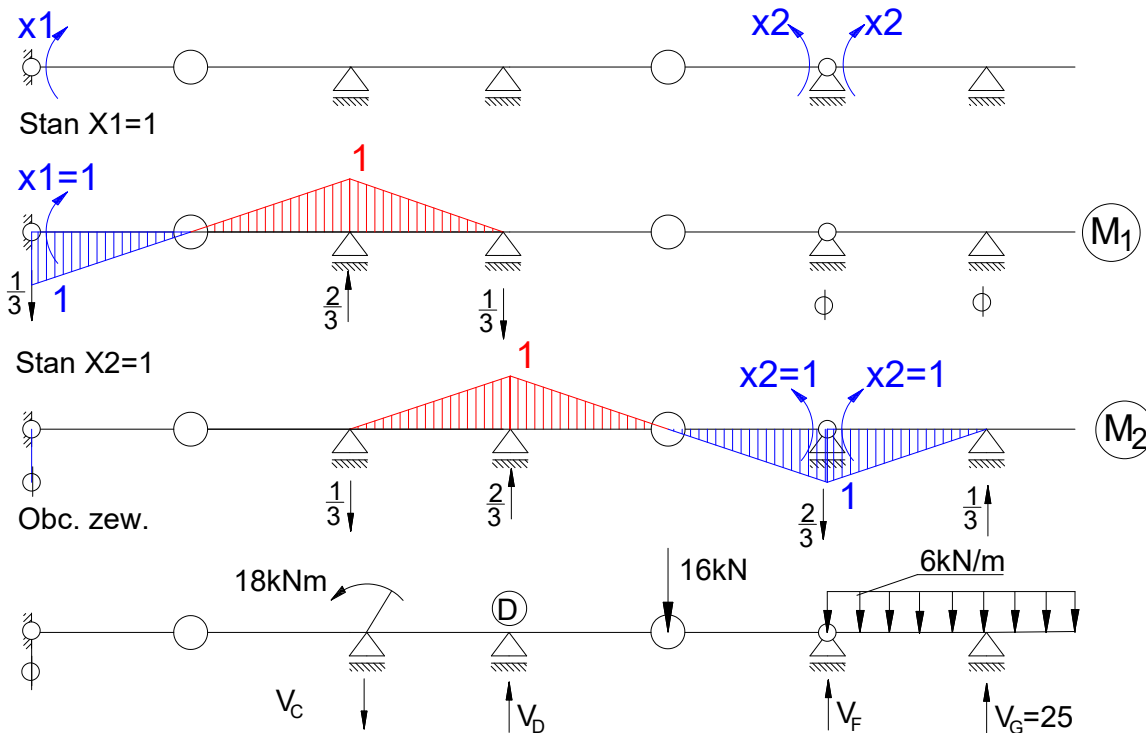


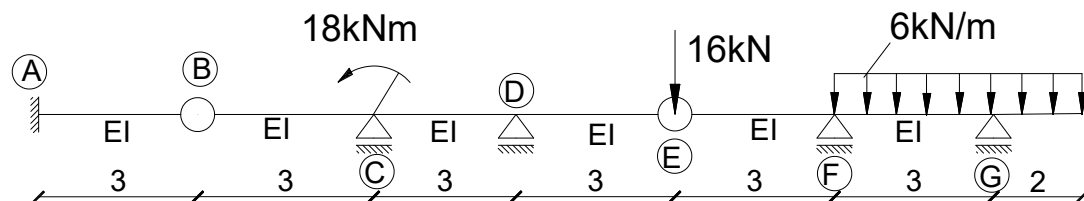


$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25 \text{ kN}$$

Schemat podstawowy:





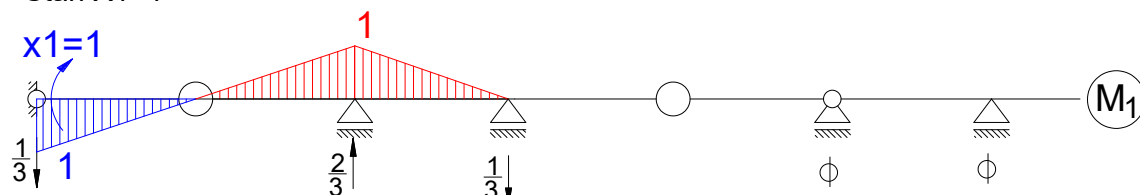
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

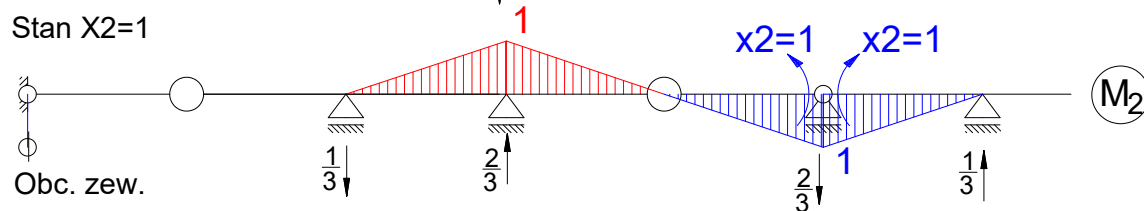
Schemat podstawowy:



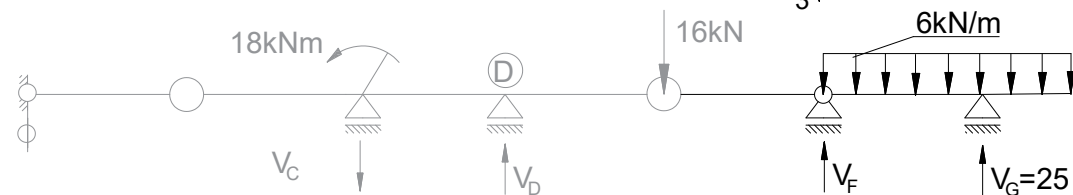
Stan X1=1

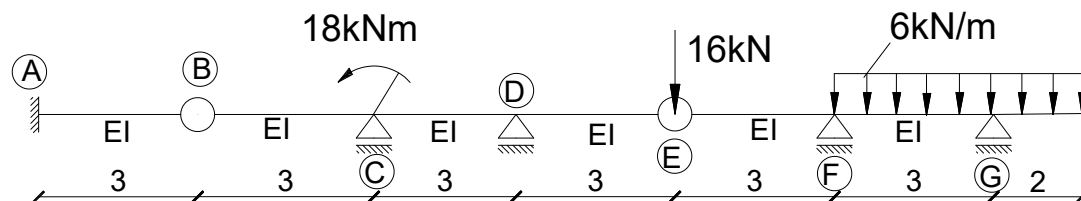


Stan X2=1



Obc. zew.





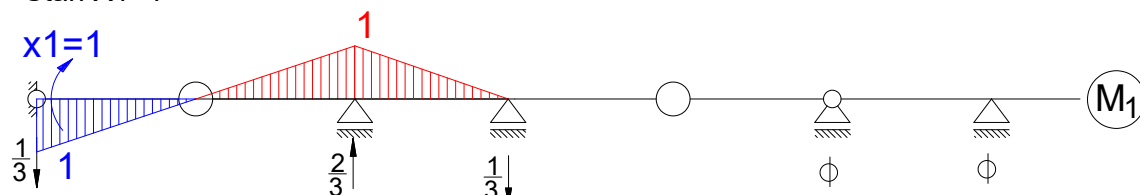
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

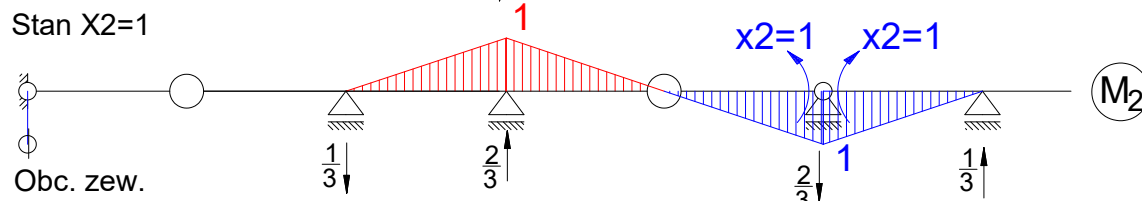
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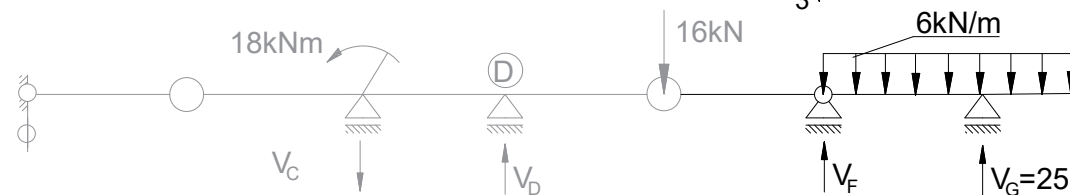
Stan X1=1

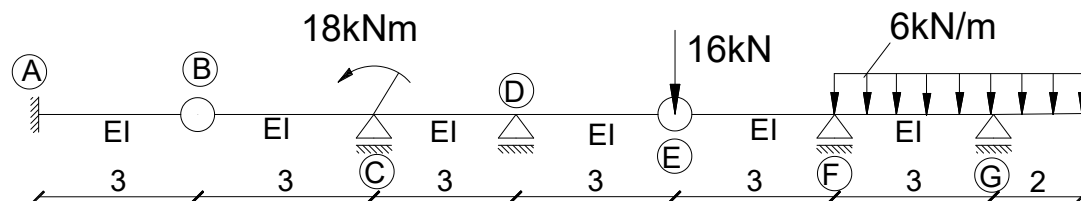


Stan X2=1



Obc. zew.





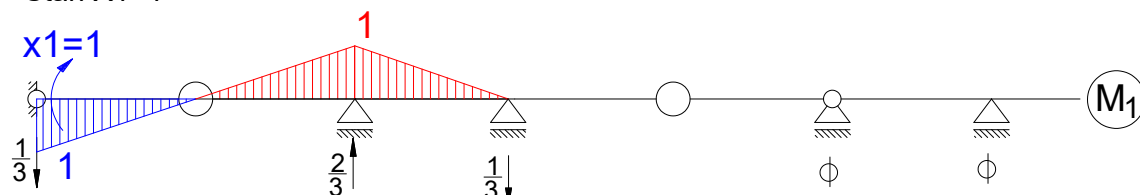
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

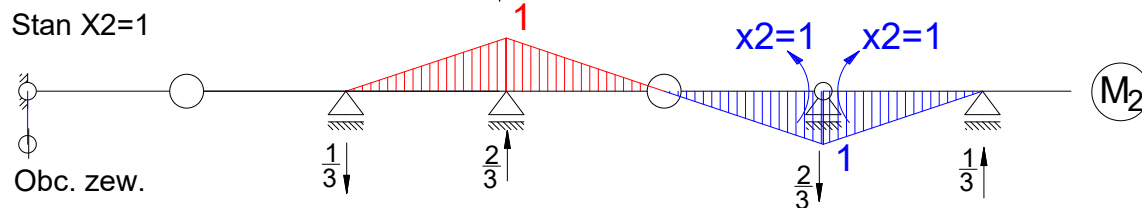
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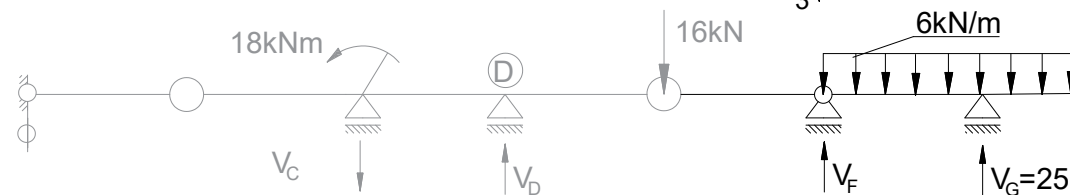
Stan X1=1

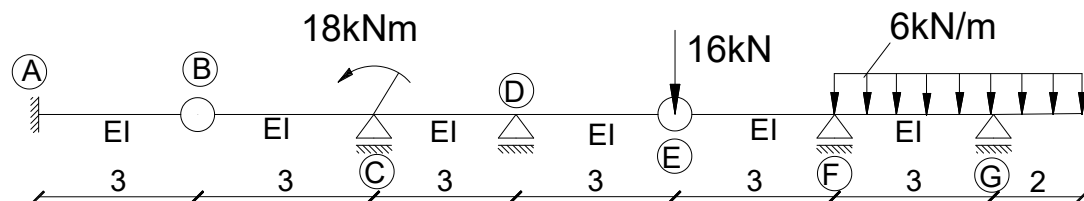


Stan X2=1



Obc. zew.





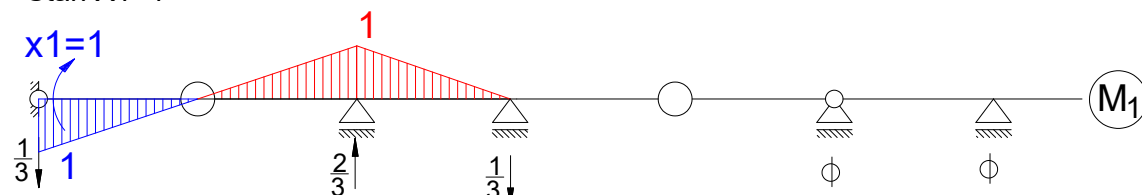
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

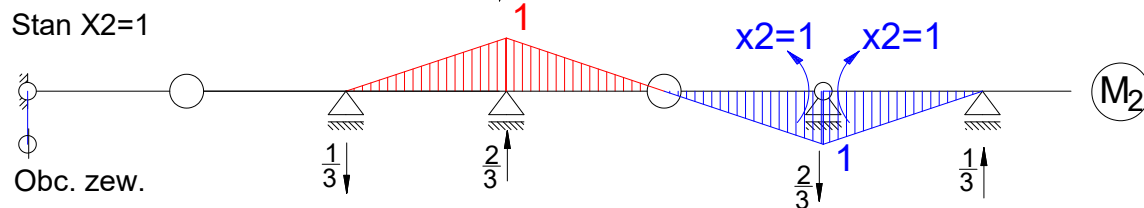
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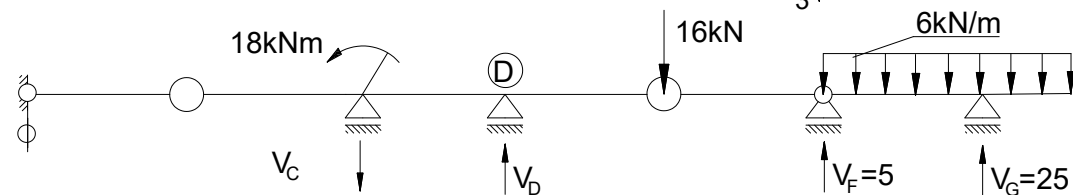
Stan X1=1

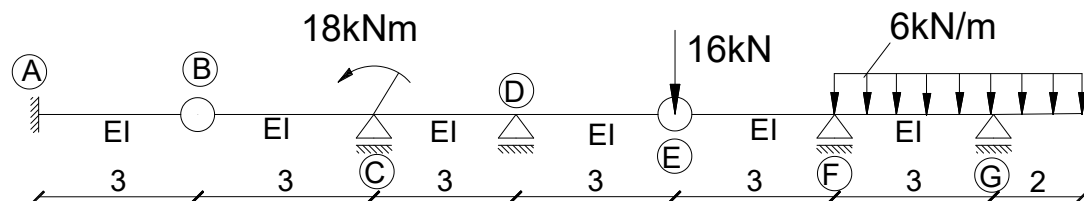


Stan X2=1



Obc. zew.





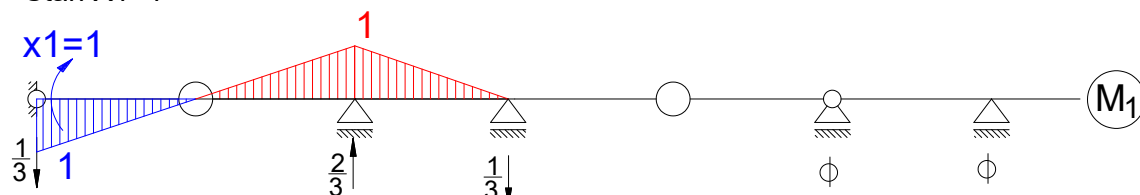
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

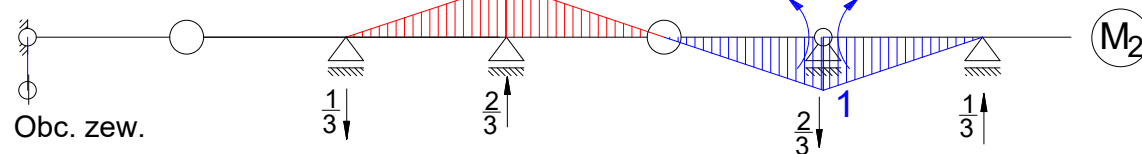
Schemat podstawowy:



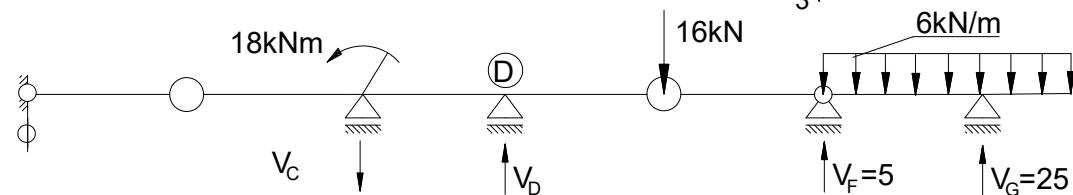
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.

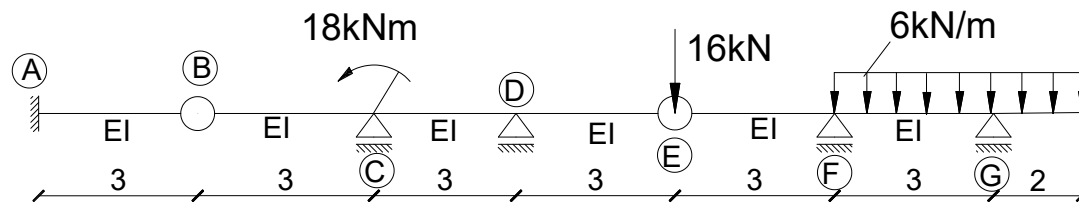


$$\sum M_{EP} = -25 \cdot 6 + 6 \cdot 5 \cdot 5,5 - V_F \cdot 3 = 0$$

$$\rightarrow V_F = 5kN$$

$$\sum M_D = -18 - V_C \cdot 3 + 16 \cdot 3 - 5 \cdot 6 + 6 \cdot 5 \cdot 8,5 - 25 \cdot 9 = 0$$

$$\rightarrow V_C = 10kN$$



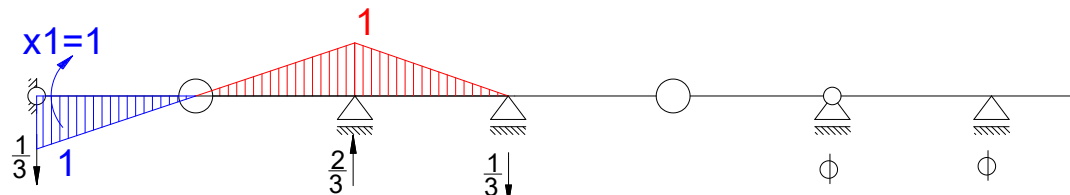
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

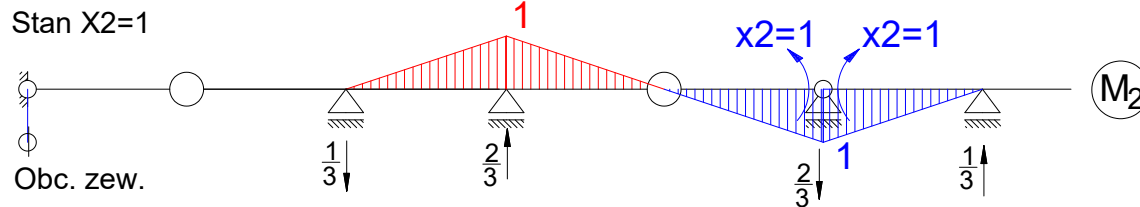
Schemat podstawowy:



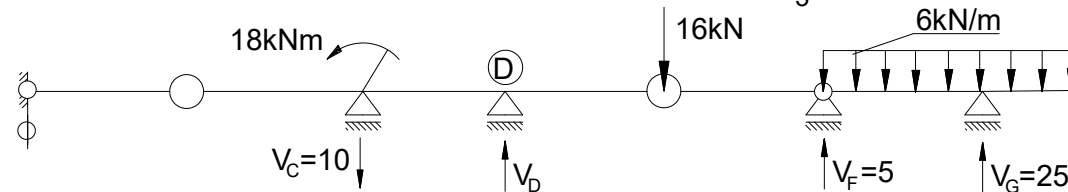
Stan X1=1



Stan X2=1



Obc. zew.

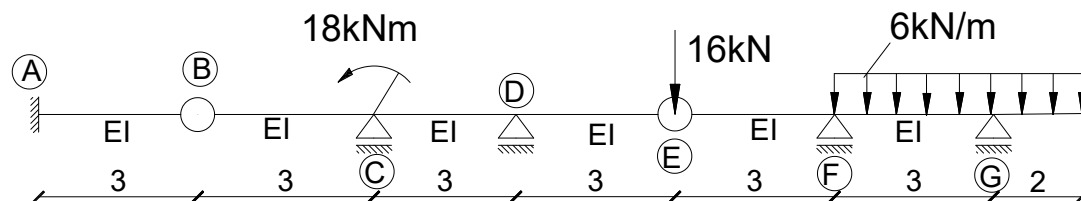


$$\sum M_{EP} = -25 \cdot 6 + 6 \cdot 5 \cdot 5,5 - V_F \cdot 3 = 0$$

$$\rightarrow V_F = 5kN$$

$$\sum M_D = -18 - V_C \cdot 3 + 16 \cdot 3 - 5 \cdot 6 + 6 \cdot 5 \cdot 8,5 - 25 \cdot 9 = 0$$

$$\rightarrow V_C = 10kN$$



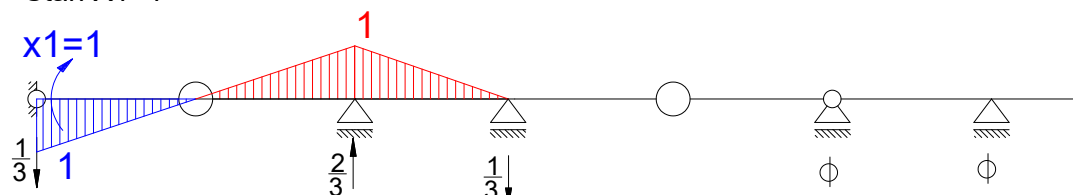
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

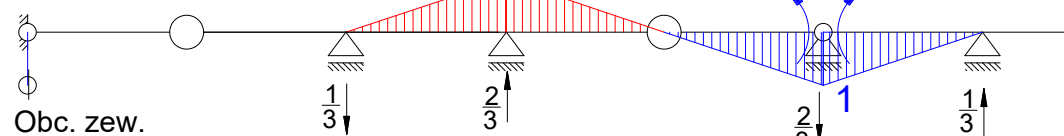
Schemat podstawowy:



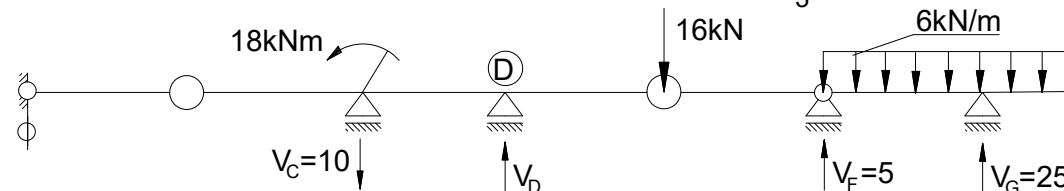
Stan X1=1



Stan X2=1



Obs. zew.



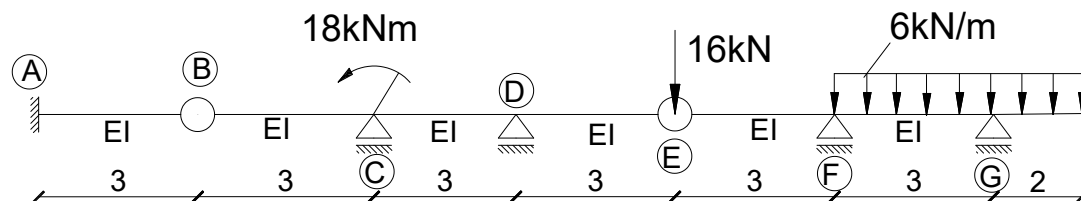
$$\sum M_{EP} = -25 \cdot 6 + 6 \cdot 5 \cdot 5,5 - V_F \cdot 3 = 0$$

$$\rightarrow V_F = 5kN$$

$$\sum M_D = -18 - V_C \cdot 3 + 16 \cdot 3 - 5 \cdot 6 + 6 \cdot 5 \cdot 8,5 - 25 \cdot 9 = 0$$

$$\rightarrow V_C = 10kN$$

$$\sum R_Y = -10 + V_D - 16 + 5 - 6 \cdot 5 + 25 = 0$$



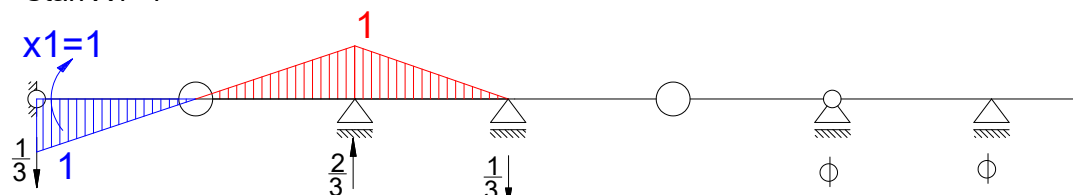
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

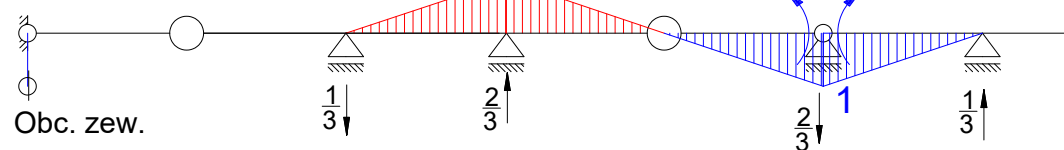
Schemat podstawowy:



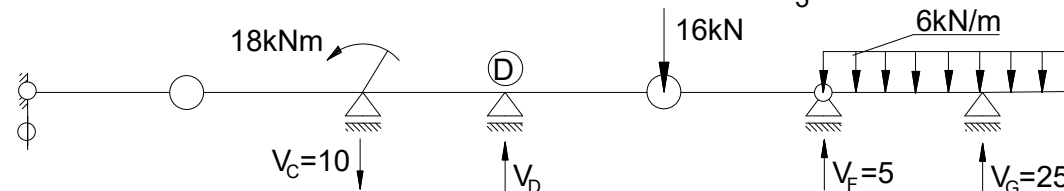
Stan X1=1



Stan X2=1



Obc. zew.



$$\sum M_{EP} = -25 \cdot 6 + 6 \cdot 5 \cdot 5,5 - V_F \cdot 3 = 0$$

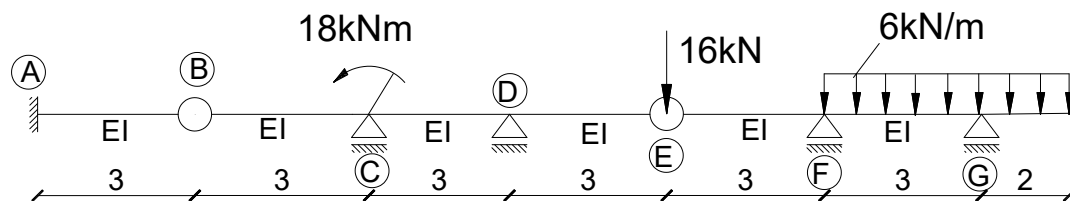
$$\rightarrow V_F = 5kN$$

$$\sum M_D = -18 - V_C \cdot 3 + 16 \cdot 3 - 5 \cdot 6 + 6 \cdot 5 \cdot 8,5 - 25 \cdot 9 = 0$$

$$\rightarrow V_C = 10kN$$

$$\sum R_Y = -10 + V_D - 16 + 5 - 6 \cdot 5 + 25 = 0$$

$$\rightarrow V_D = 26kN$$



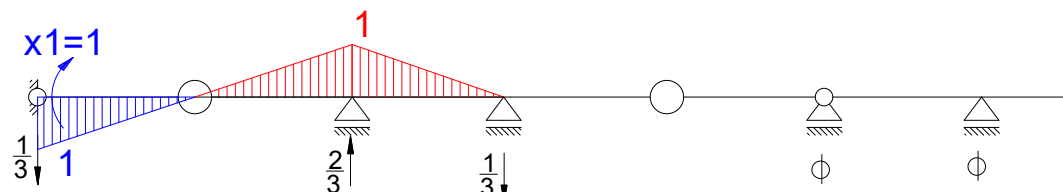
$$\sum M_{FP} = 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$

$$\rightarrow V_G = 25kN$$

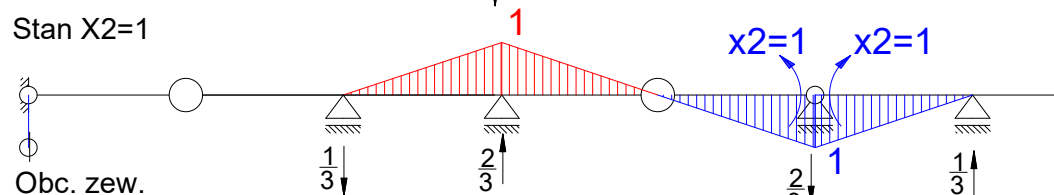
Schemat podstawowy:



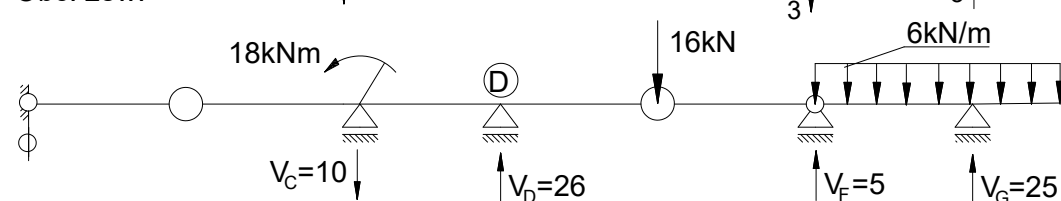
Stan X1=1



Stan X2=1



Obc. zew.



$$\sum M_{EP} = -25 \cdot 6 + 6 \cdot 5 \cdot 5,5 - V_F \cdot 3 = 0$$

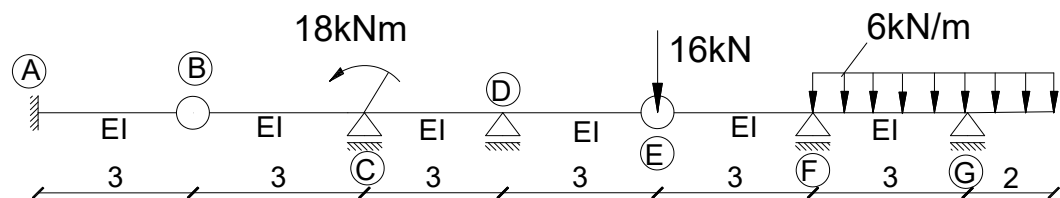
$$\rightarrow V_F = 5kN$$

$$\sum M_D = -18 - V_C \cdot 3 + 16 \cdot 3 - 5 \cdot 6 + 6 \cdot 5 \cdot 8,5 - 25 \cdot 9 = 0$$

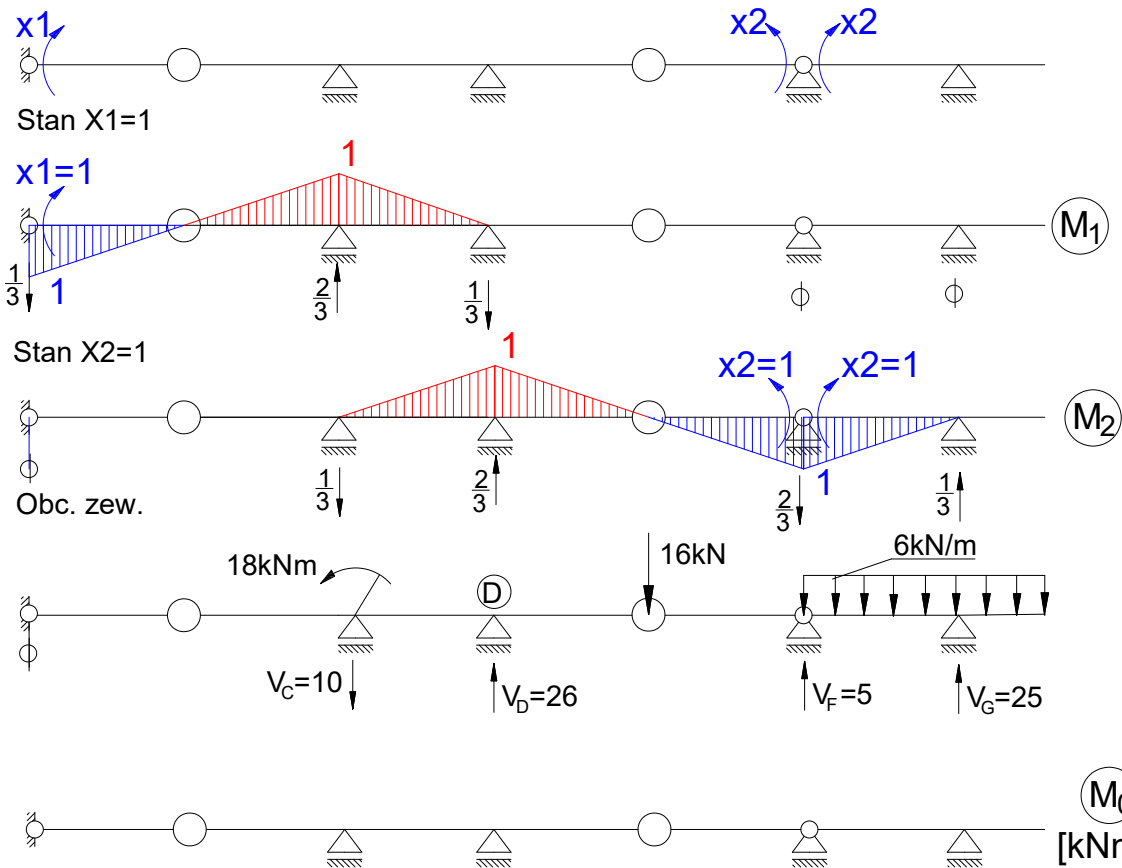
$$\rightarrow V_C = 10kN$$

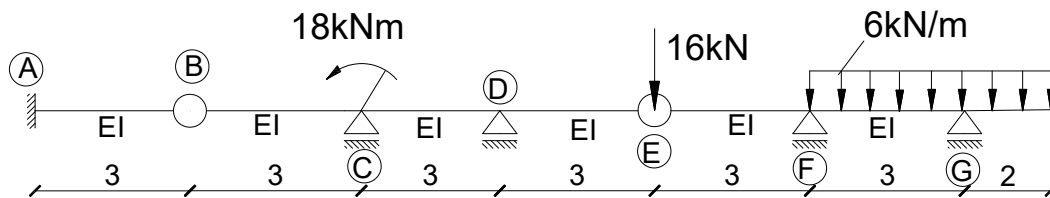
$$\sum R_Y = -10 + V_D - 16 + 5 - 6 \cdot 5 + 25 = 0$$

$$\rightarrow V_D = 26kN$$

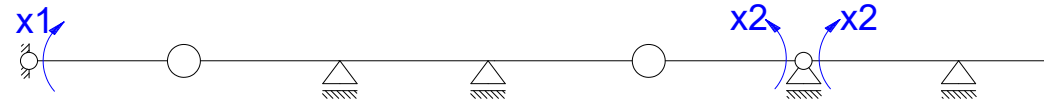


Schemat podstawowy:

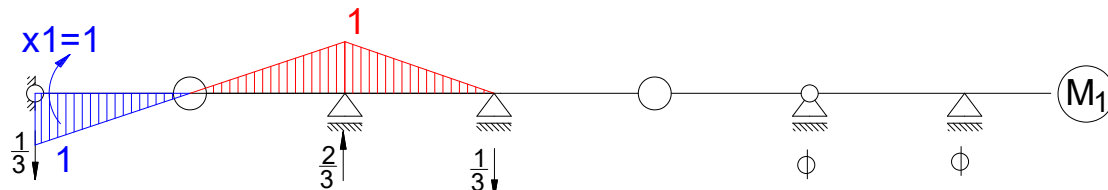




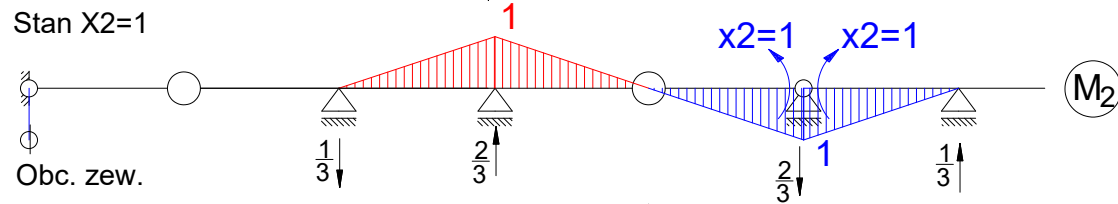
Schemat podstawowy:



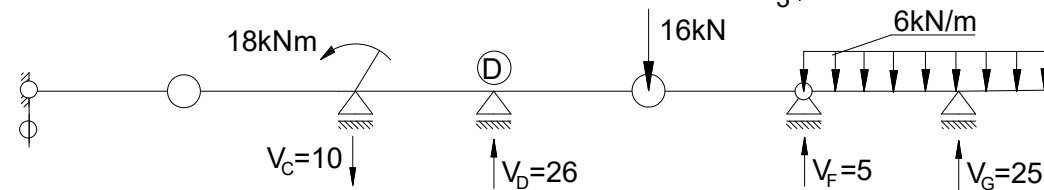
Stan $X_1=1$

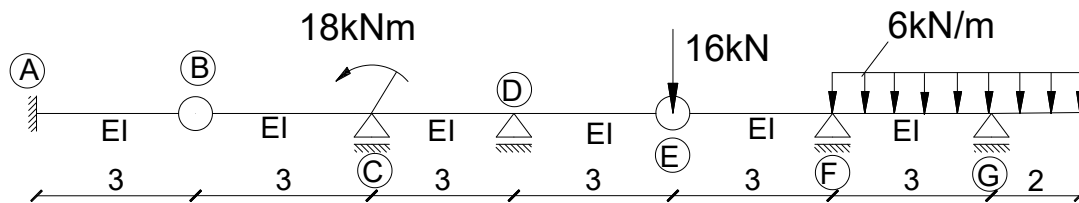


Stan $X_2=1$



Obc. zew.

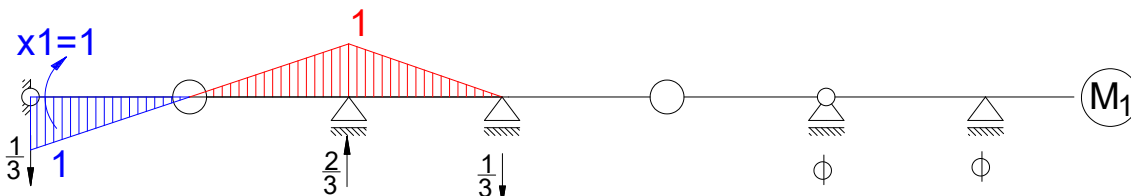




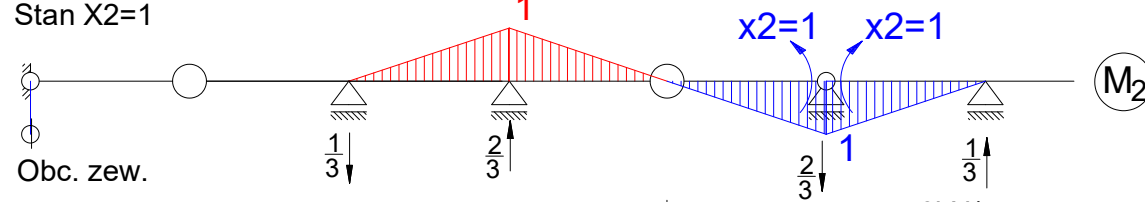
Schemat podstawowy:



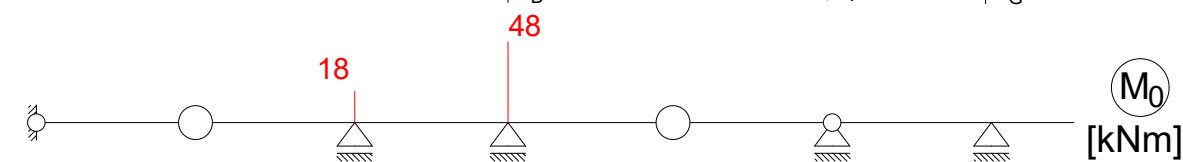
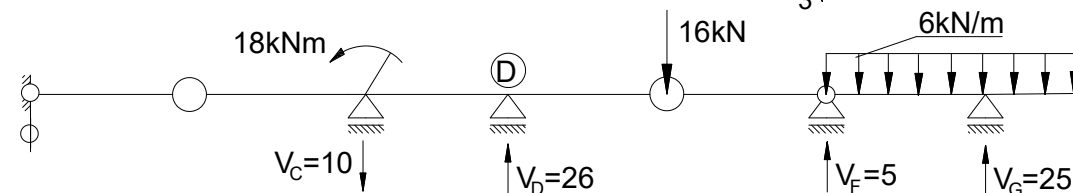
Stan $X_1=1$

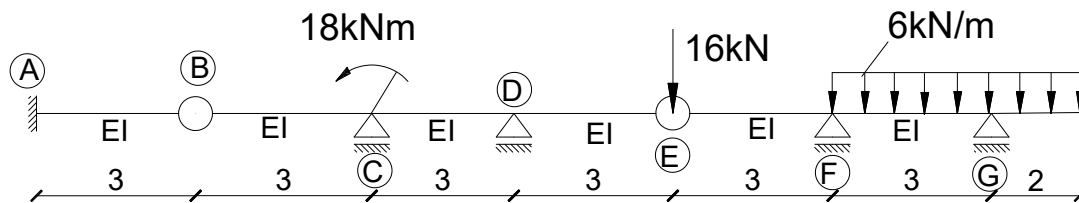


Stan $X_2=1$



Obc. zew.

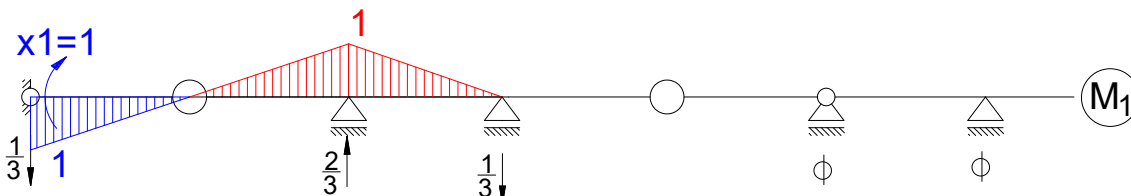




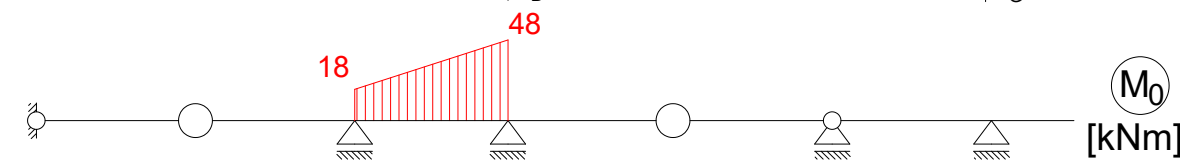
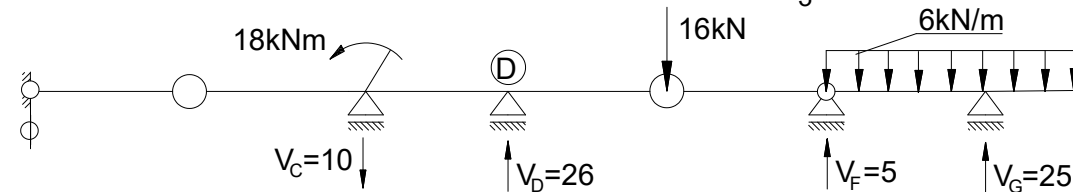
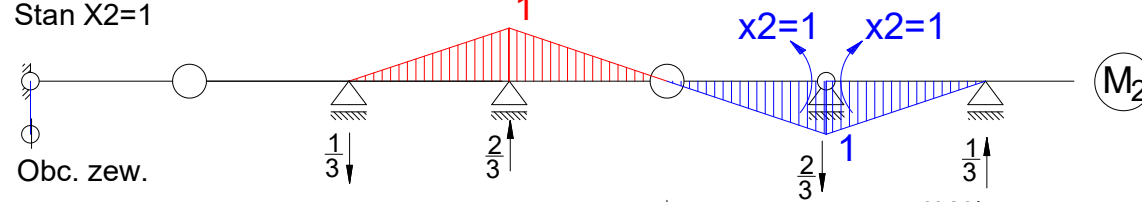
Schemat podstawowy:

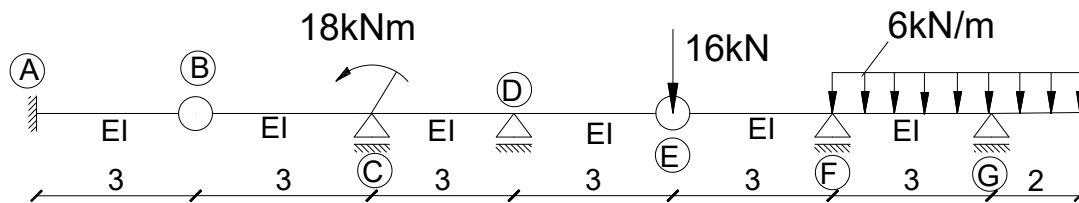


Stan $X_1=1$

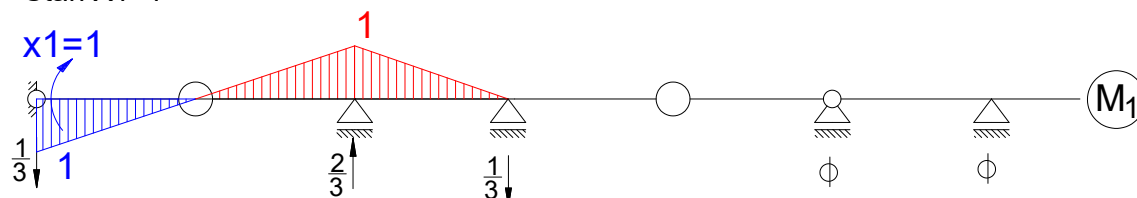


Stan $X_2=1$

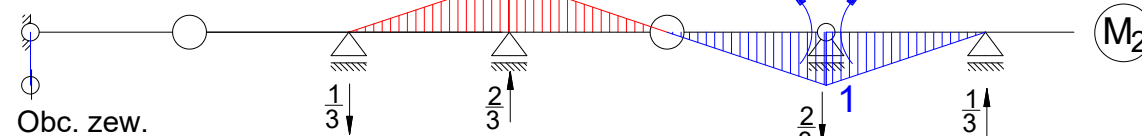




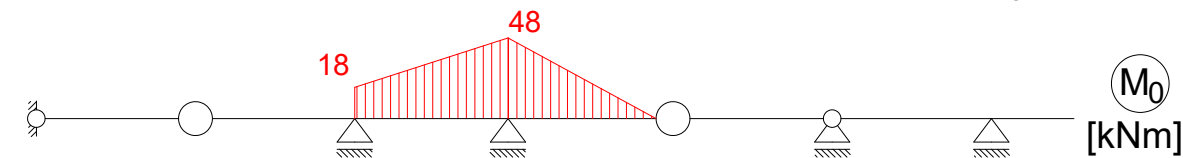
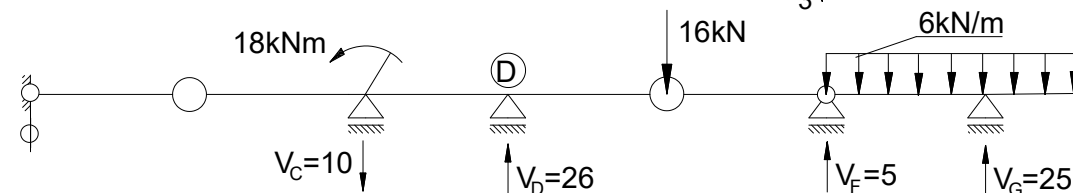
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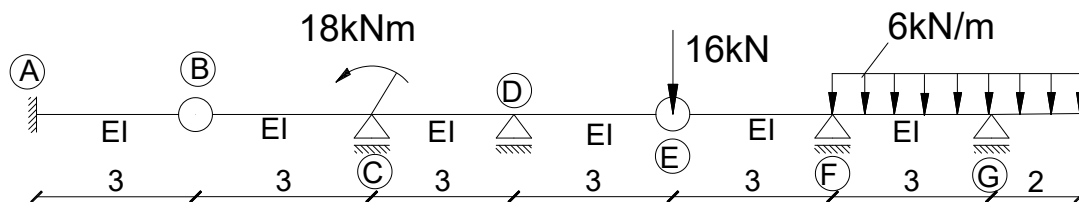


Stan $X_2=1$



Obc. zew.

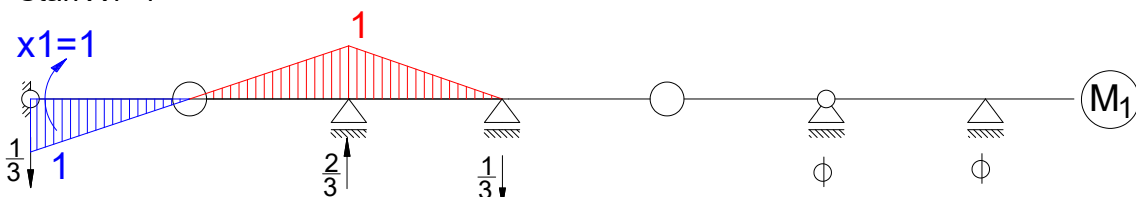




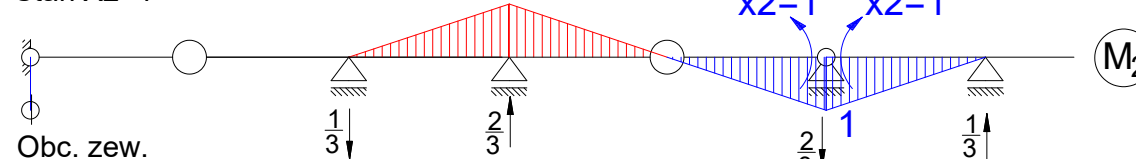
Schemat podstawowy:



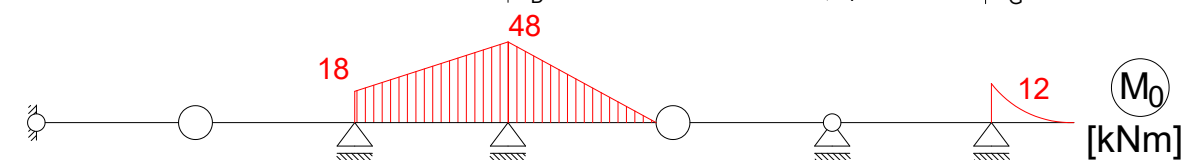
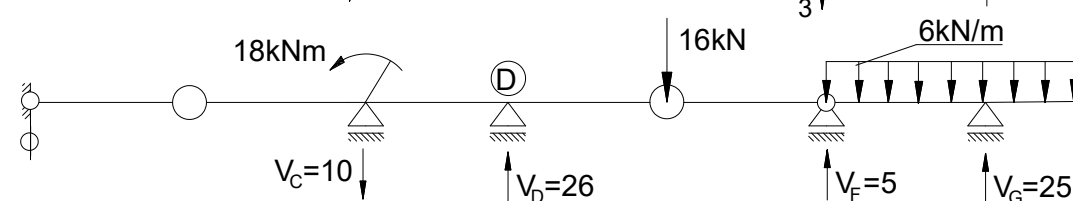
Stan $X_1=1$

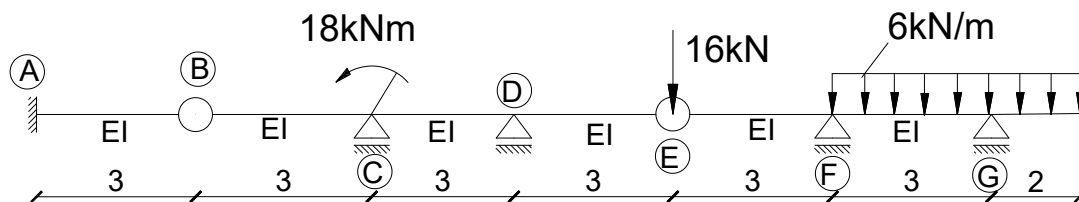


Stan $X_2=1$



Obc. zew.

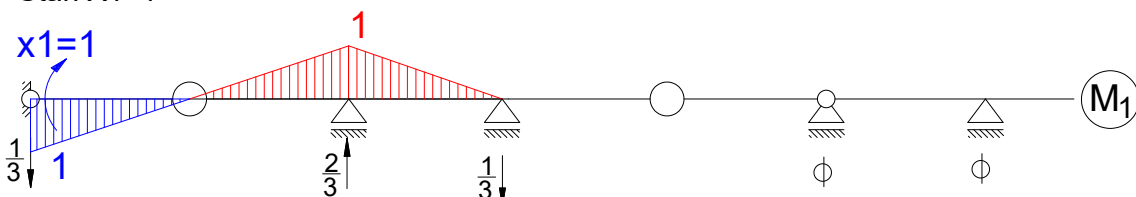




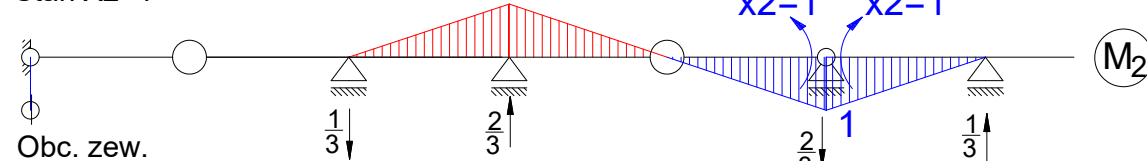
Schemat podstawowy:



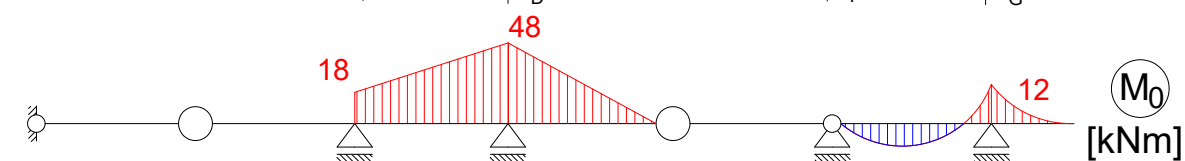
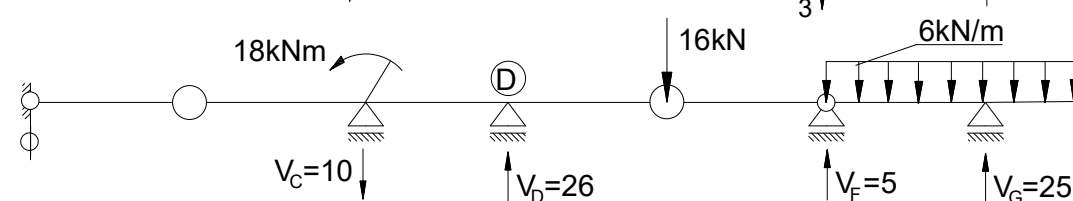
Stan $X_1=1$

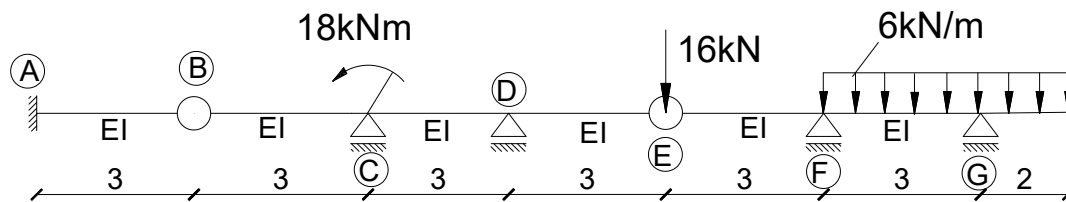


Stan $X_2=1$



Obc. zew.

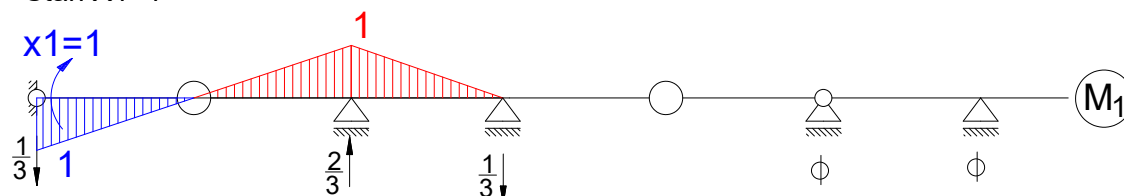




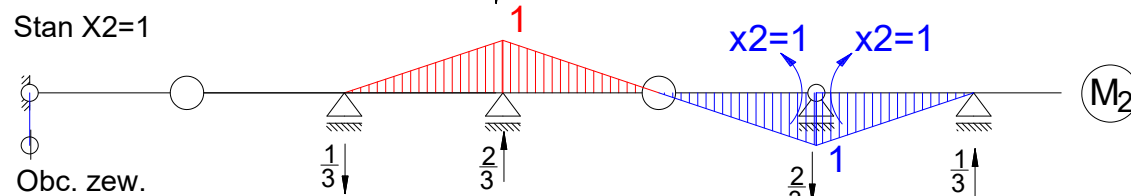
Schemat podstawowy:



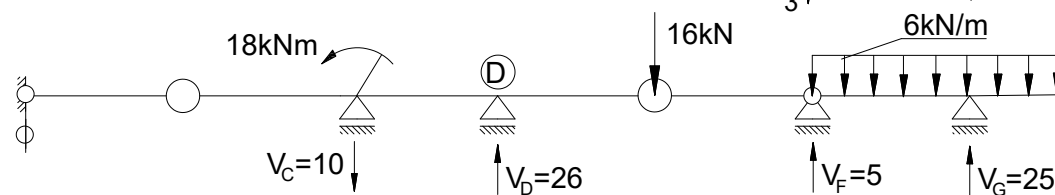
Stan $X_1=1$

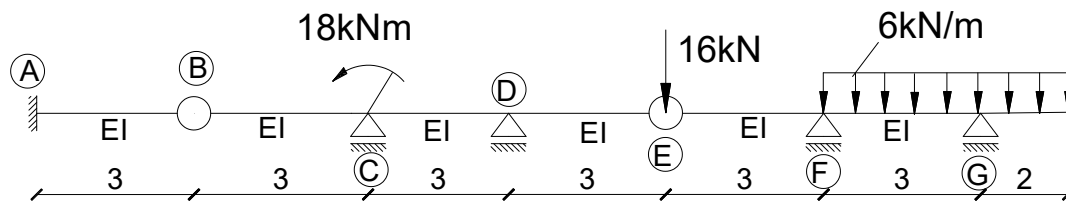


Stan $X_2=1$



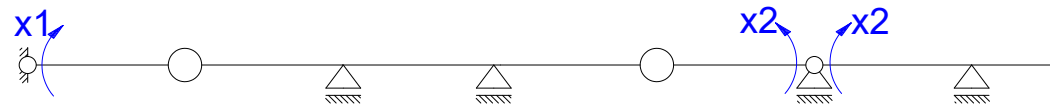
Obc. zew.



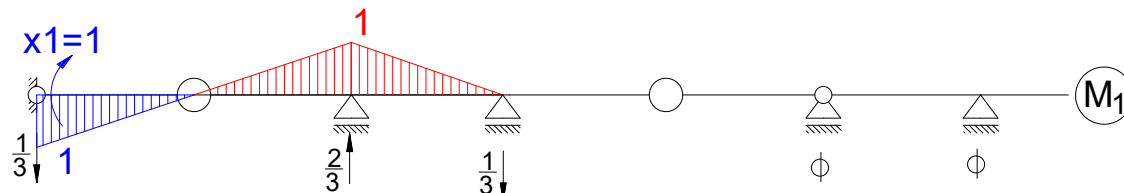


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right)$$

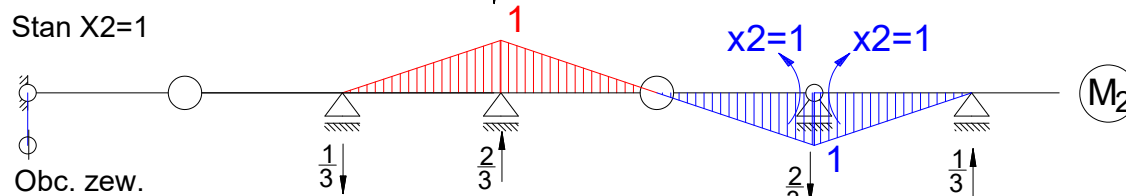
Schemat podstawowy:



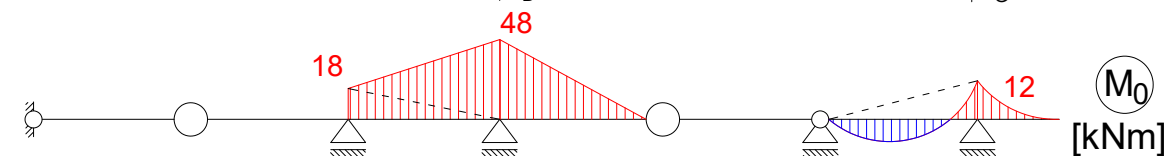
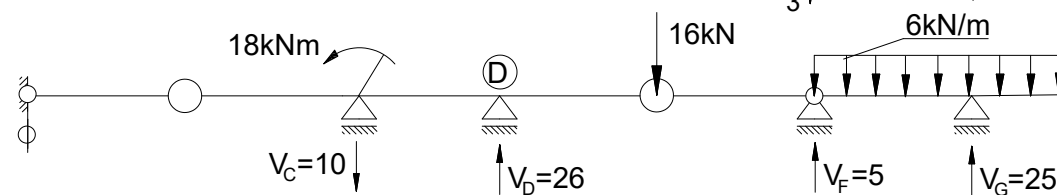
Stan X1=1

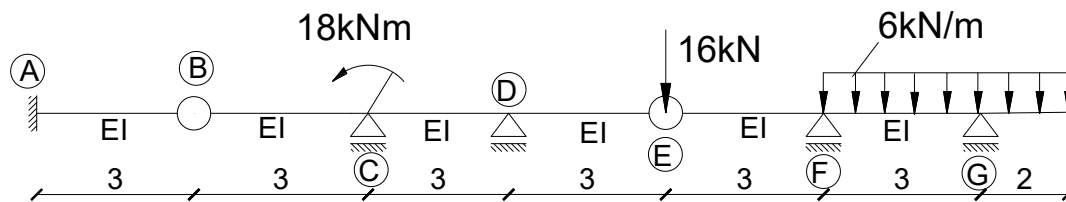


Stan X2=1



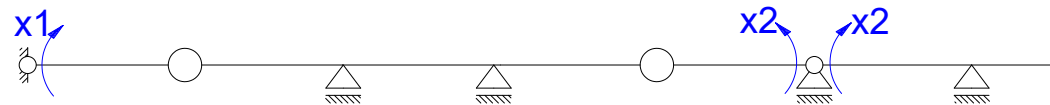
Obc. zew.



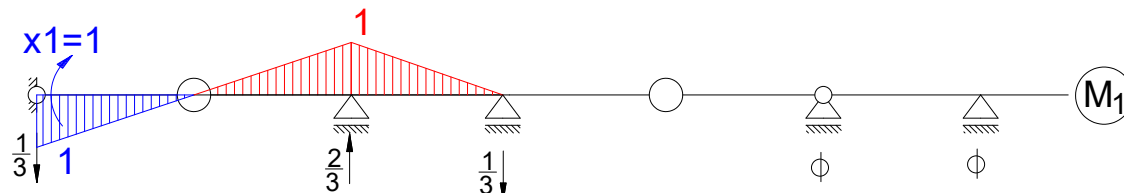


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3$$

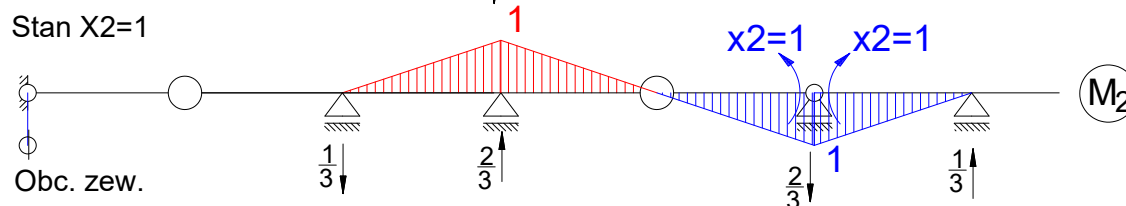
Schemat podstawowy:



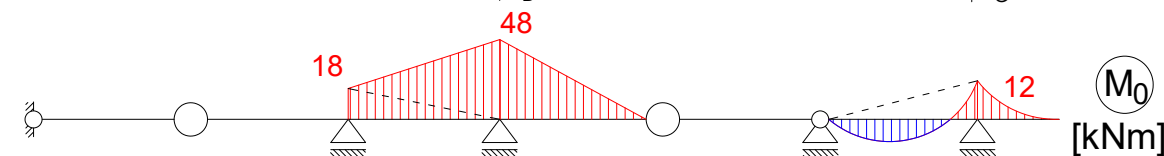
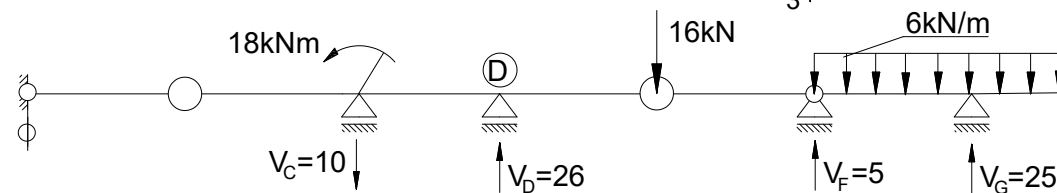
Stan $X_1=1$

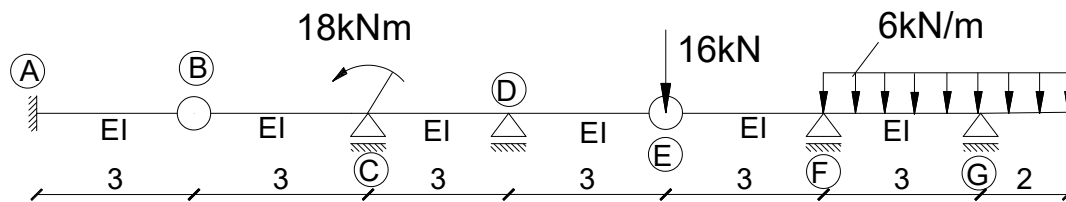


Stan $X_2=1$



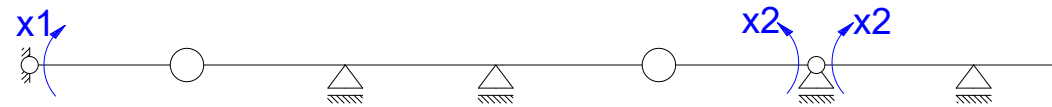
Obc. zew.



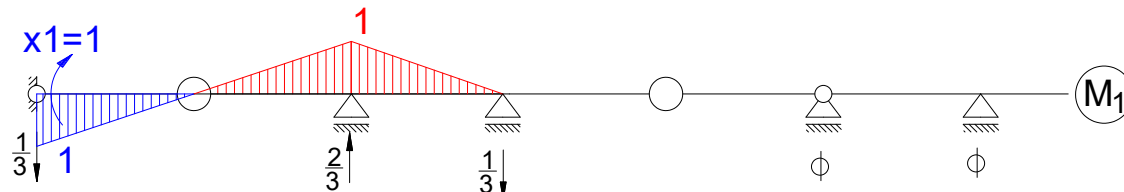


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

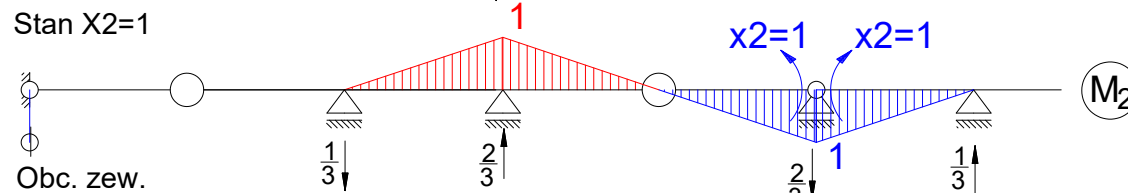
Schemat podstawowy:



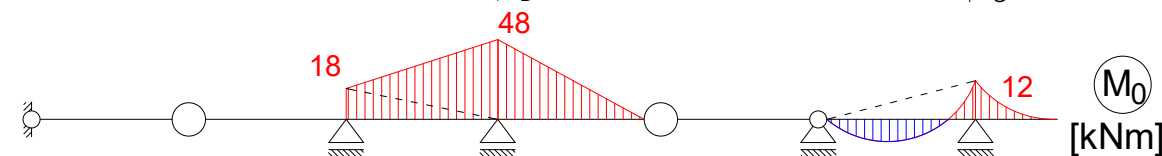
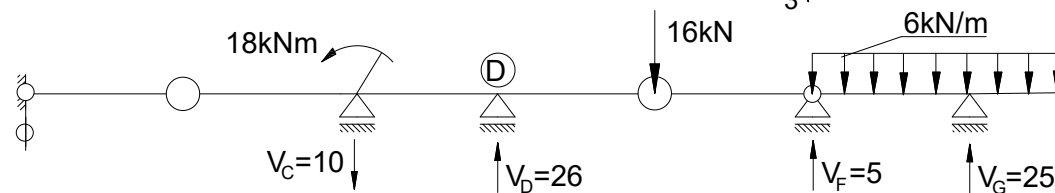
Stan $X_1=1$

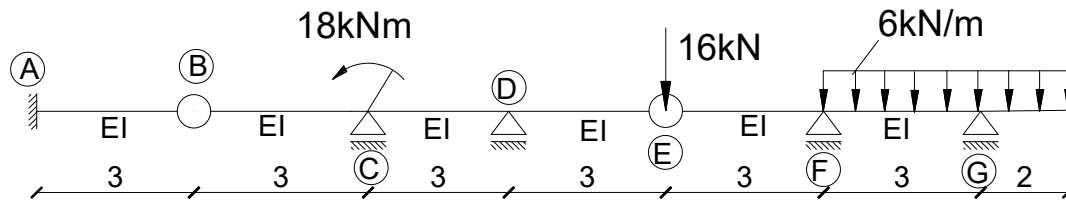


Stan $X_2=1$

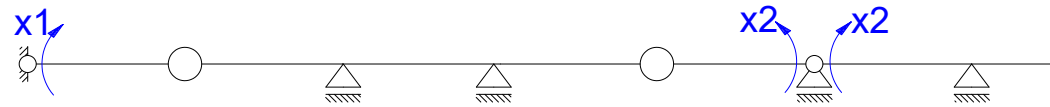


Obc. zew.

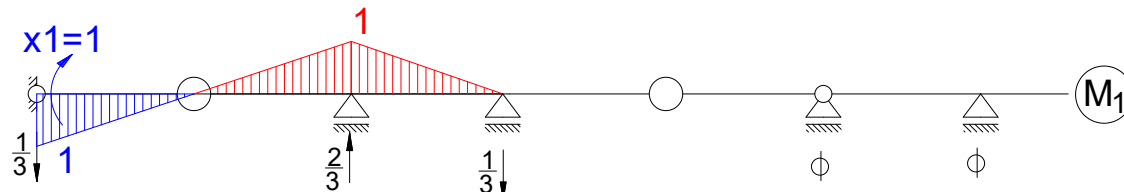




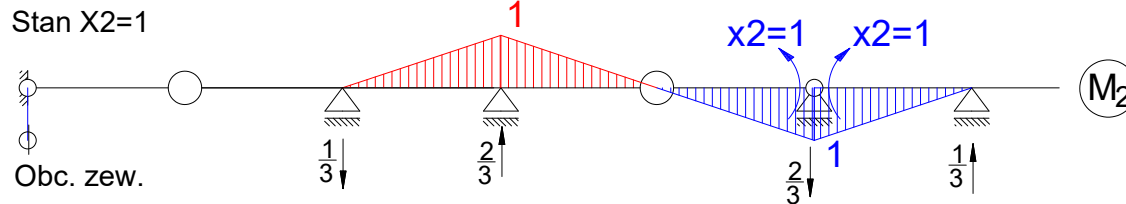
Schemat podstawowy:



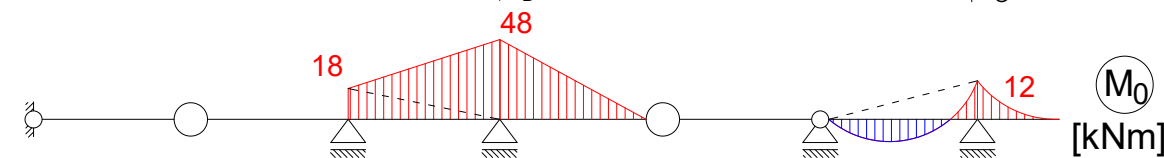
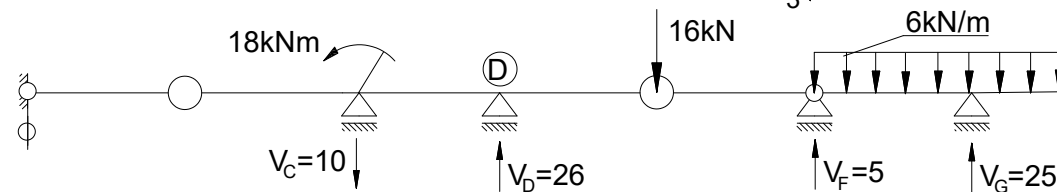
Stan $X_1=1$



Stan $X_2=1$

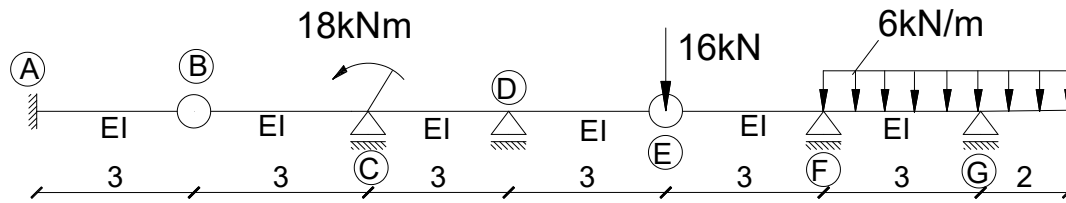


Obc. zew.

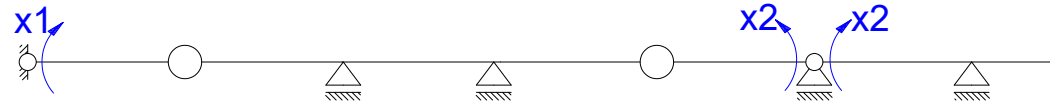


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

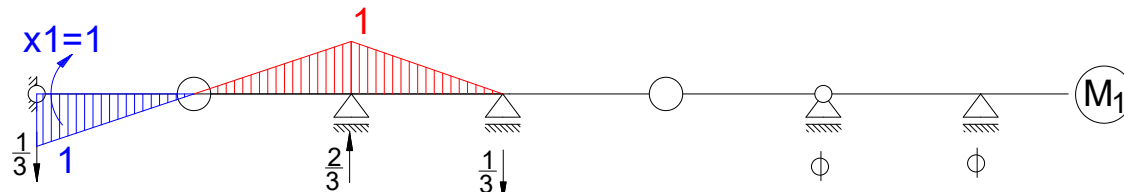
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right)$$



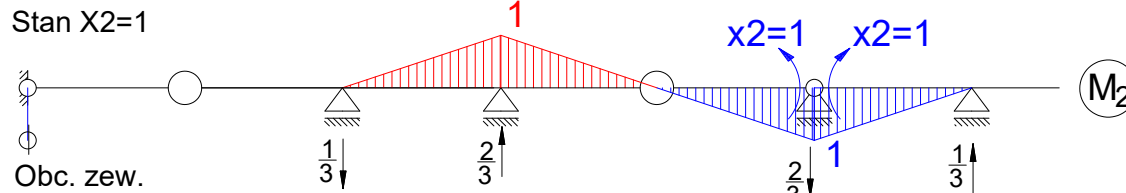
Schemat podstawowy:



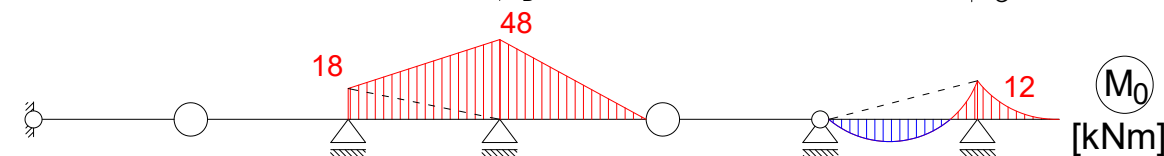
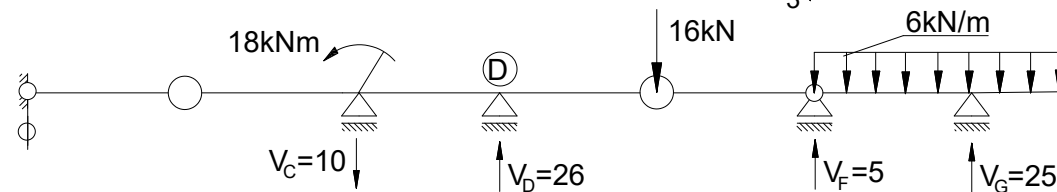
Stan $X_1=1$



Stan $X_2=1$

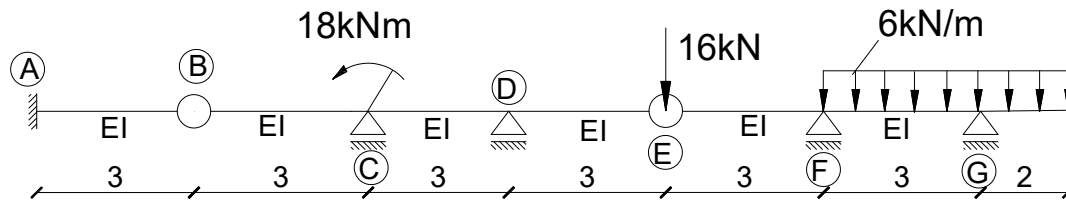


Obc. zew.

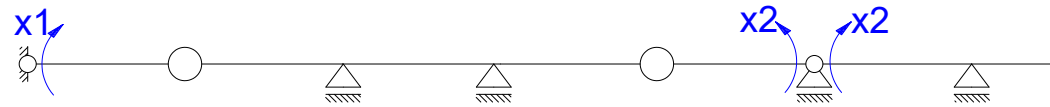


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

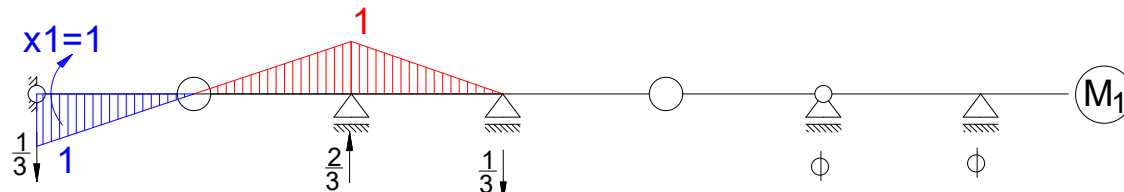
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI}$$



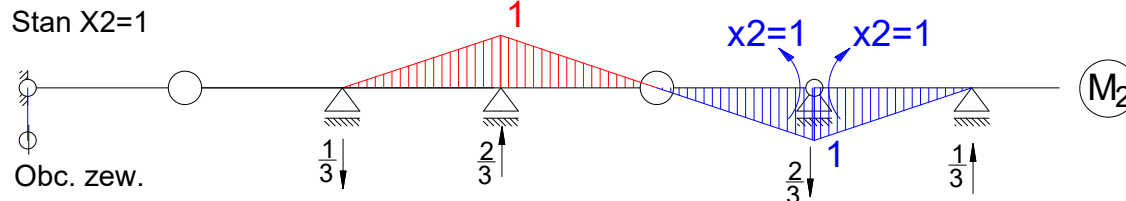
Schemat podstawowy:



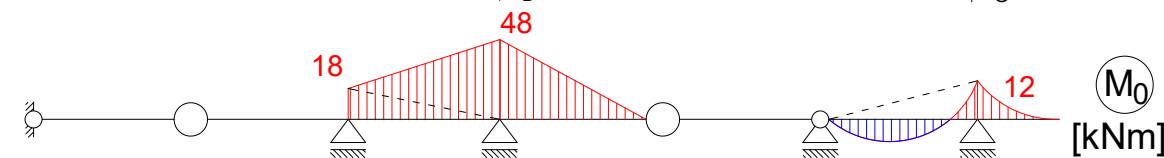
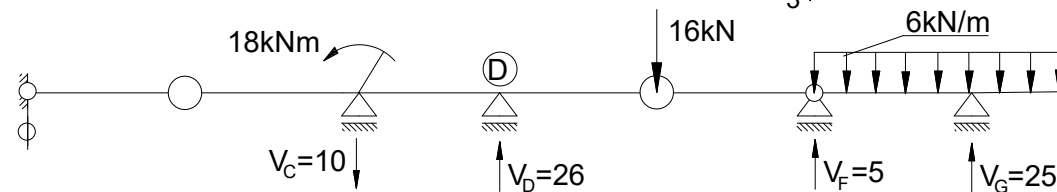
Stan $X_1=1$



Stan $X_2=1$

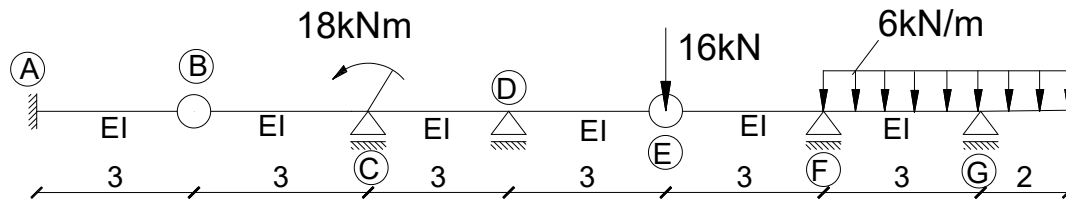


Obc. zew.

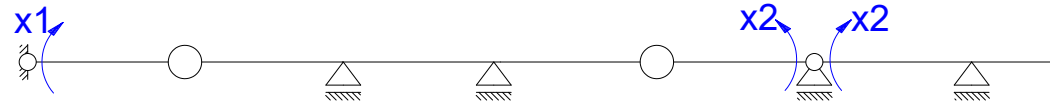


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

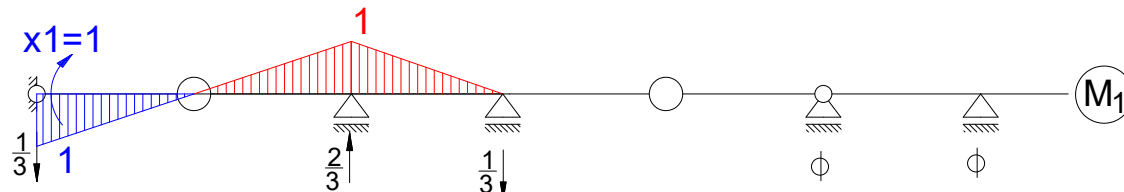
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$



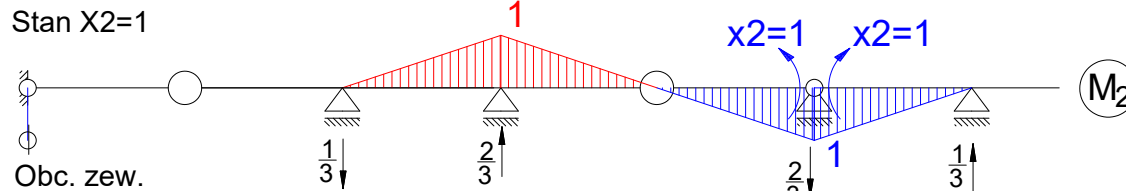
Schemat podstawowy:



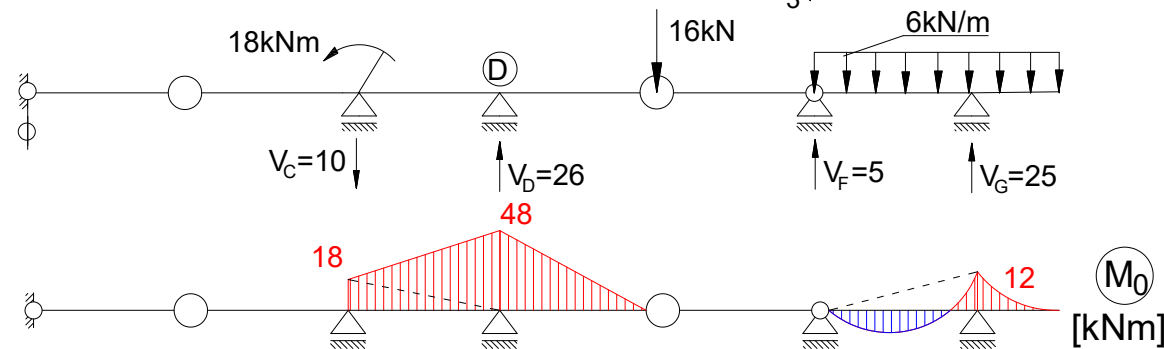
Stan $X_1=1$



Stan $X_2=1$



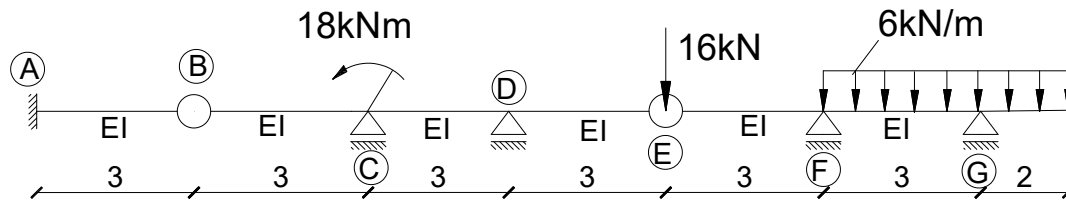
Obc. zew.



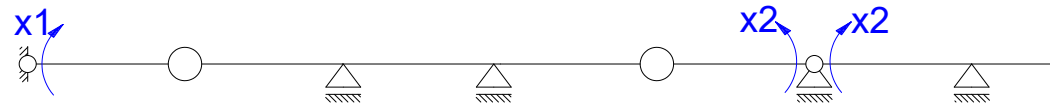
$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

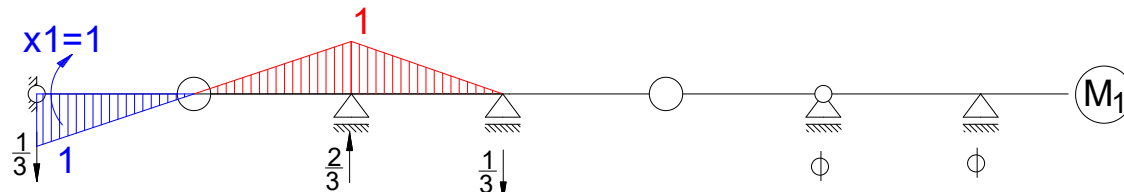
$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right)$$



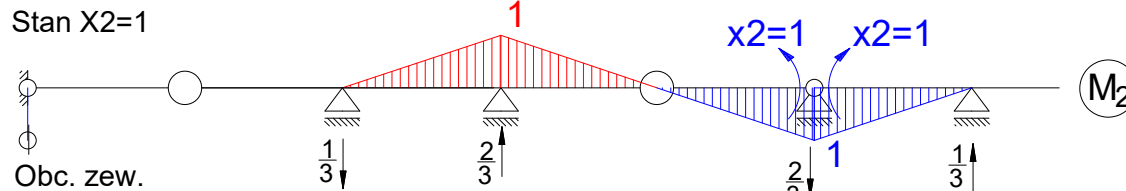
Schemat podstawowy:



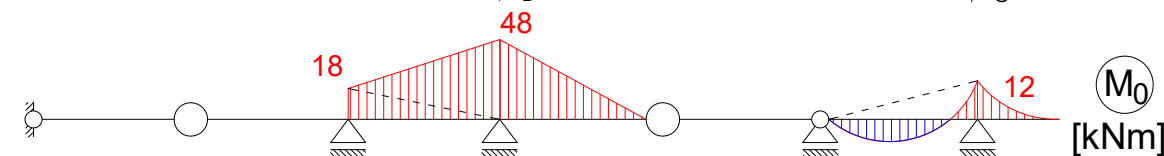
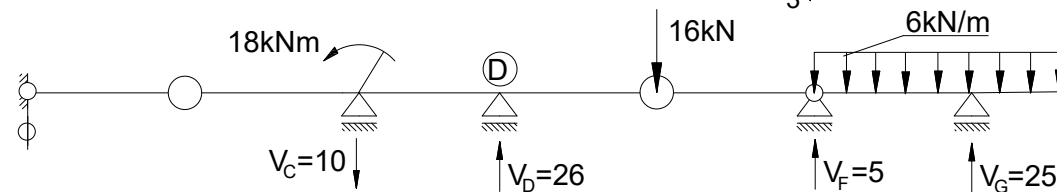
Stan $X_1=1$



Stan $X_2=1$



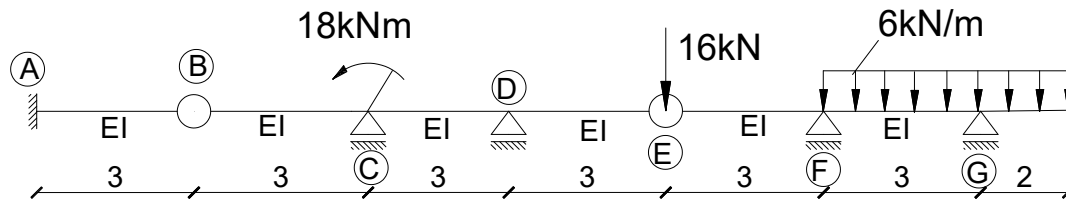
Obc. zew.



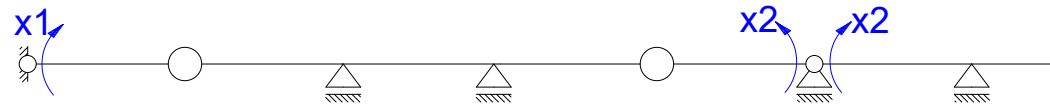
$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

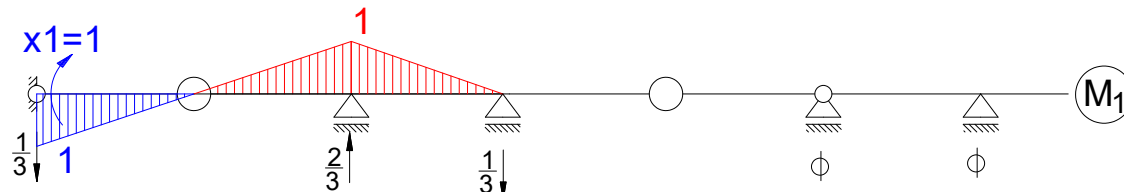
$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4$$



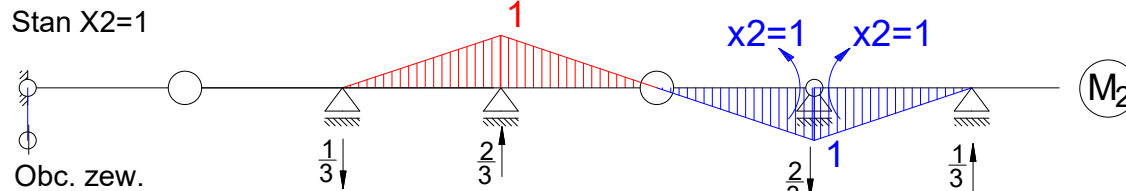
Schemat podstawowy:



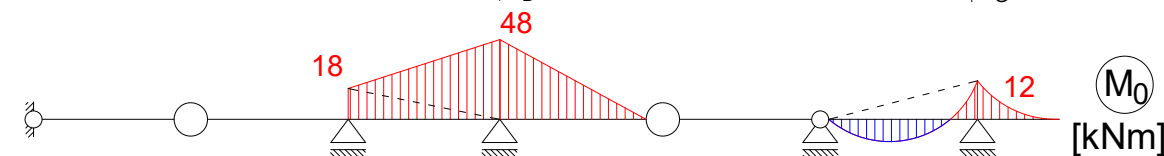
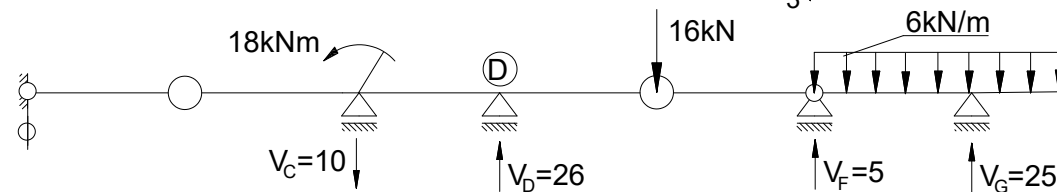
Stan $X_1=1$



Stan $X_2=1$



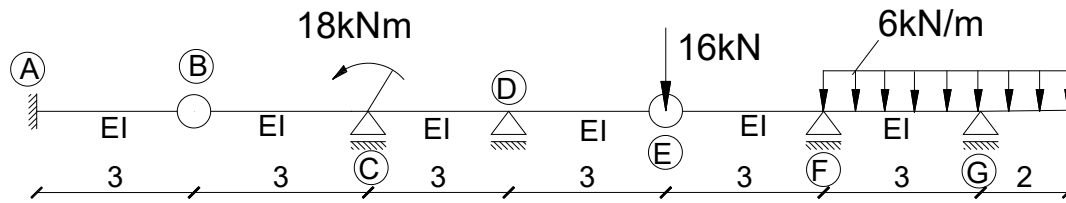
Obc. zew.



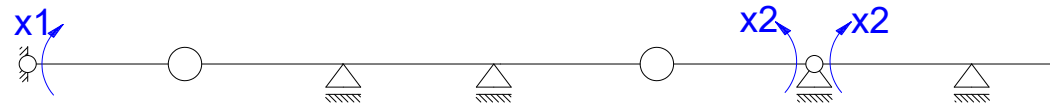
$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

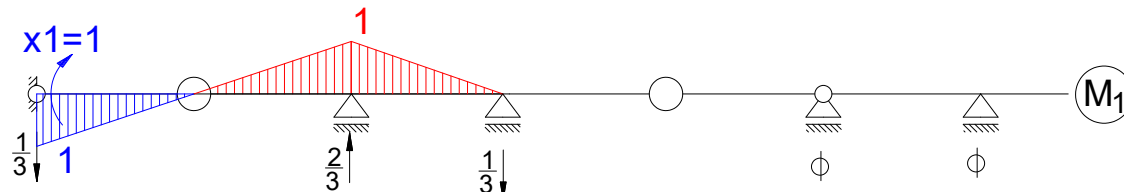
$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$



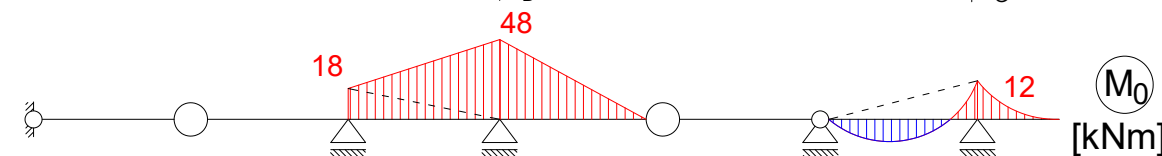
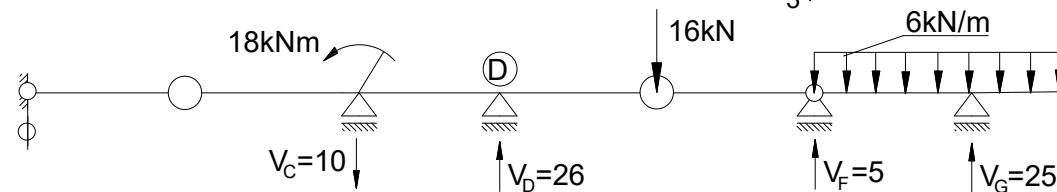
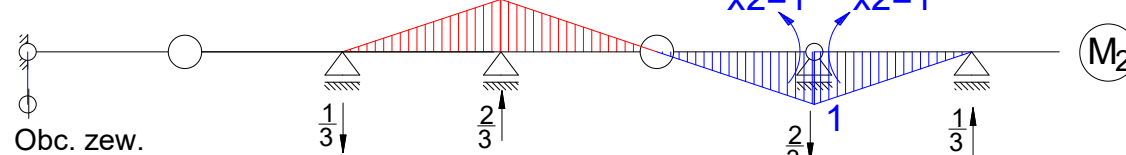
Schemat podstawowy:



Stan $X_1=1$



Stan $X_2=1$

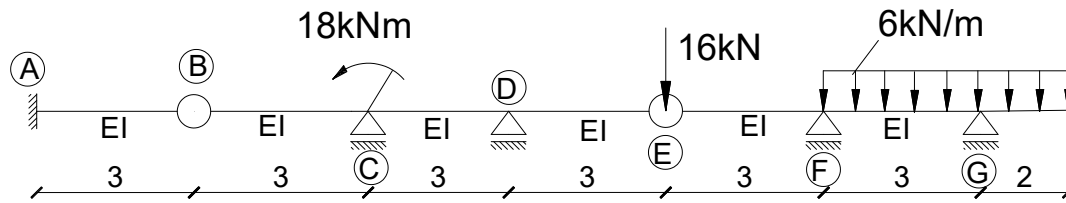


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

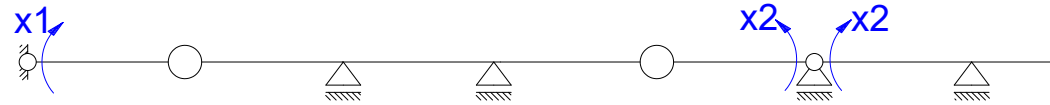
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

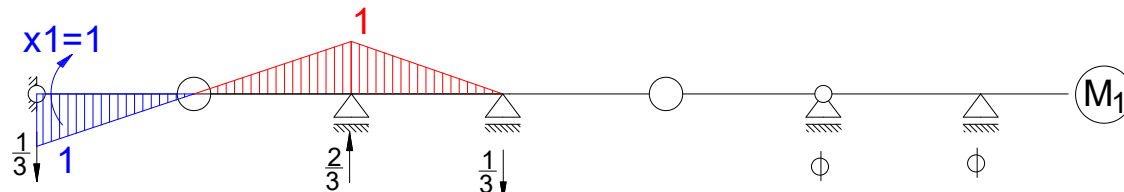
$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot$$



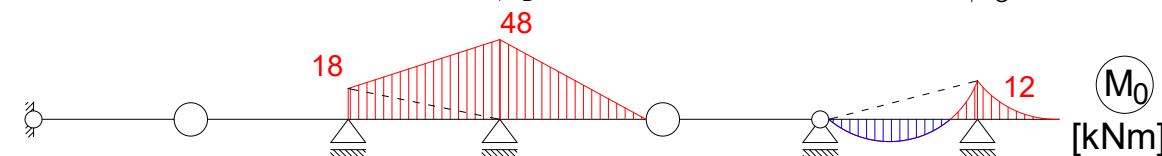
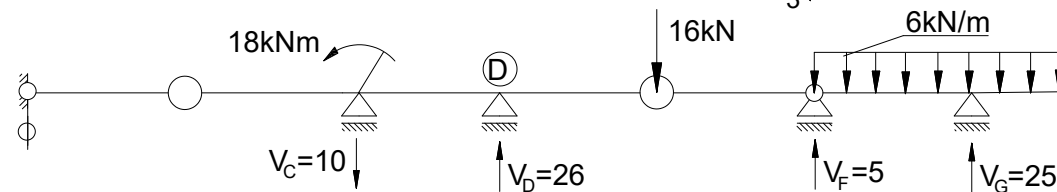
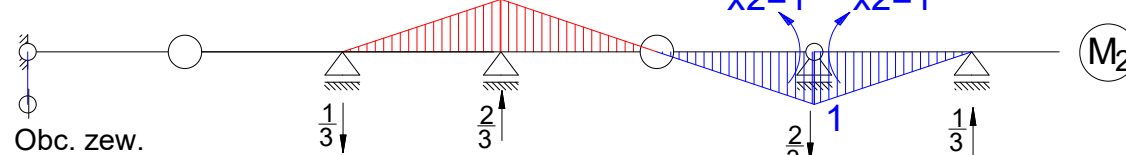
Schemat podstawowy:



Stan $X_1=1$



Stan $X_2=1$

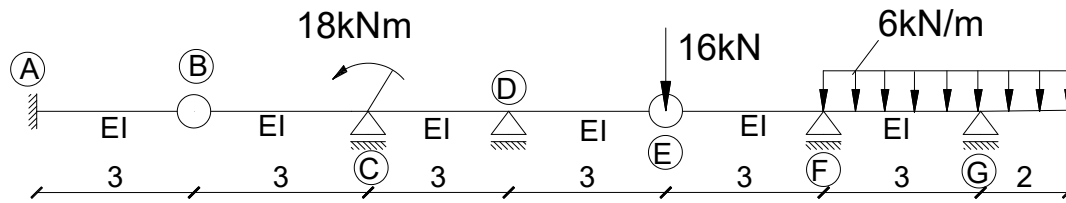


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

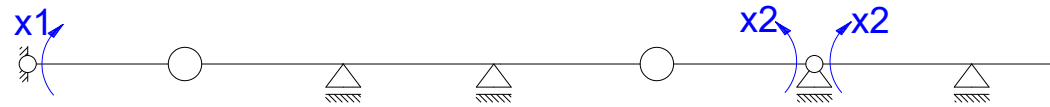
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

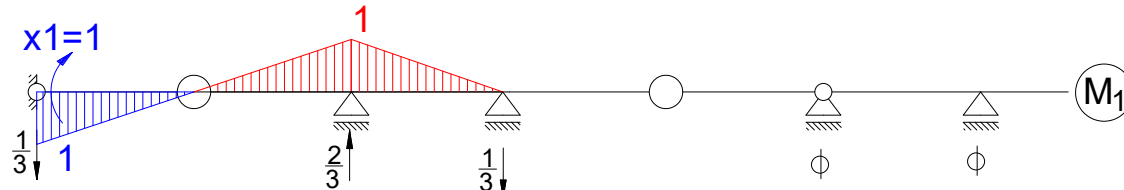
$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right)$$



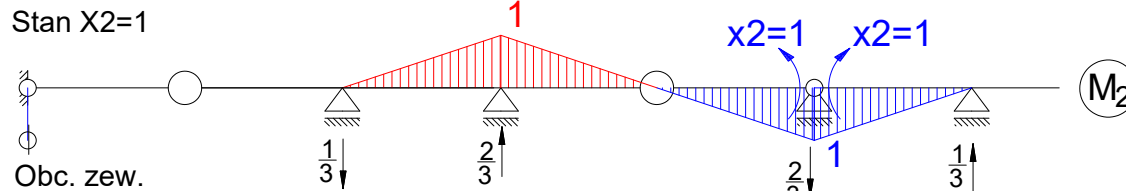
Schemat podstawowy:



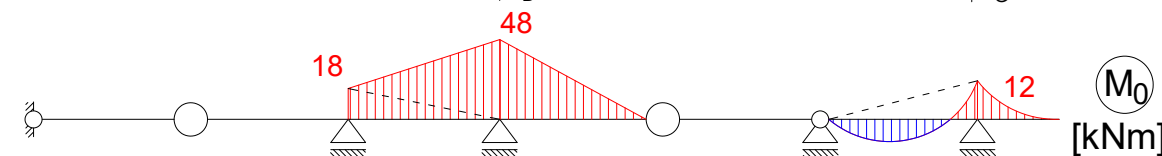
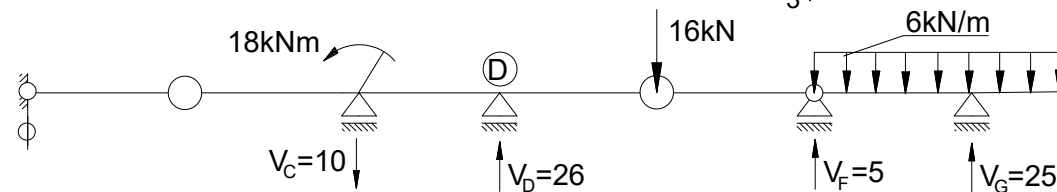
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.

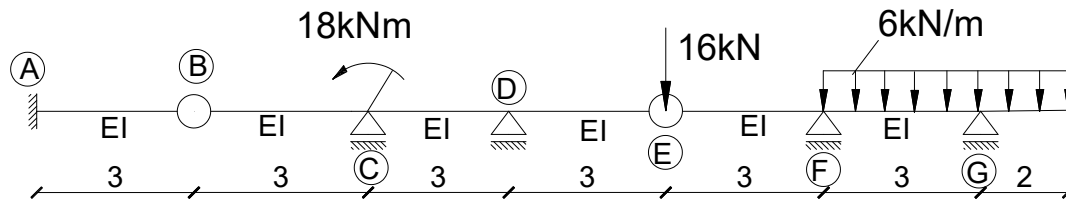


$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

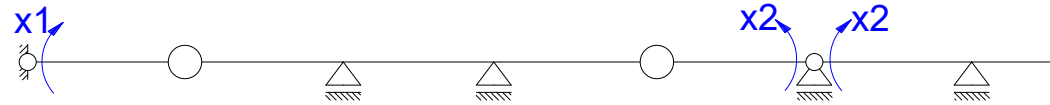
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

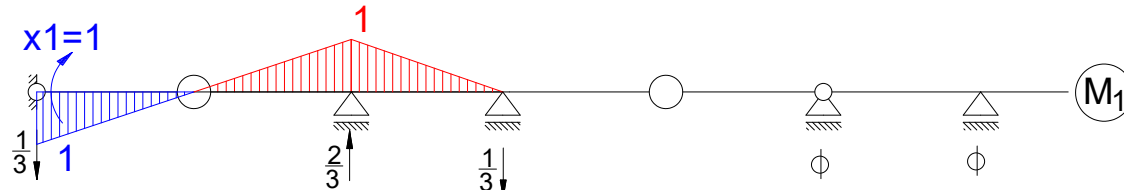
$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$



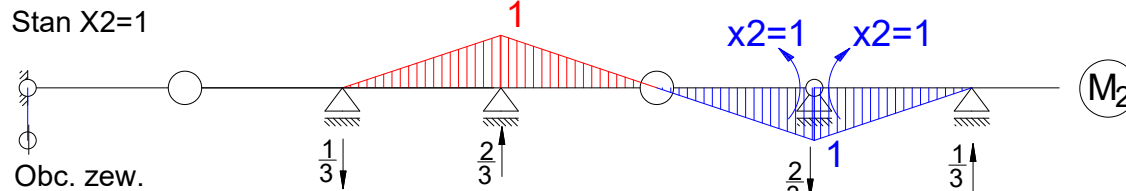
Schemat podstawowy:



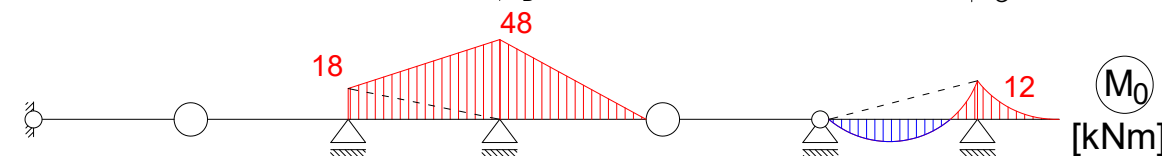
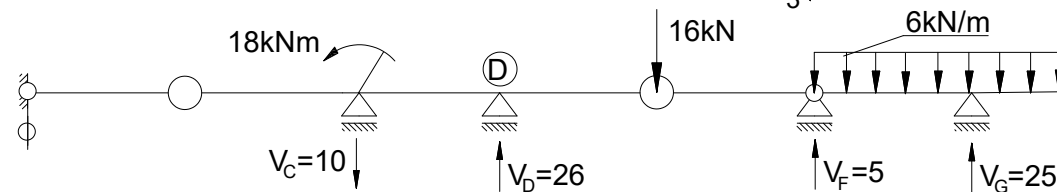
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



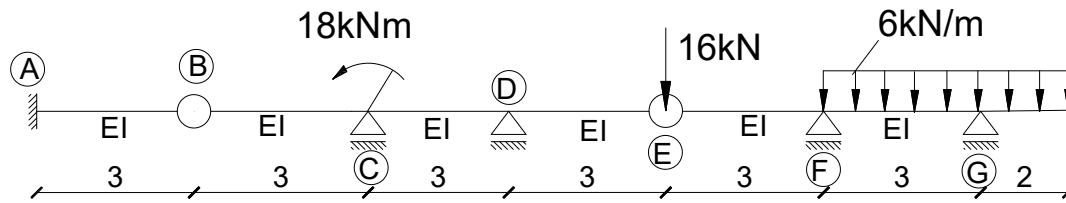
$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

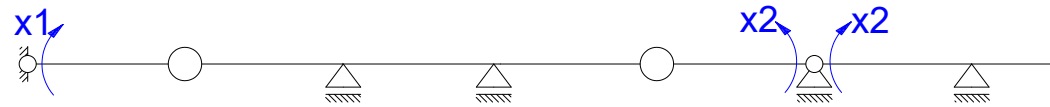
$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

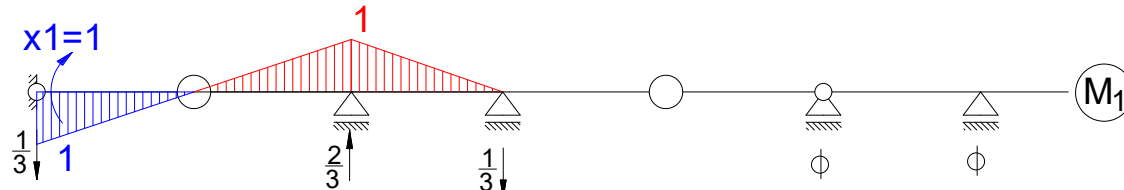
$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot$$



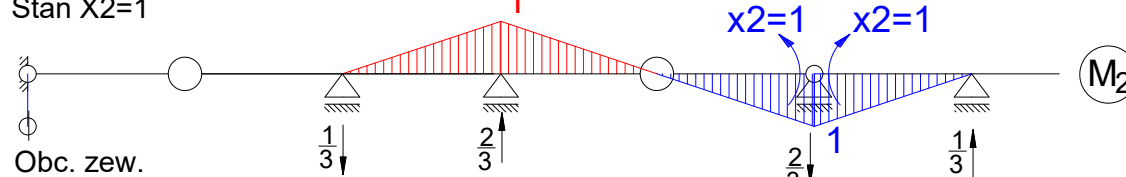
Schemat podstawowy:



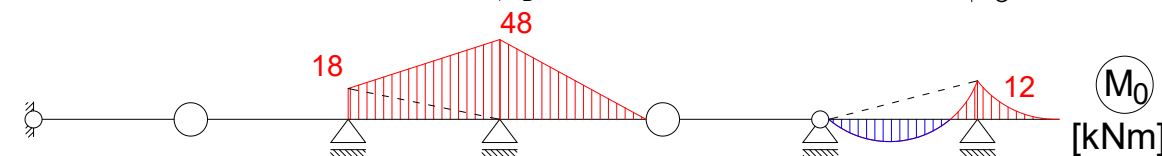
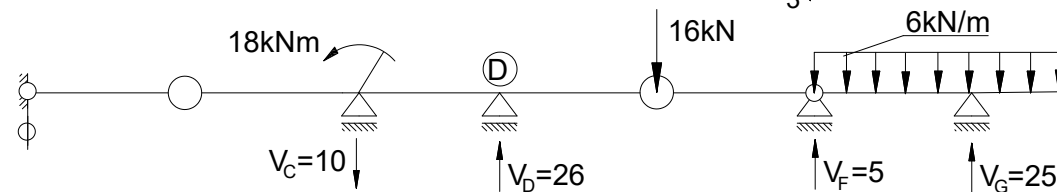
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



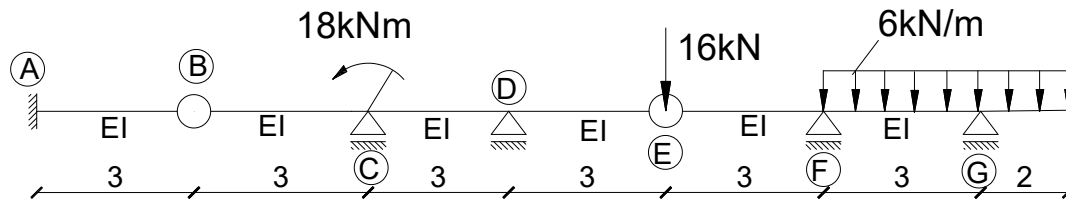
$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

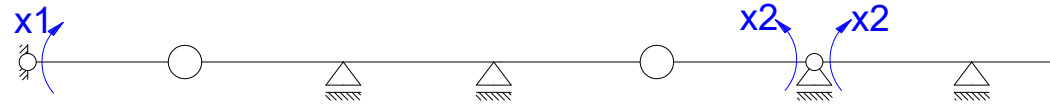
$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

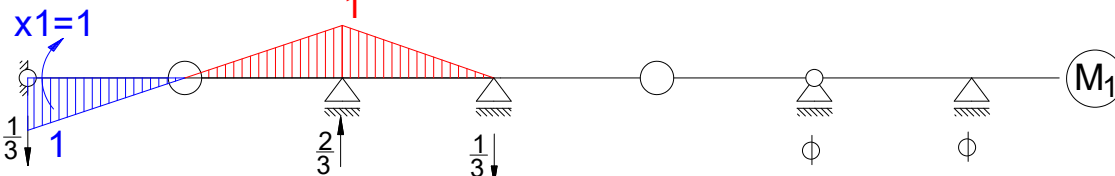
$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$



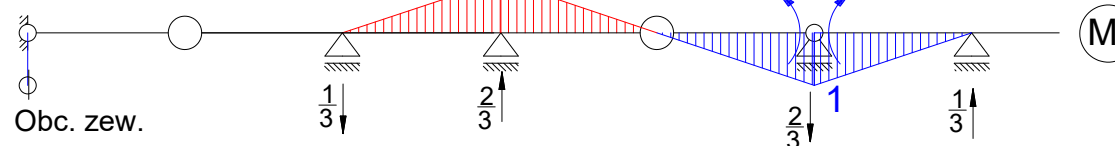
Schemat podstawowy:



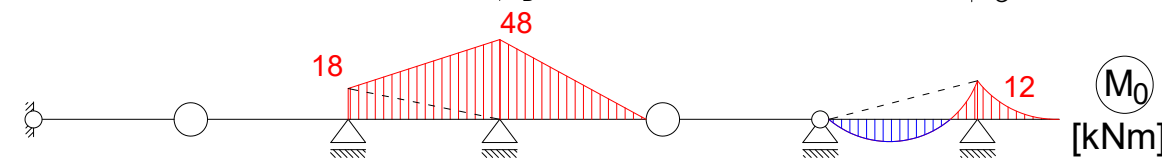
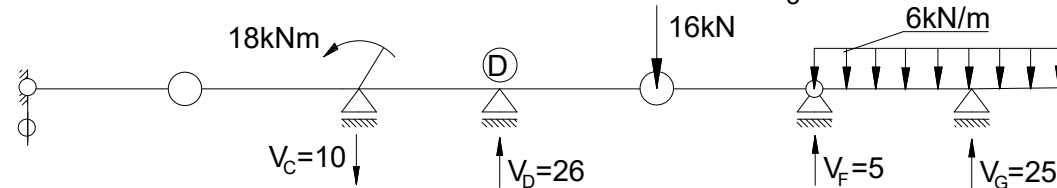
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

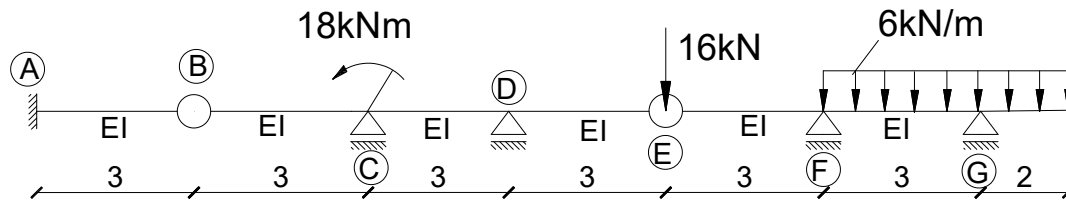
$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

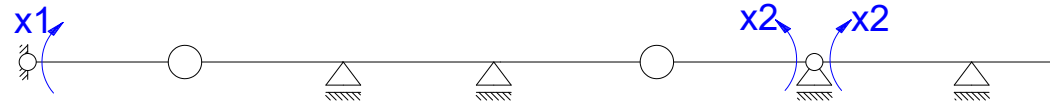
$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

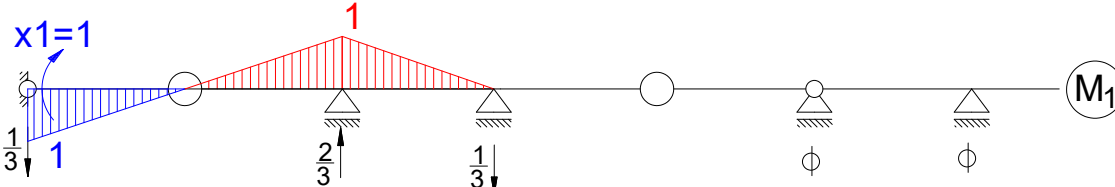
$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$



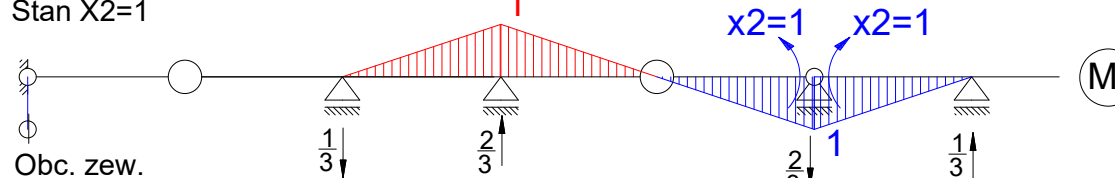
Schemat podstawowy:



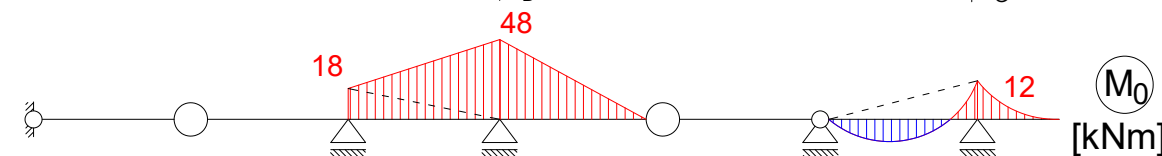
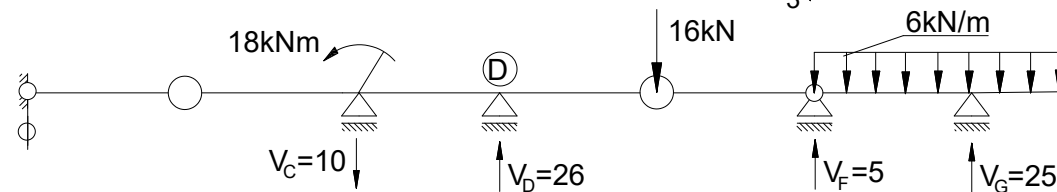
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

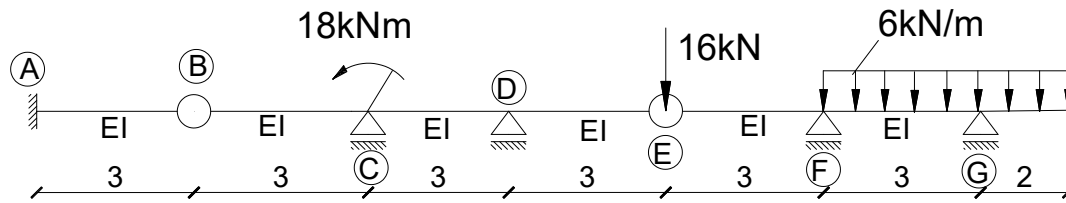
$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

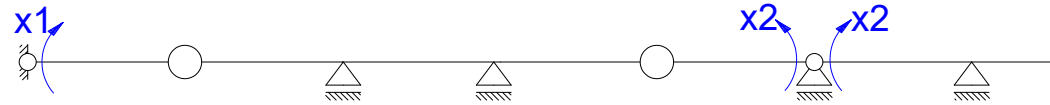
$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

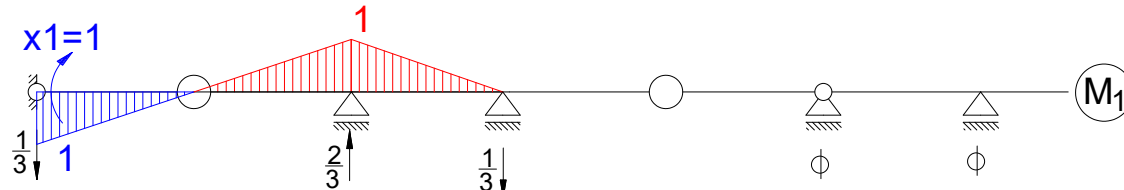
$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$



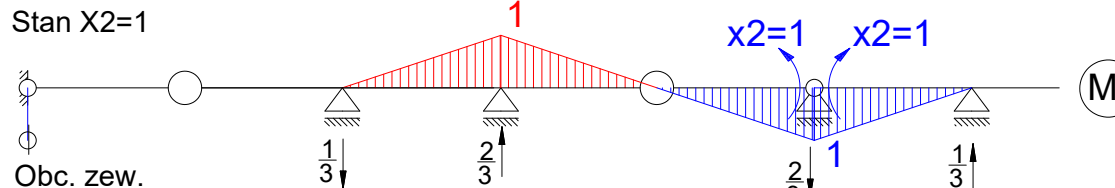
Schemat podstawowy:



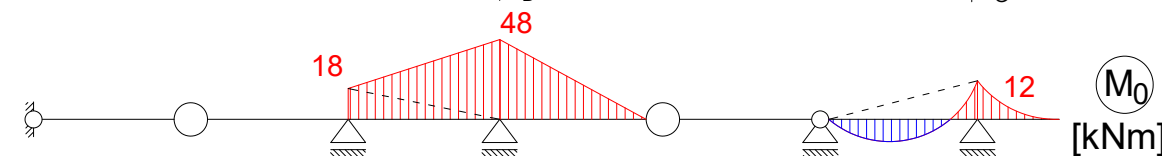
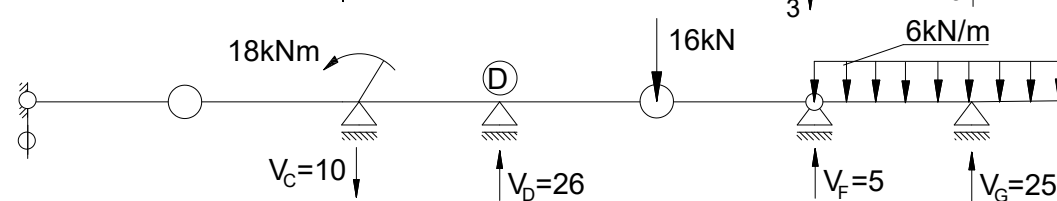
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

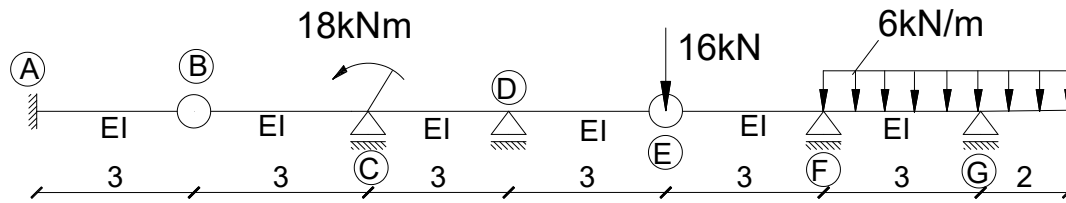
$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

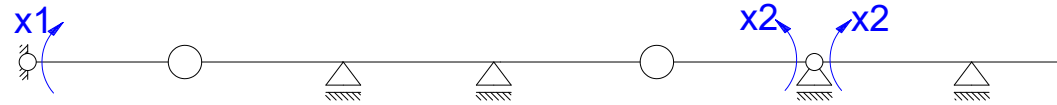
$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$

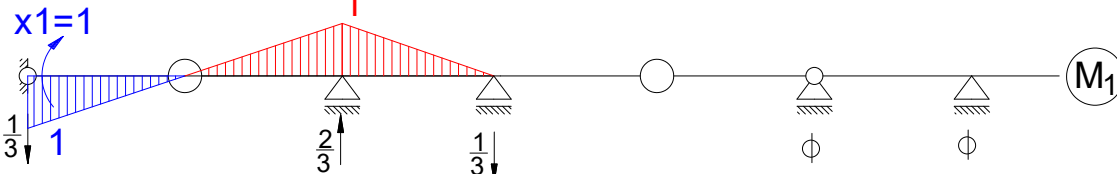
$$+ \frac{1}{EI} \frac{2}{3} \cdot \frac{6 \cdot 3^2}{8} \cdot 3 \cdot \frac{1}{2} \cdot 1$$



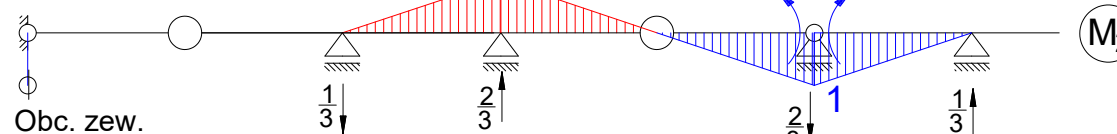
Schemat podstawowy:



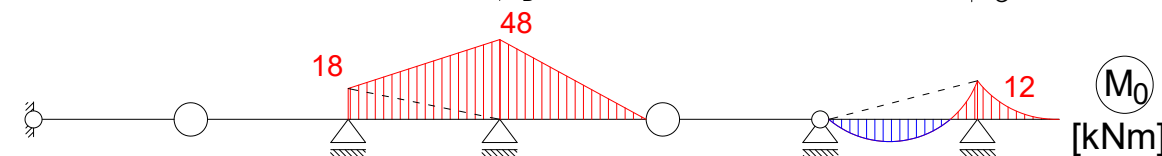
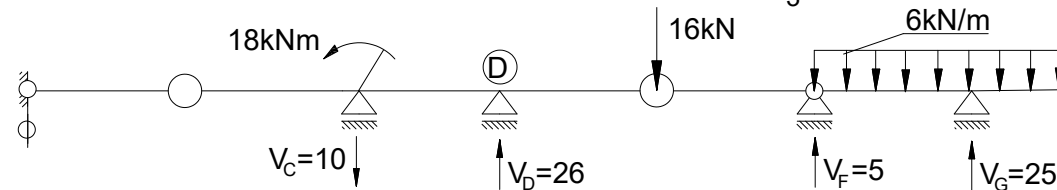
Stan X1=1



Stan X2=1



Obc. zew.



$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

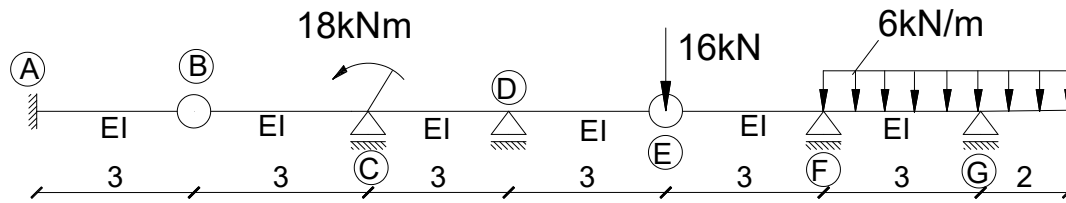
$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

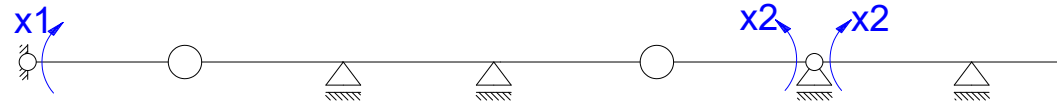
$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$

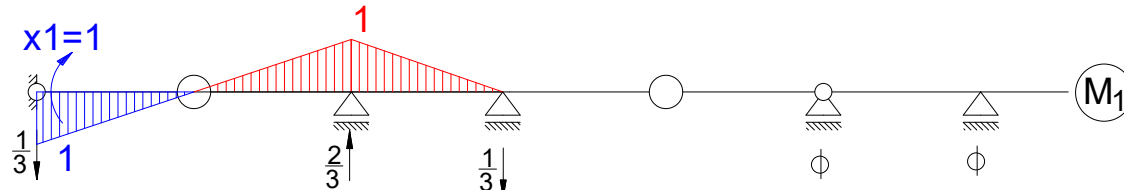
$$+ \frac{1}{EI} \frac{2}{3} \cdot \frac{6 \cdot 3^2}{8} \cdot 3 \cdot \frac{1}{2} \cdot 1 = \frac{105,75}{EI}$$



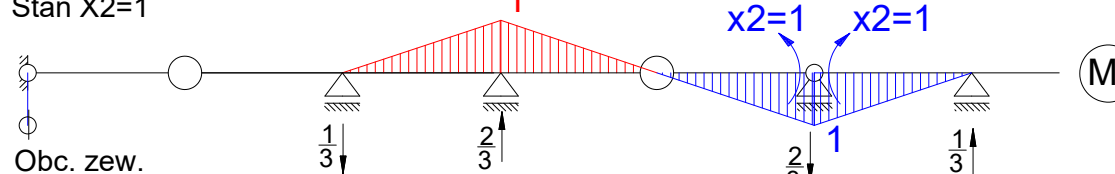
Schemat podstawowy:



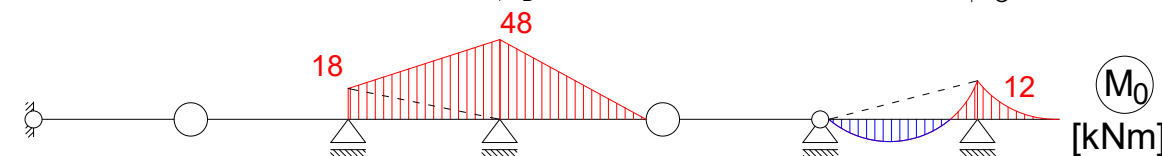
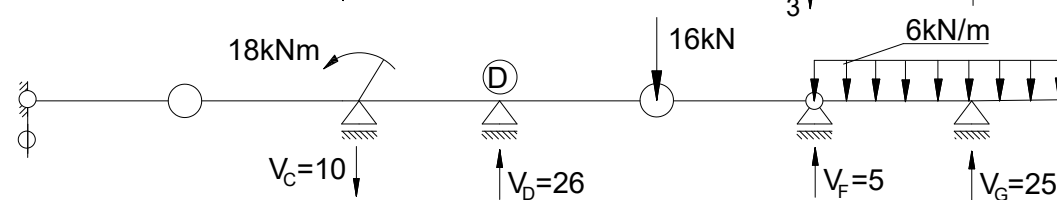
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

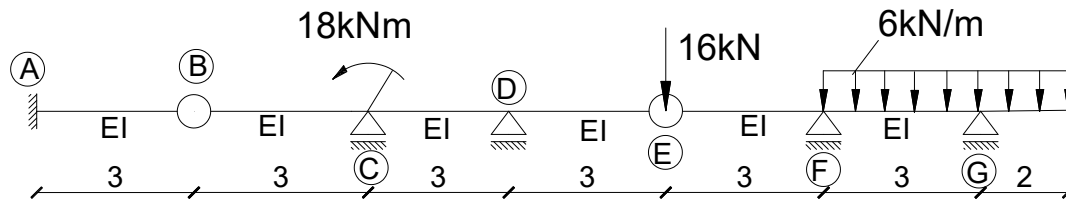
$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

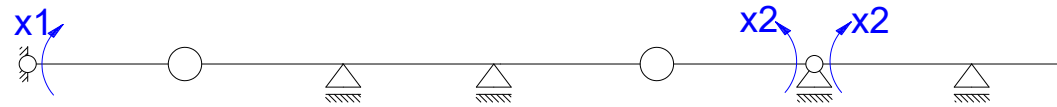
$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$

$$+ \frac{1}{EI} \frac{2}{3} \cdot \frac{6 \cdot 3^2}{8} \cdot 3 \cdot \frac{1}{2} \cdot 1 = \frac{105,75}{EI}$$

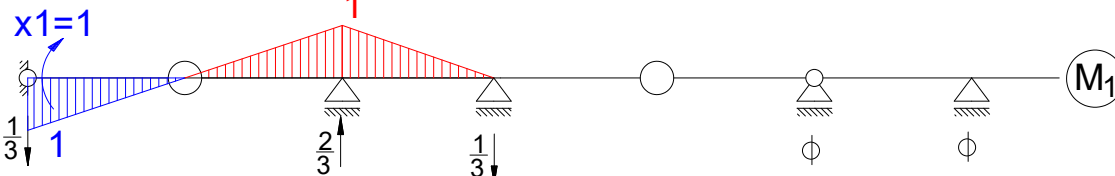
Układ równań metody sił:



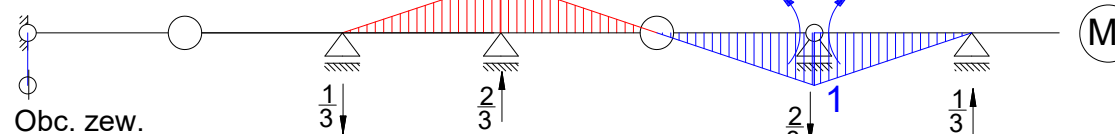
Schemat podstawowy:



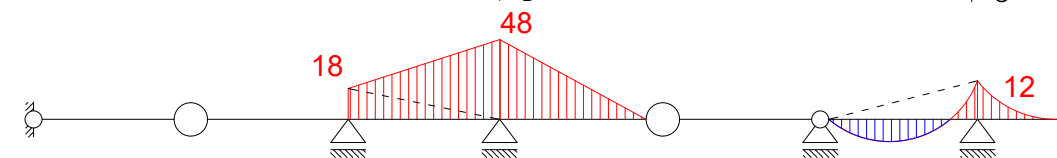
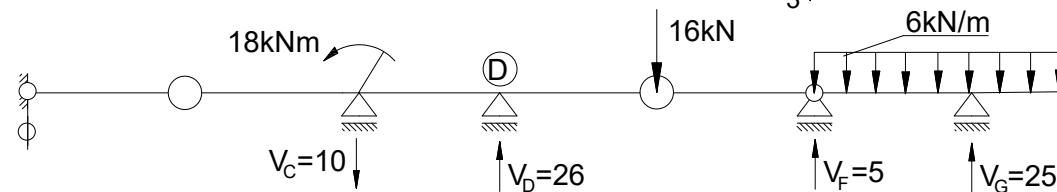
Stan X1=1



Stan X2=1



Obc. zew.



[kNm]

$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

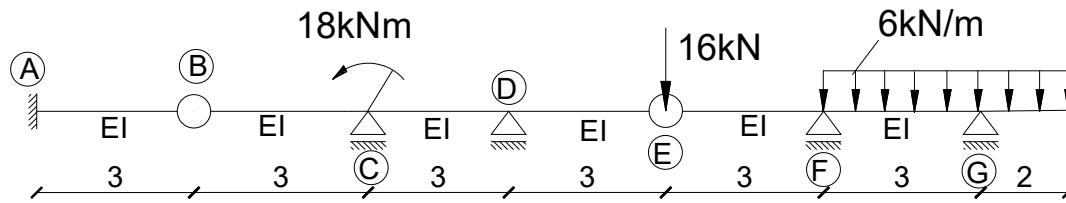
$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$

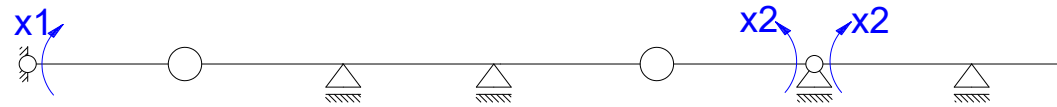
$$+ \frac{1}{EI} \frac{2}{3} \cdot \frac{6 \cdot 3^2}{8} \cdot 3 \cdot \frac{1}{2} \cdot 1 = \frac{105,75}{EI}$$

Układ równań metody sił:

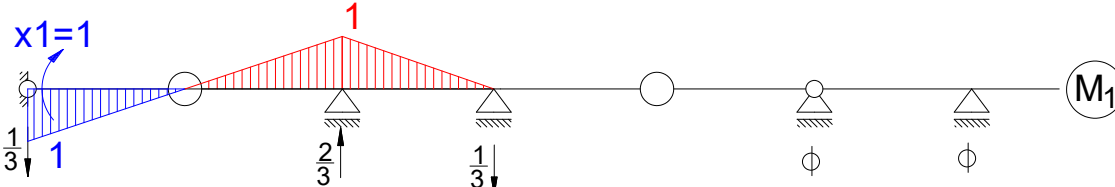
$$\begin{cases} \delta_{11} \cdot X_1 + \delta_{12} \cdot X_2 + \delta_{10} = 0 \\ \delta_{21} \cdot X_1 + \delta_{22} \cdot X_2 + \delta_{20} = 0 \end{cases}$$



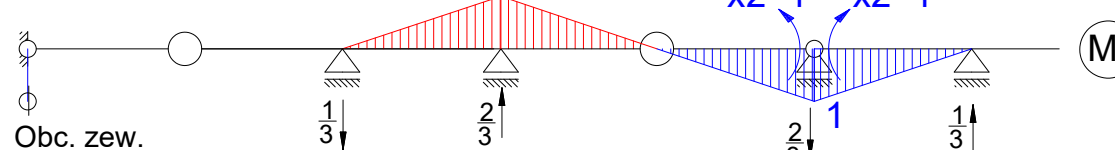
Schemat podstawowy:



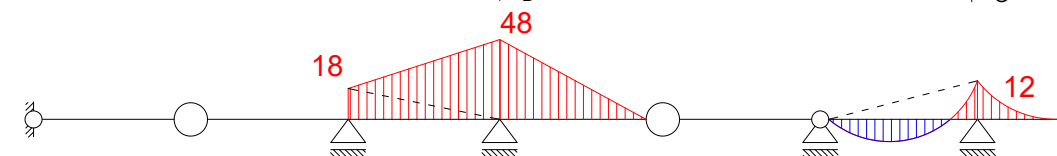
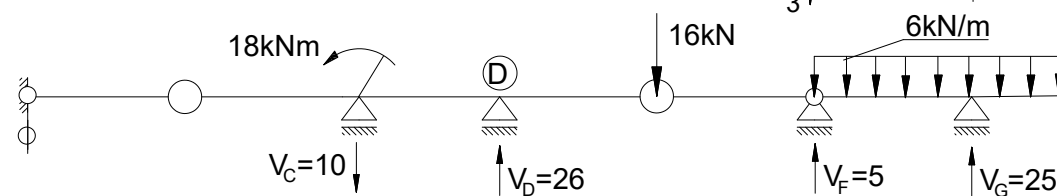
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



[kNm]

$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

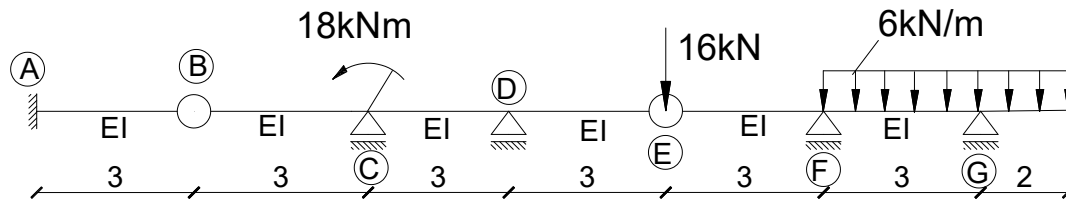
$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$

$$+ \frac{1}{EI} \frac{2}{3} \cdot \frac{6 \cdot 3^2}{8} \cdot 3 \cdot \frac{1}{2} \cdot 1 = \frac{105,75}{EI}$$

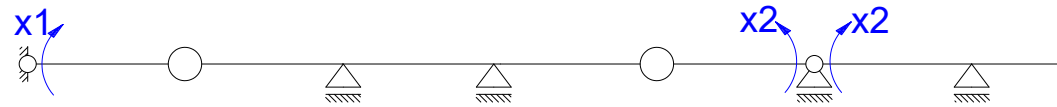
Układ równań metody sił:

$$\begin{cases} \delta_{11} \cdot X_1 + \delta_{12} \cdot X_2 + \delta_{10} = 0 \\ \delta_{21} \cdot X_1 + \delta_{22} \cdot X_2 + \delta_{20} = 0 \end{cases}$$

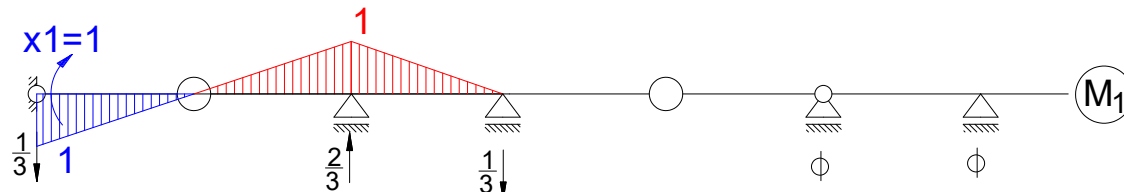
$$\begin{cases} \frac{3}{EI} \cdot X_1 + \frac{1}{2EI} \cdot X_2 + \frac{42}{EI} = 0 \\ \frac{1}{2EI} \cdot X_1 + \frac{4}{EI} \cdot X_2 + \frac{105,75}{EI} = 0 \end{cases}$$



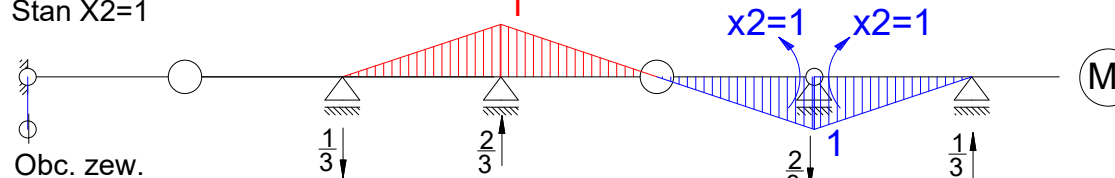
Schemat podstawowy:



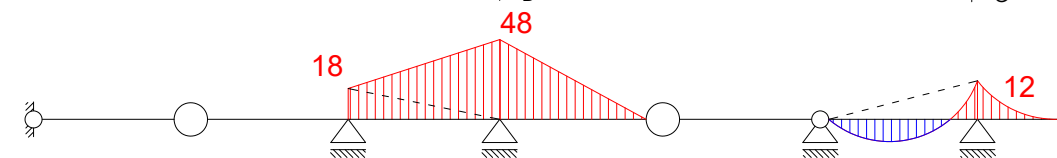
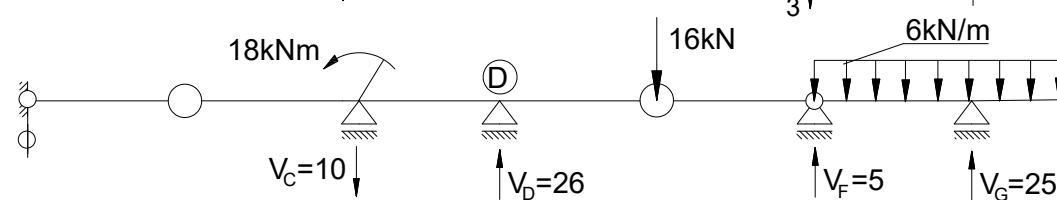
Stan $X_1=1$



Stan $X_2=1$



Obc. zew.



$$\begin{cases} \frac{3}{EI} \cdot X_1 + \frac{1}{2EI} \cdot X_2 + \frac{42}{EI} = 0 \\ \frac{1}{2EI} \cdot X_1 + \frac{4}{EI} \cdot X_2 + \frac{105,75}{EI} = 0 \end{cases} \rightarrow \begin{cases} X_1 = -9,8 \text{ kNm} \\ X_2 = -25,21 \text{ kNm} \end{cases}$$

$$\delta_{11} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 3 = \frac{3}{EI}$$

$$\delta_{12} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{1}{3} \cdot 1 \right) = \frac{1}{2EI} = \delta_{21}$$

$$\delta_{22} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \cdot \frac{2}{3} \cdot 1 \right) \cdot 4 = \frac{4}{EI}$$

$$\delta_{10} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{2}{3} \cdot 18 + \frac{1}{3} \cdot 48 \right) = \frac{42}{EI}$$

$$\delta_{20} = \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \left(\frac{1}{3} \cdot 18 + \frac{2}{3} \cdot 48 \right)$$

$$+ \frac{1}{EI} \left(\frac{1}{2} \cdot 1 \cdot 3 \right) \cdot \frac{2}{3} \cdot 48$$

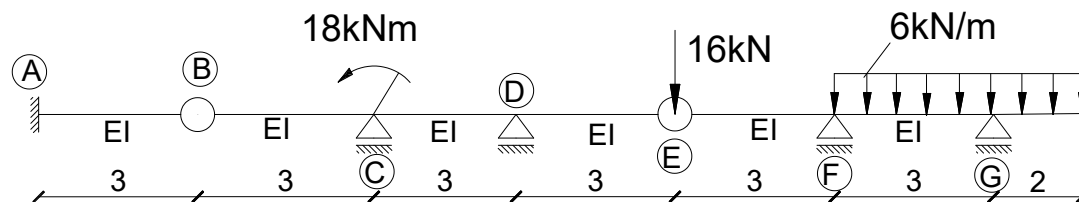
$$- \frac{1}{EI} \left(\frac{1}{2} \cdot 12 \cdot 3 \right) \cdot \frac{1}{3} \cdot 1$$

$$+ \frac{1}{EI} \frac{2}{3} \cdot \frac{6 \cdot 3^2}{8} \cdot 3 \cdot \frac{1}{2} \cdot 1 = \frac{105,75}{EI}$$

Układ równań metody sił:

$$\begin{cases} \delta_{11} \cdot X_1 + \delta_{12} \cdot X_2 + \delta_{10} = 0 \\ \delta_{21} \cdot X_1 + \delta_{22} \cdot X_2 + \delta_{20} = 0 \end{cases}$$

dr inż. Hanna Weber



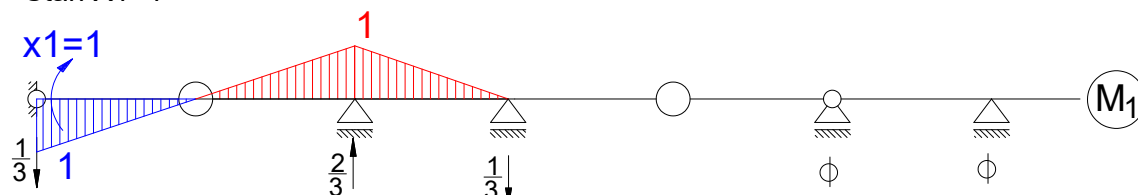
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

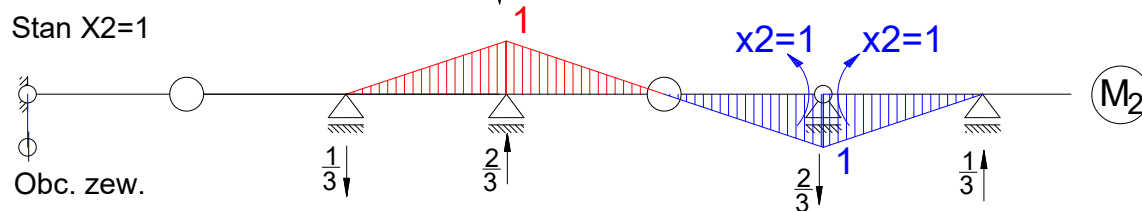
Schemat podstawowy:



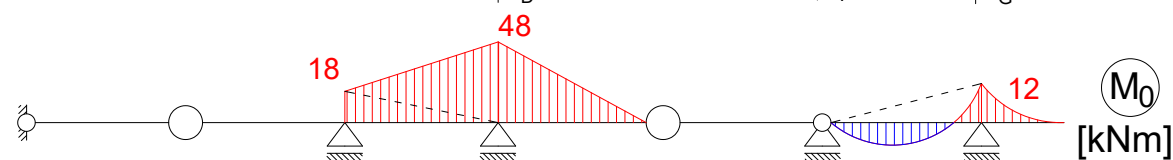
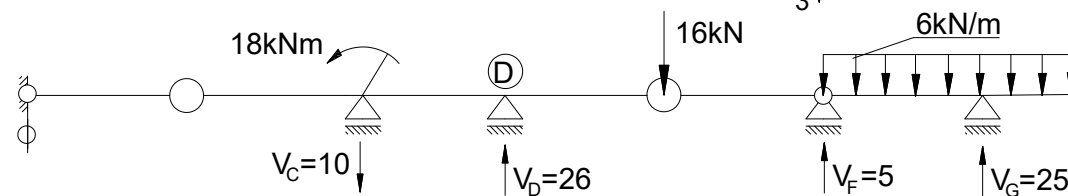
Stan $X1=1$

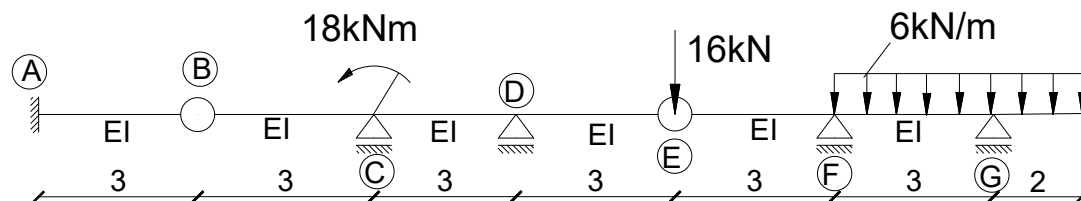


Stan $X2=1$



Obc. zew.





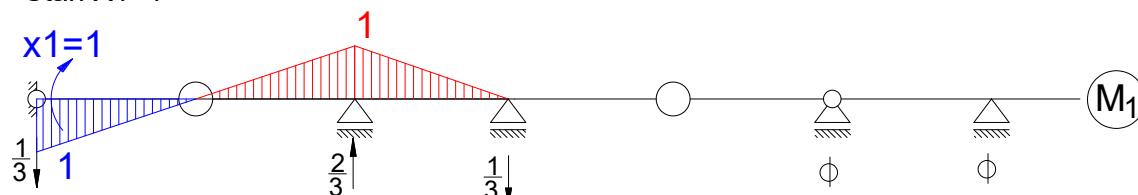
$$X1 = -9,8\text{kNm}$$

$$X2 = -25,21\text{kNm}$$

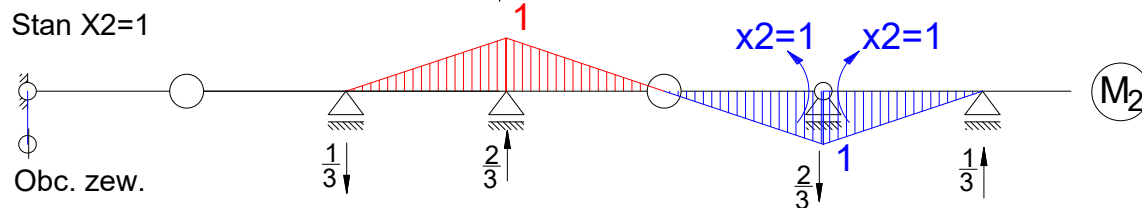
Schemat podstawowy:



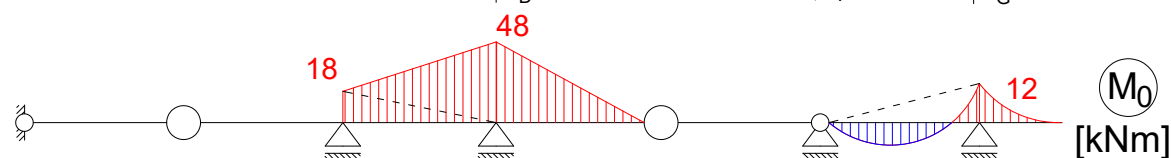
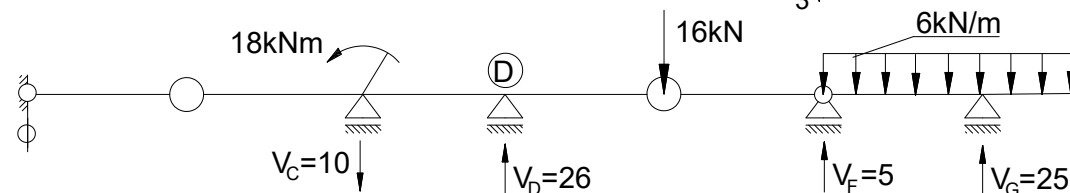
Stan $X1=1$



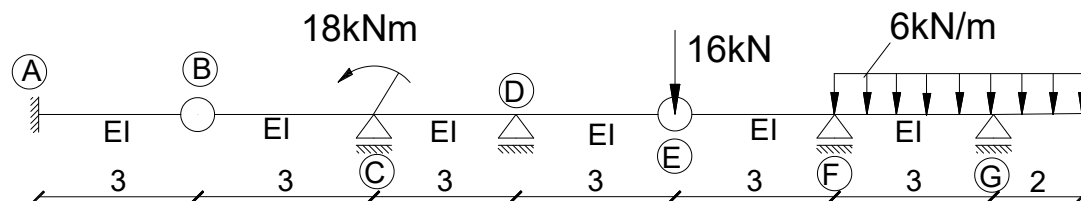
Stan $X2=1$



Obc. zew.



Wyznaczenie końcowego wykresu momentów:



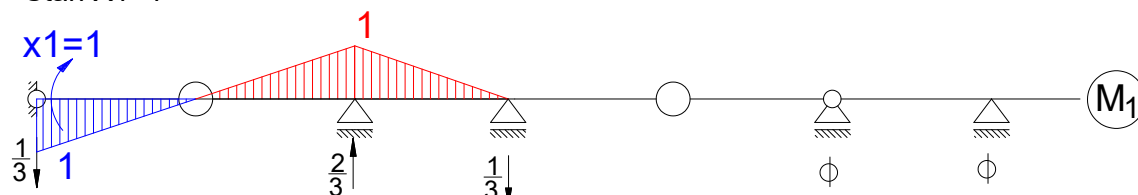
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

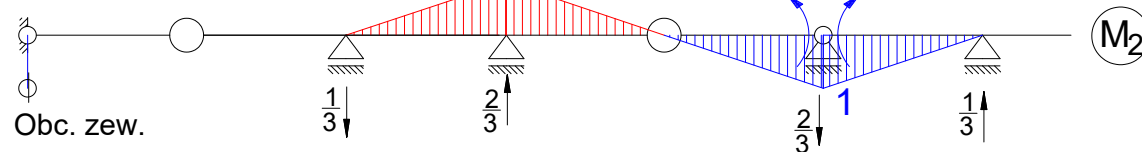
Schemat podstawowy:



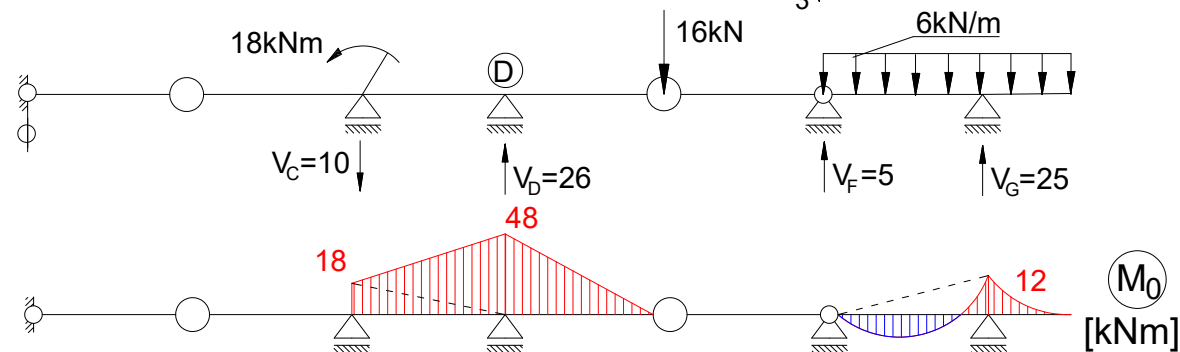
Stan $X1=1$



Stan $X2=1$

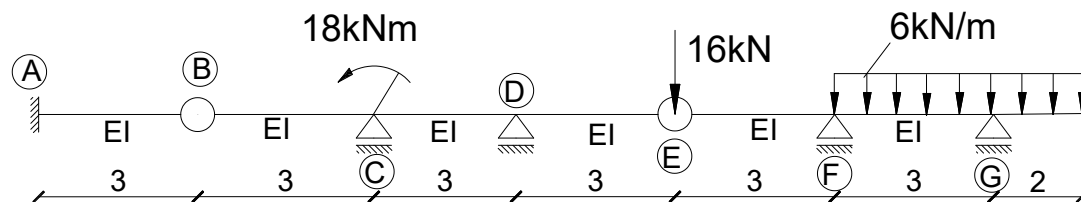


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



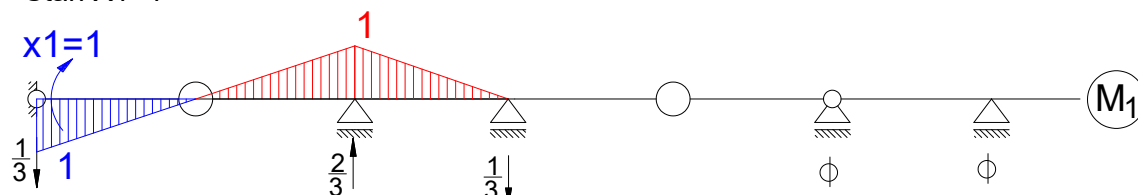
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

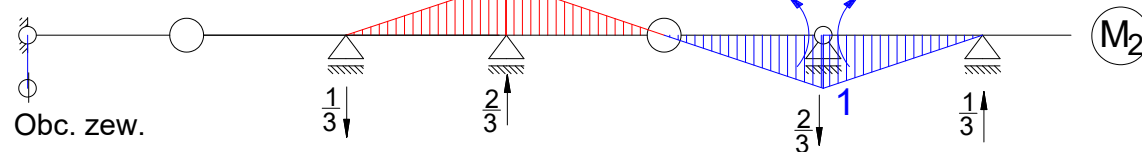
Schemat podstawowy:



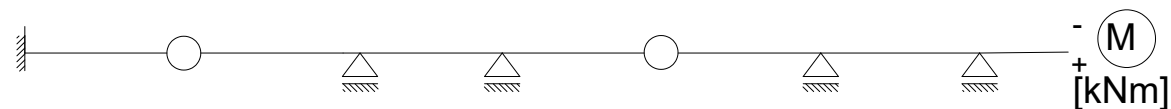
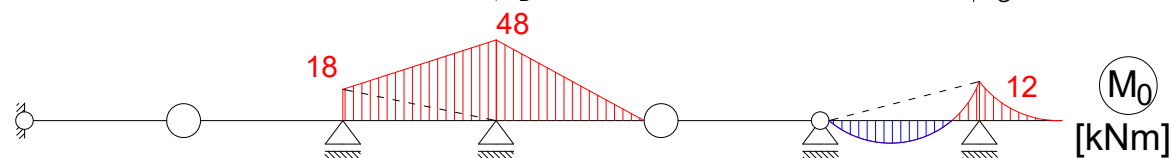
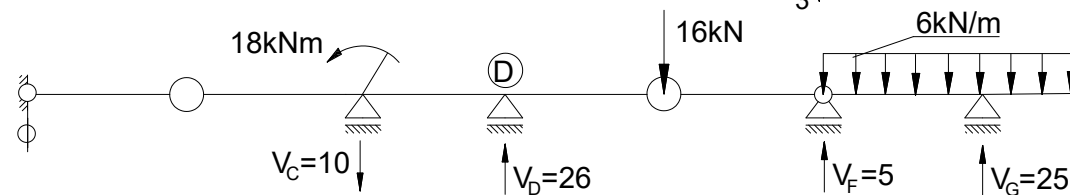
Stan $X1=1$



Stan $X2=1$

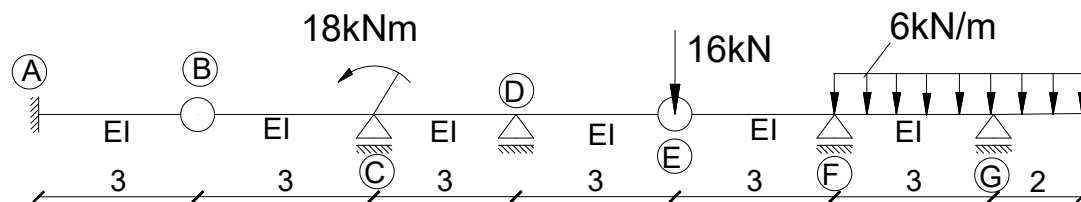


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



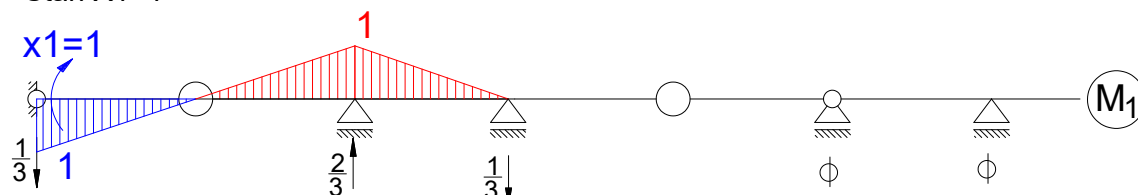
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

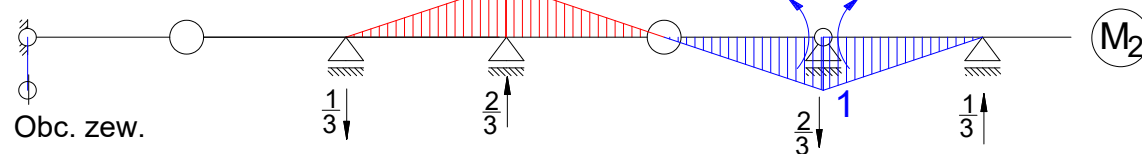
Schemat podstawowy:



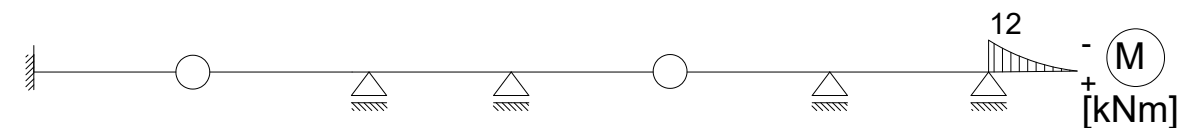
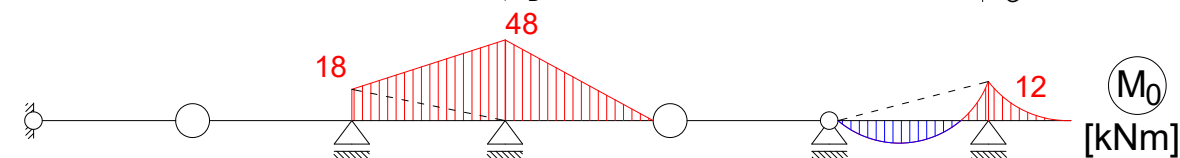
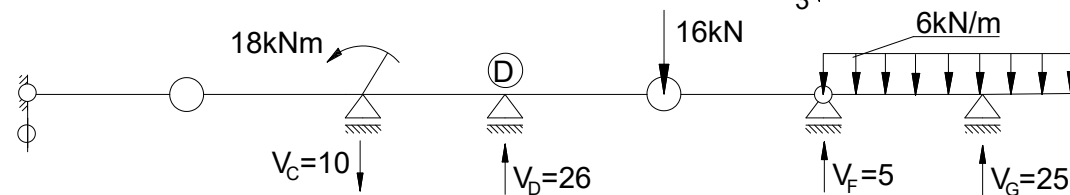
Stan $X1=1$



Stan $X2=1$

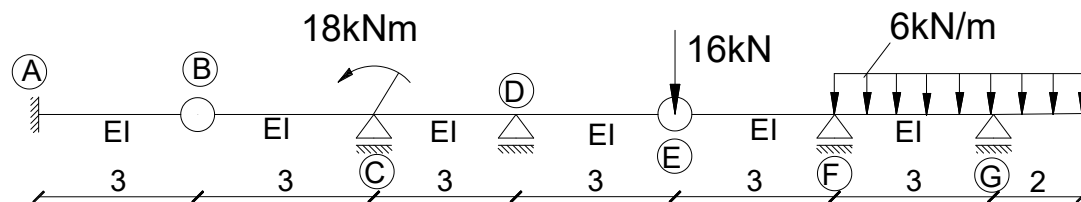


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



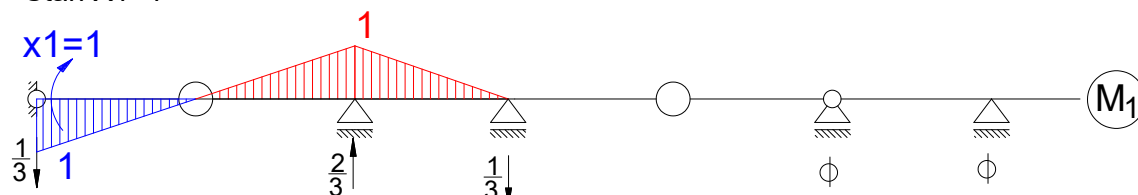
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

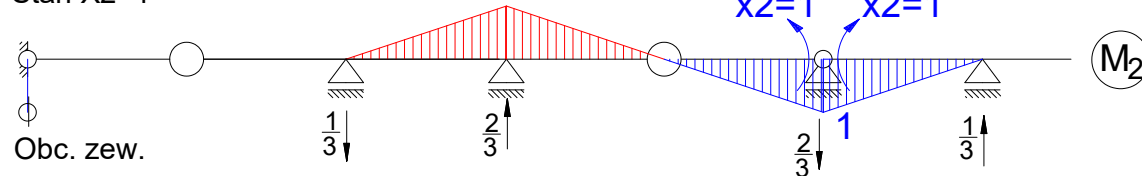
Schemat podstawowy:



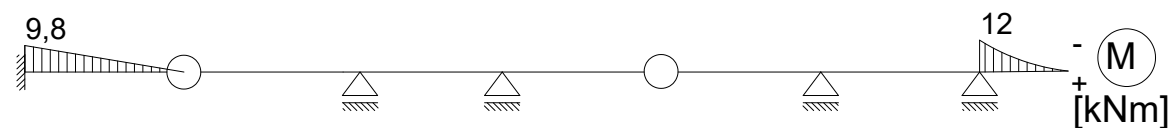
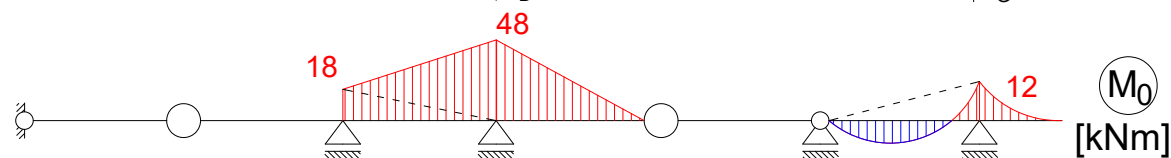
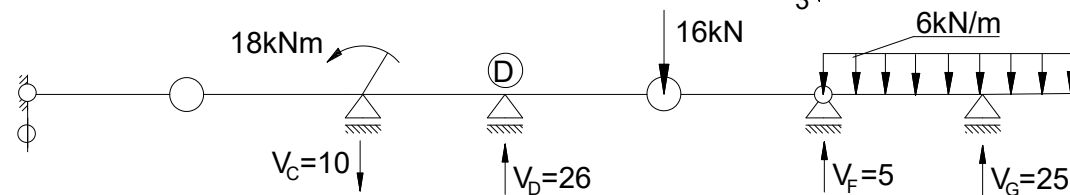
Stan $X1=1$



Stan $X2=1$

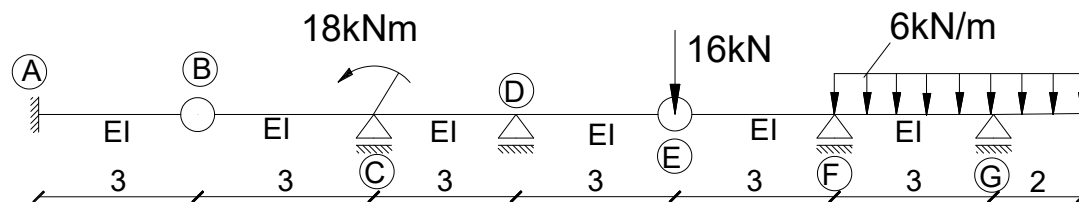


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



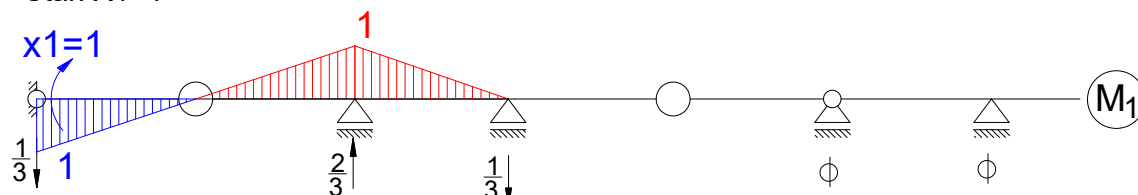
$$X1 = -9,8 kNm$$

$$X2 = -25,21 kNm$$

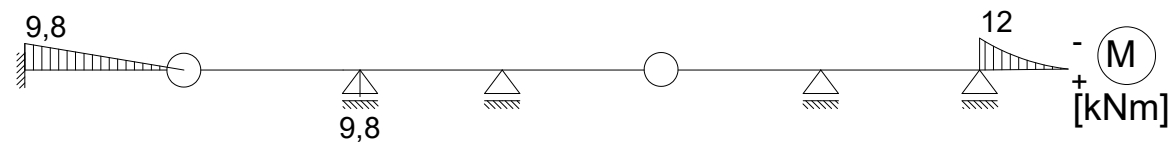
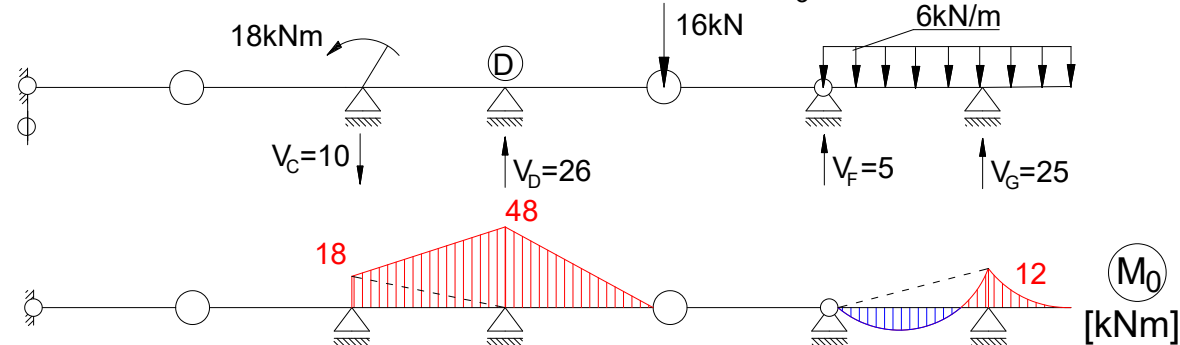
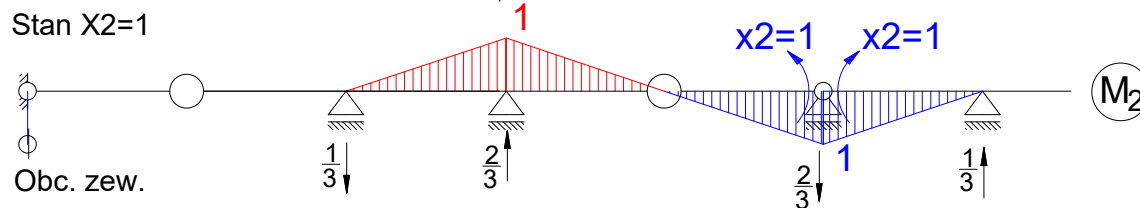
Schemat podstawowy:



Stan $X1=1$

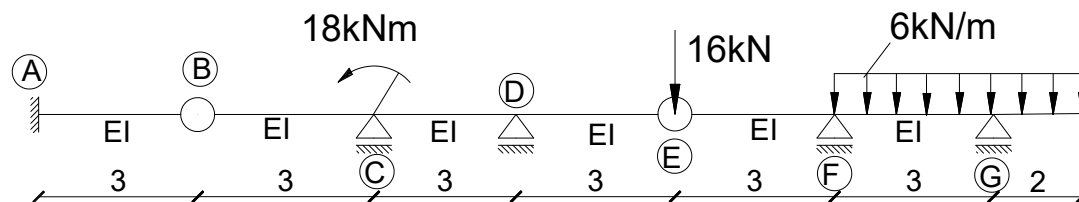


Stan $X2=1$



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



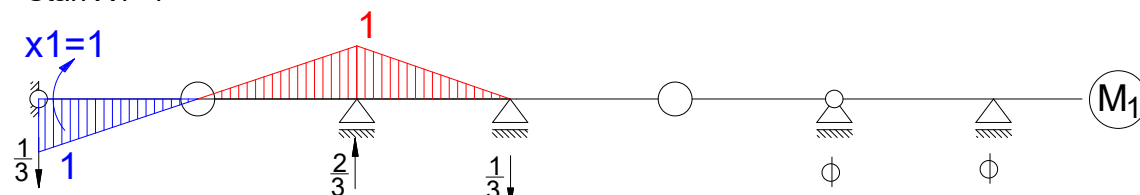
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

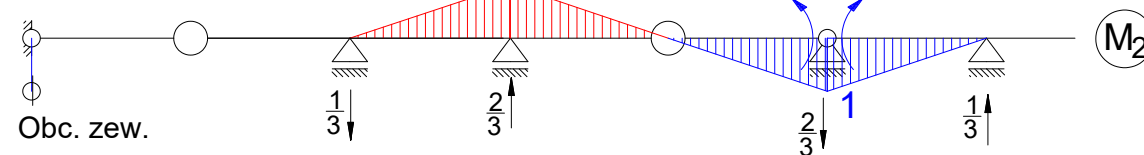
Schemat podstawowy:



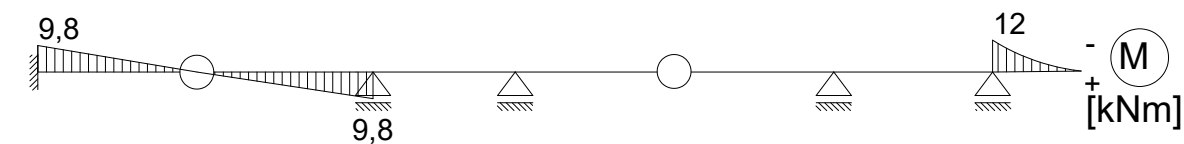
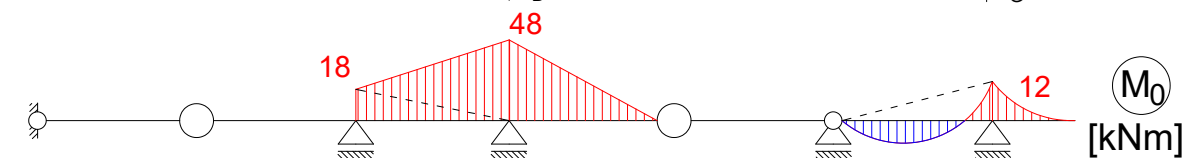
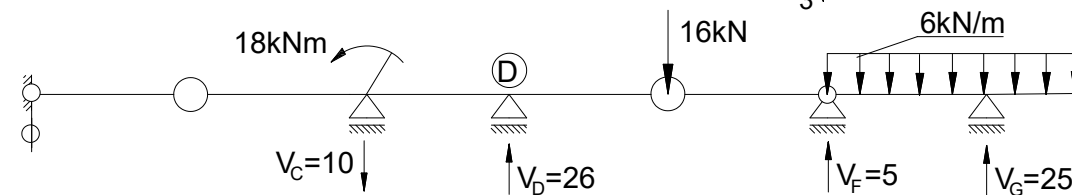
Stan $X1=1$



Stan $X2=1$

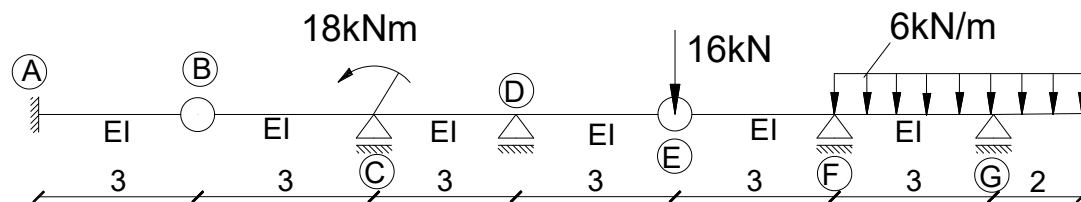


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



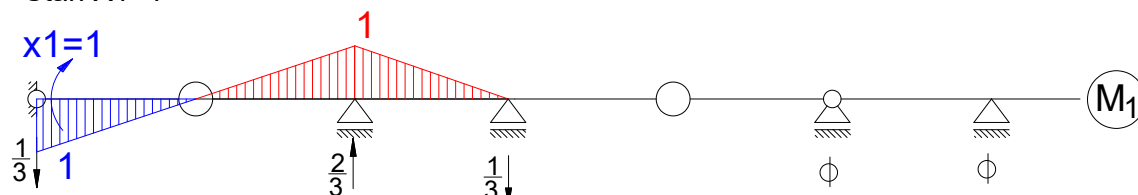
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

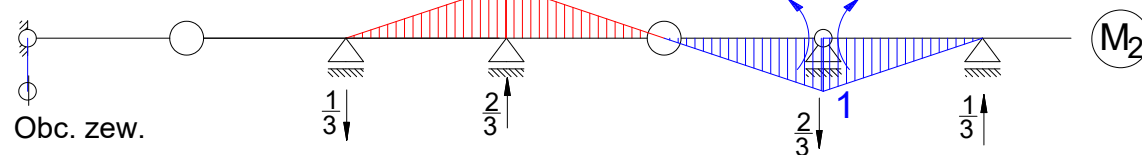
Schemat podstawowy:



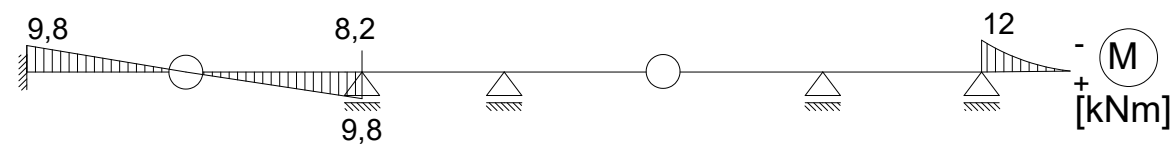
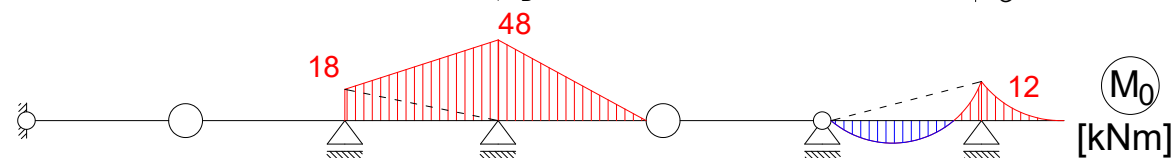
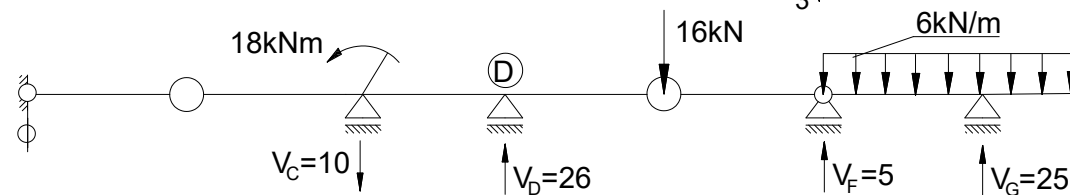
Stan $X1=1$



Stan $X2=1$

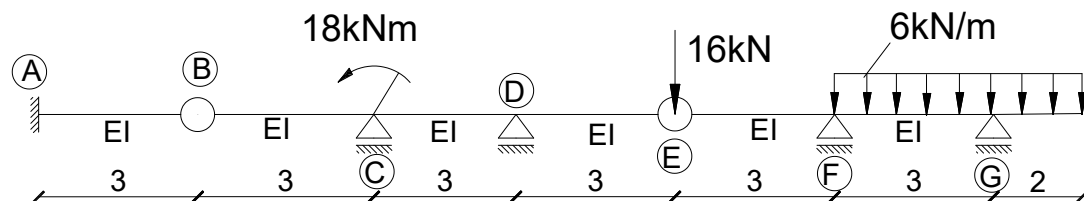


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



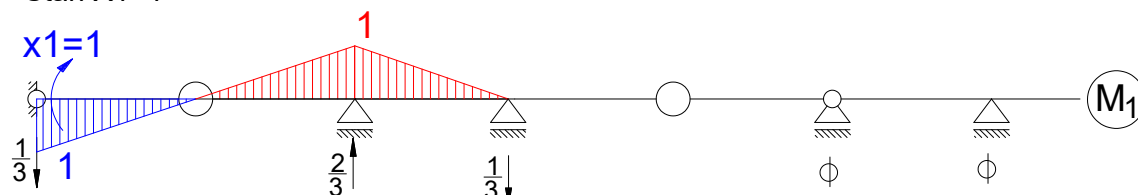
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

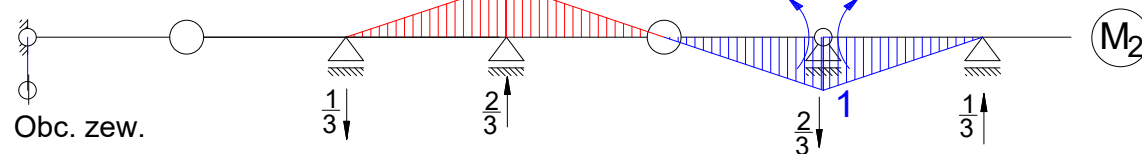
Schemat podstawowy:



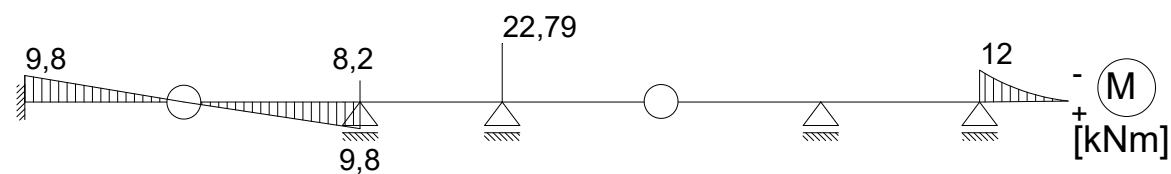
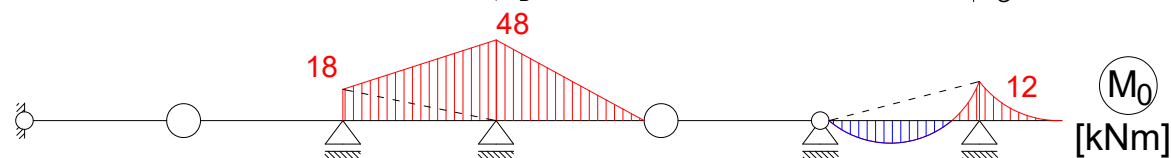
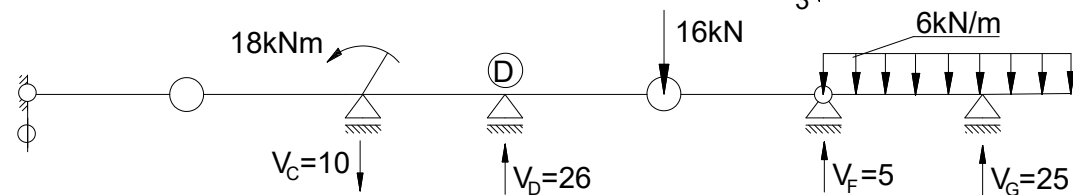
Stan $X1=1$



Stan $X2=1$

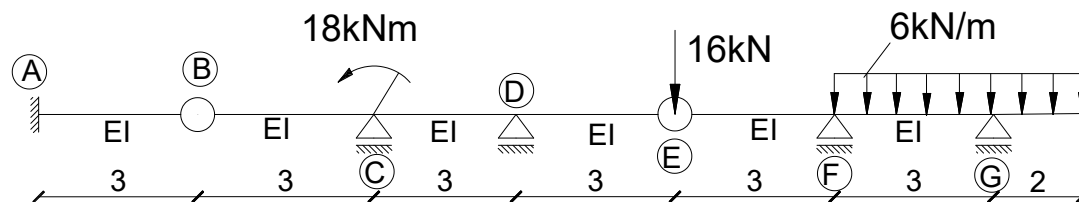


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



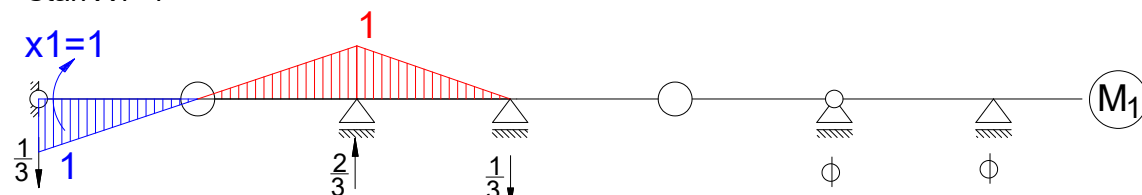
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

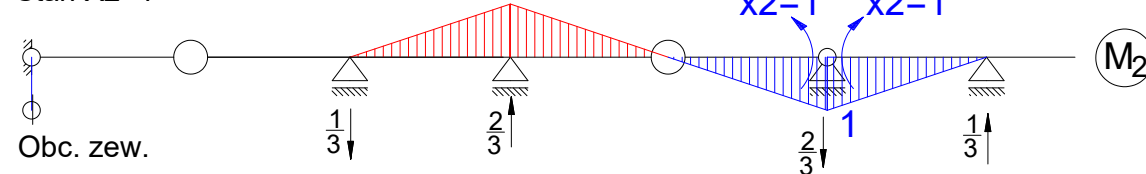
Schemat podstawowy:



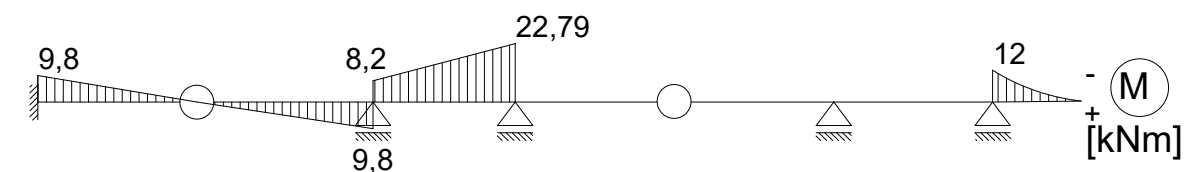
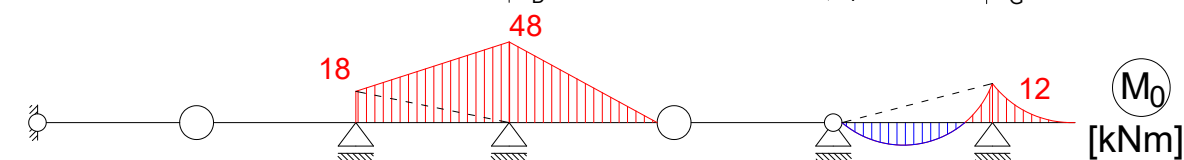
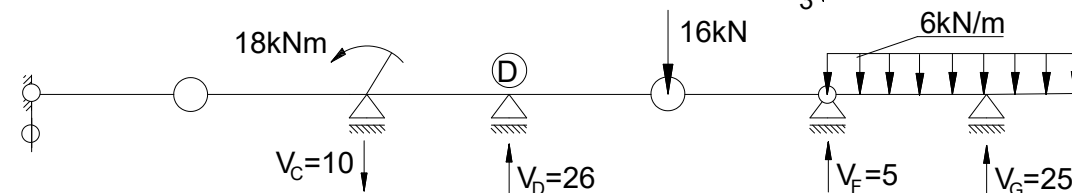
Stan $X1=1$



Stan $X2=1$

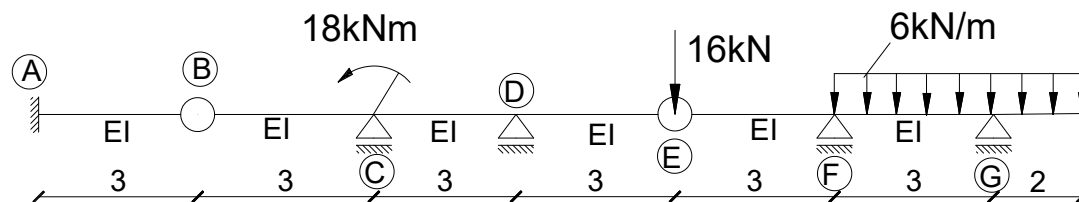


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



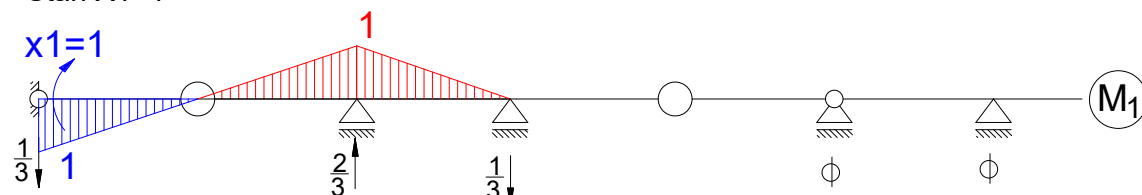
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

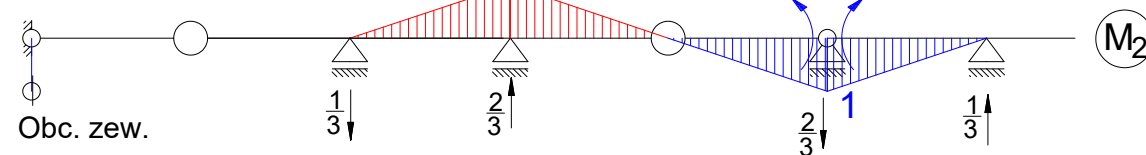
Schemat podstawowy:



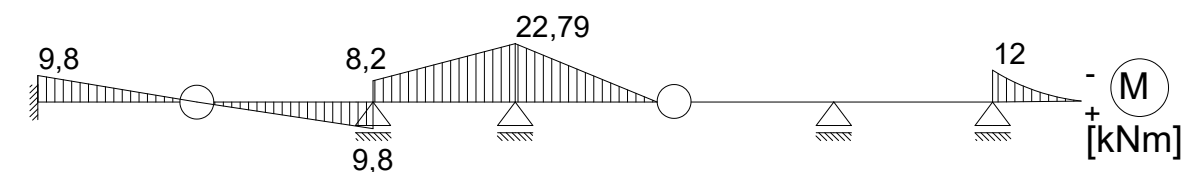
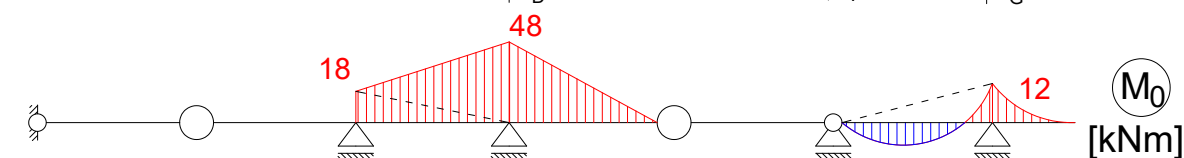
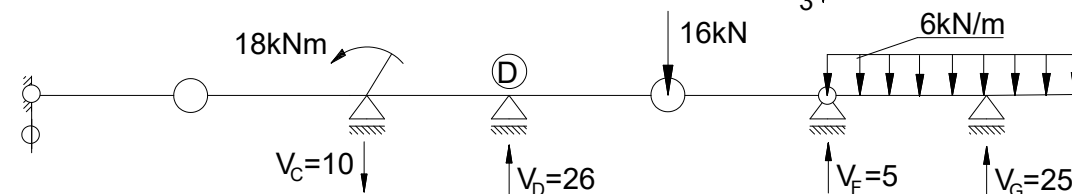
Stan $X1=1$



Stan $X2=1$

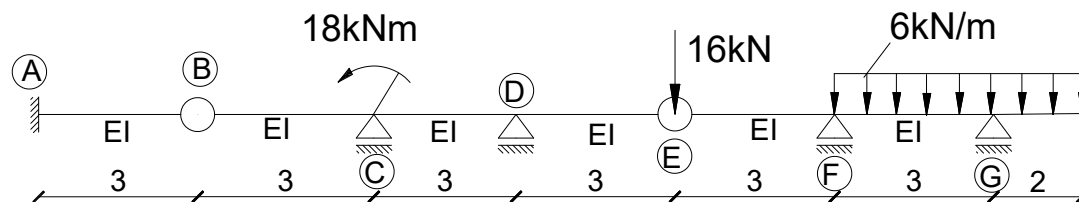


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



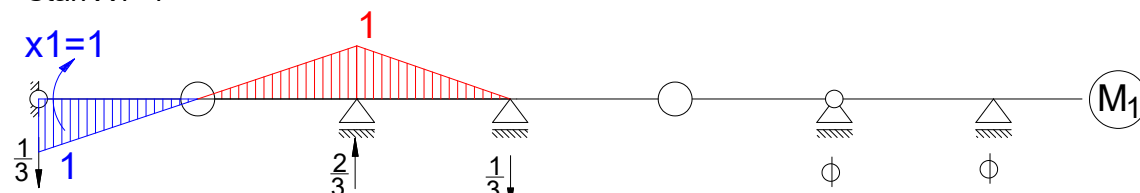
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

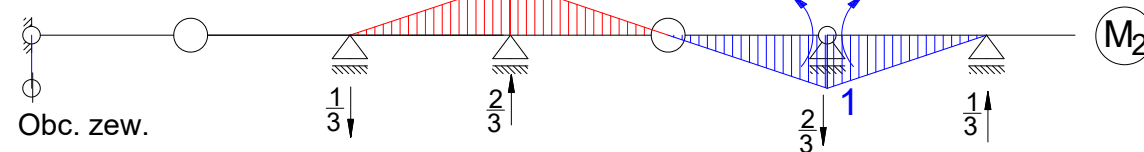
Schemat podstawowy:



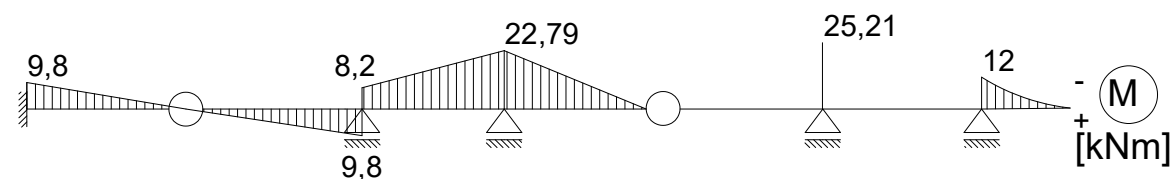
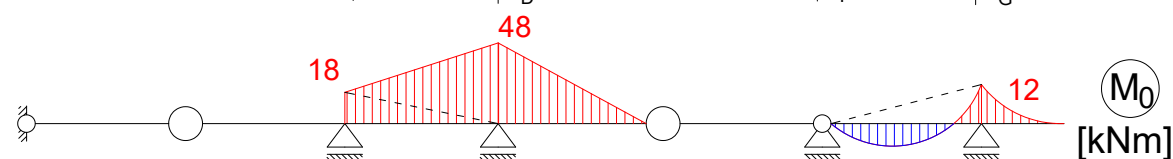
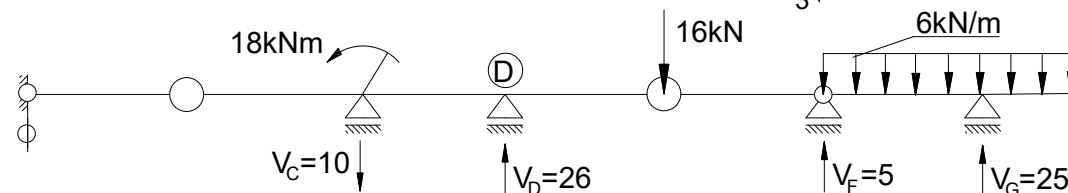
Stan $X1=1$



Stan $X2=1$

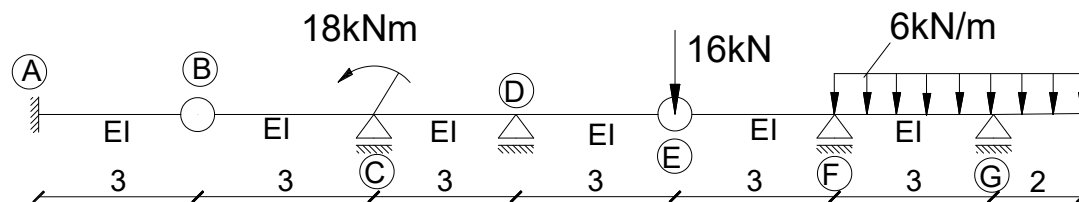


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



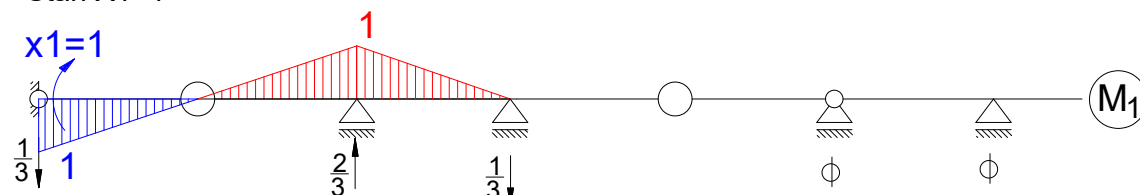
$$X1 = -9,8 \text{ kNm}$$

$$X2 = -25,21 \text{ kNm}$$

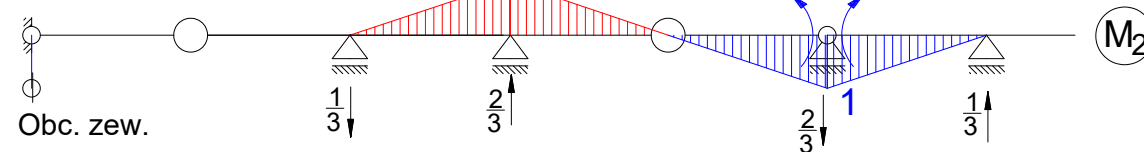
Schemat podstawowy:



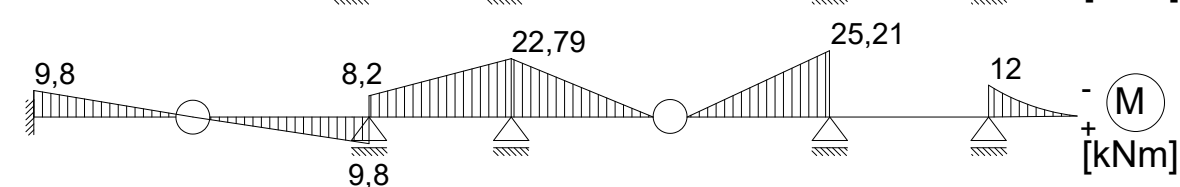
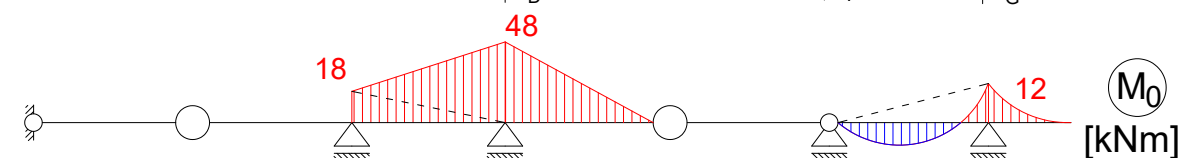
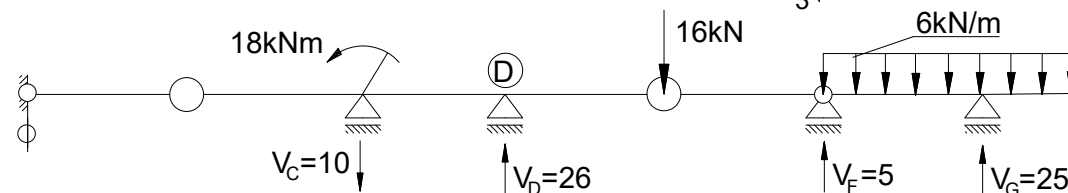
Stan $X1=1$



Stan $X2=1$

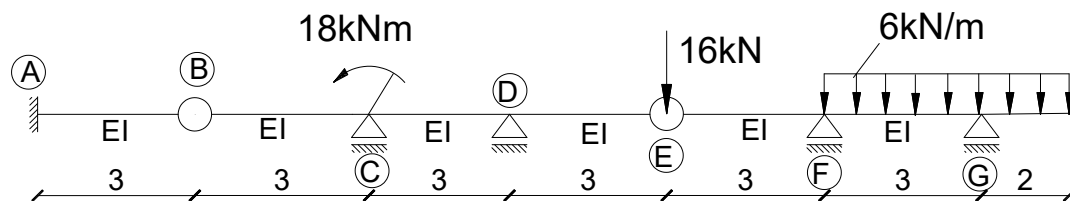


Obc. zew.



Wyznaczenie końcowego wykresu momentów:

$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$



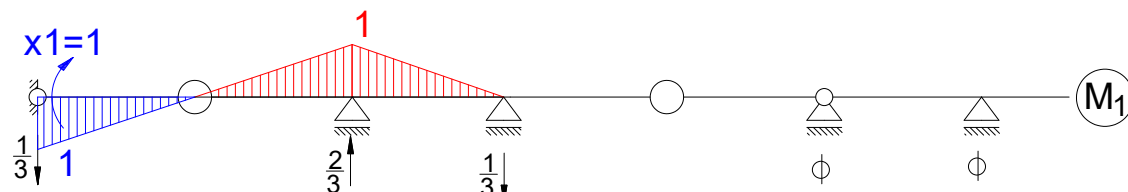
$$X1 = -9,8kNm$$

$$X2 = -25,21kNm$$

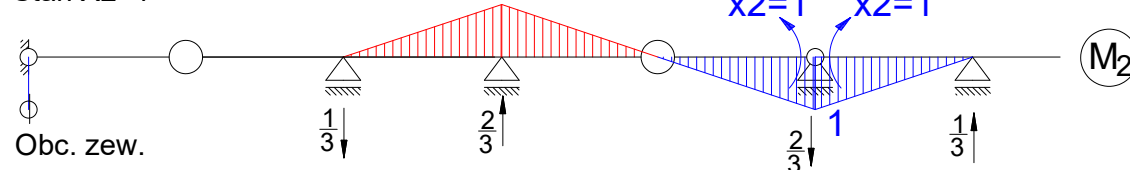
Schemat podstawowy:



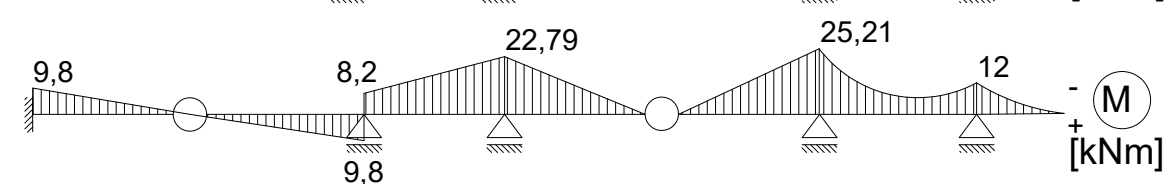
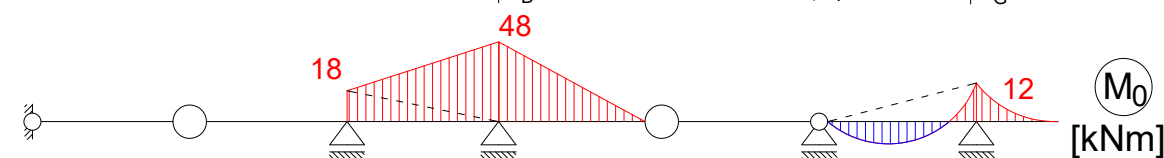
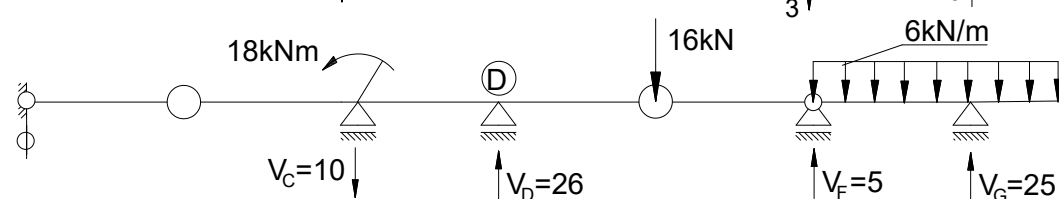
Stan $X1=1$



Stan $X2=1$

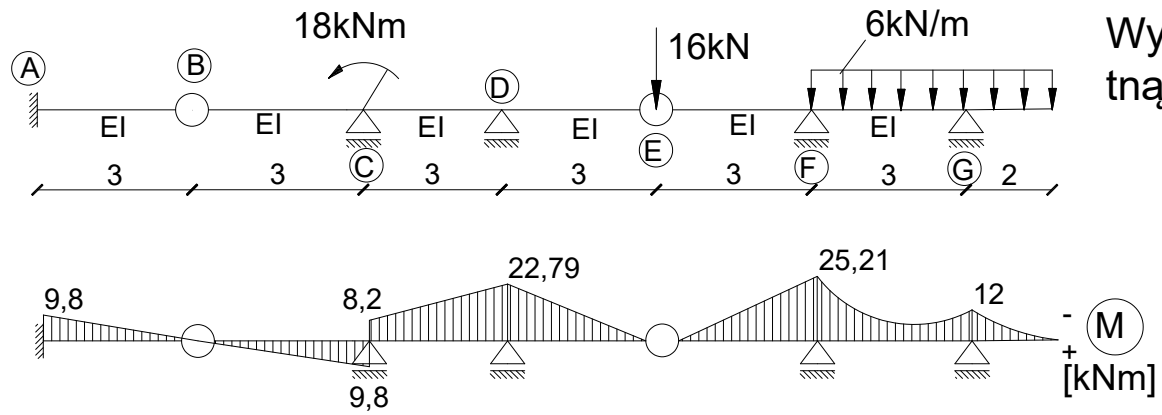


Obc. zew.

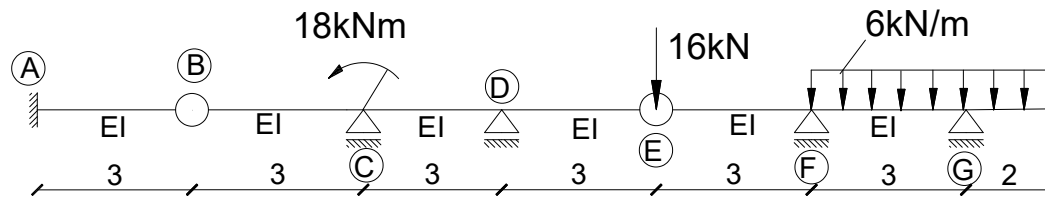


Wyznaczenie końcowego wykresu momentów:

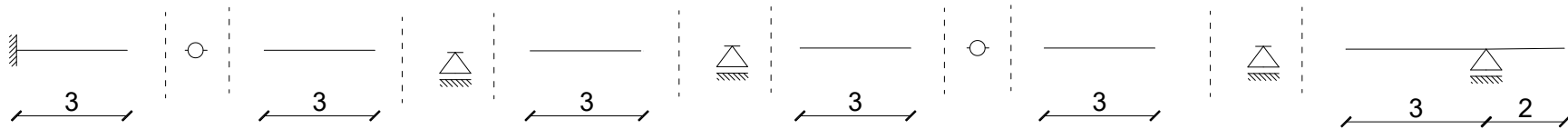
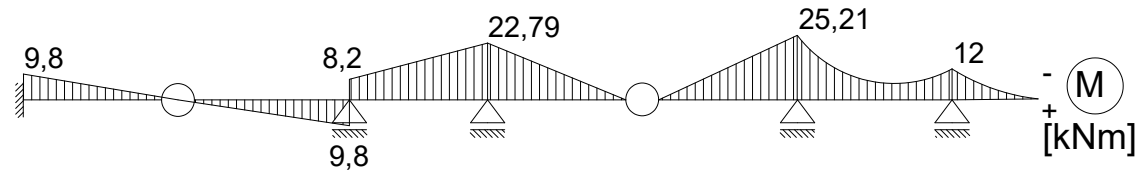
$$M_i = M_{i1} \cdot X1 + M_{i2} \cdot X2 + M_0$$

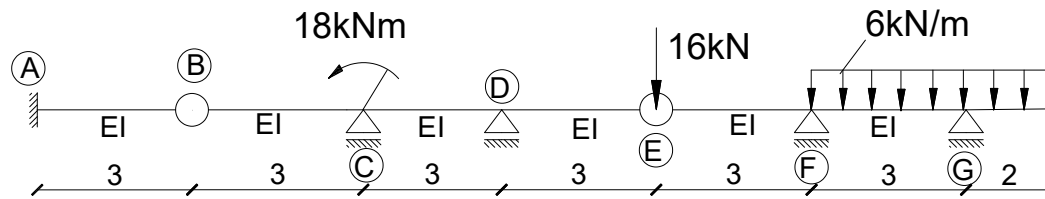


Wyznaczenie sił
tnących:

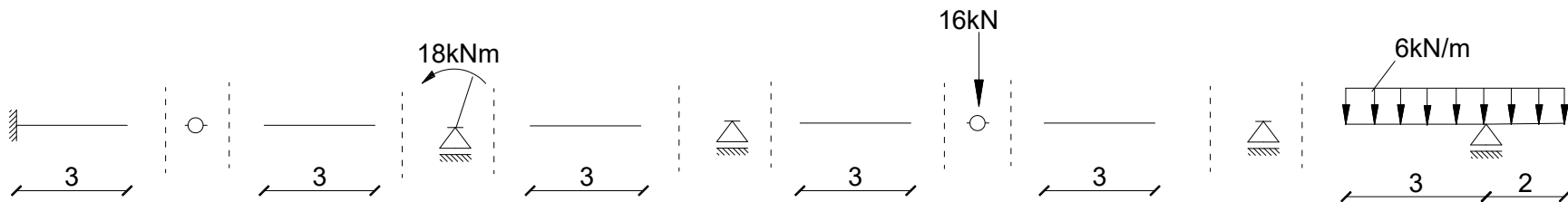
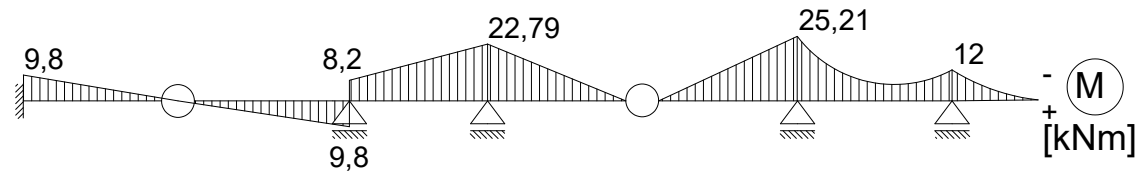


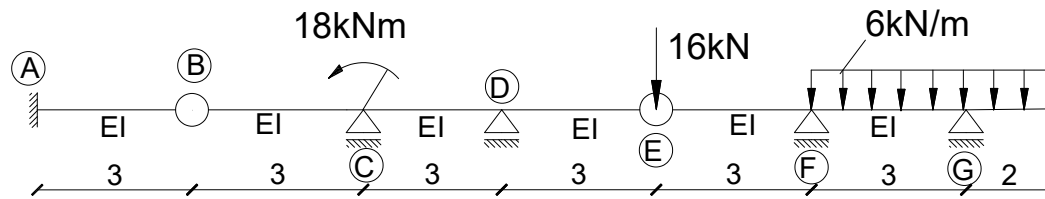
Wyznaczenie sił
tnących:



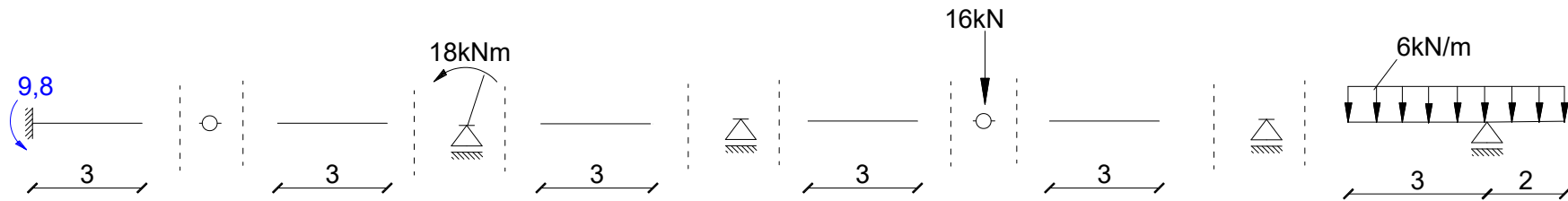
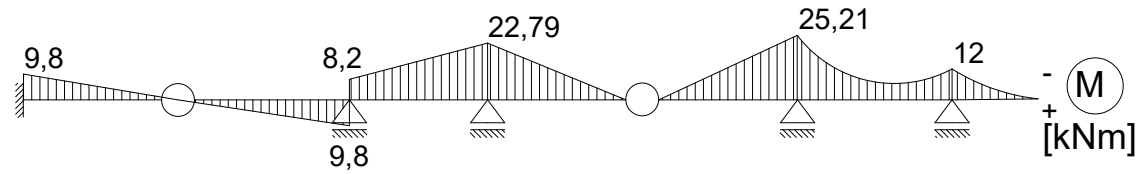


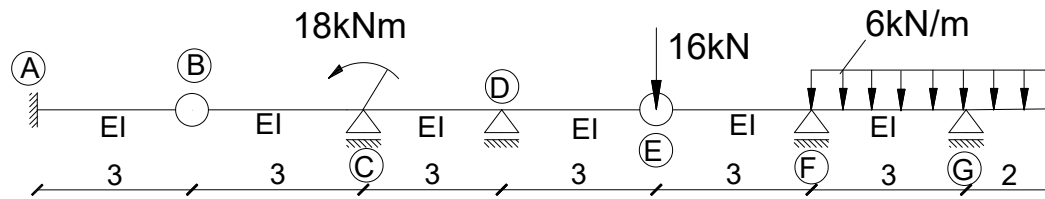
Wyznaczenie sił
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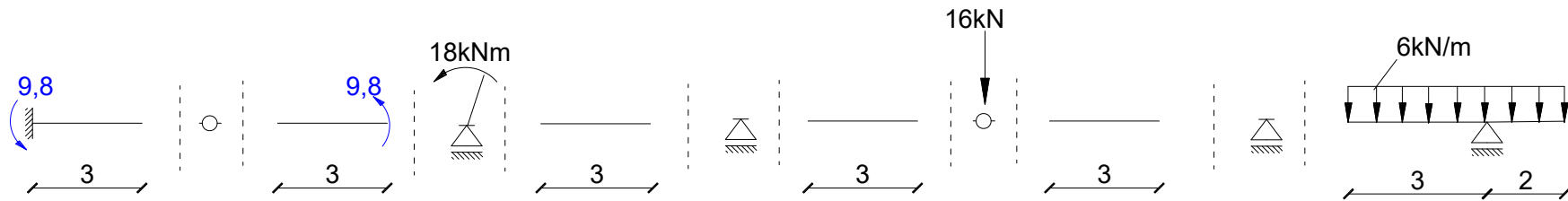
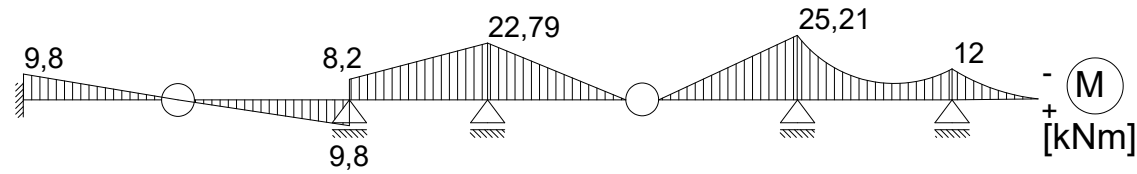


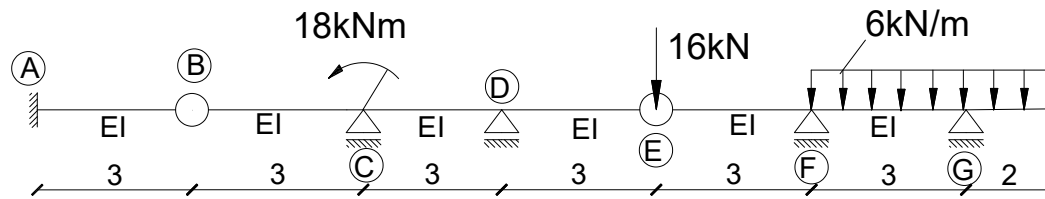
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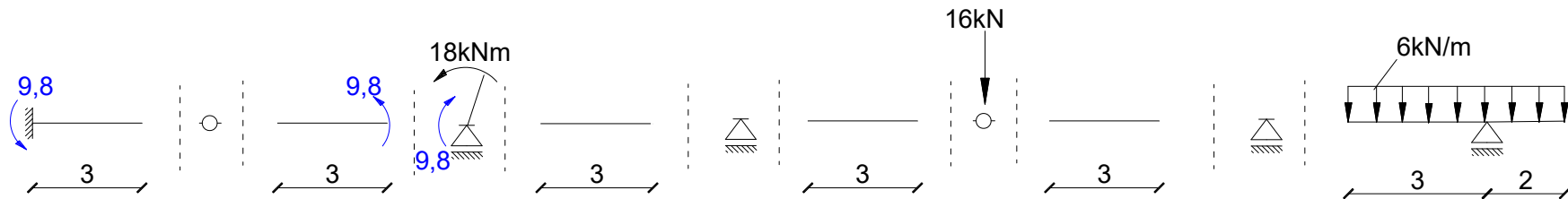
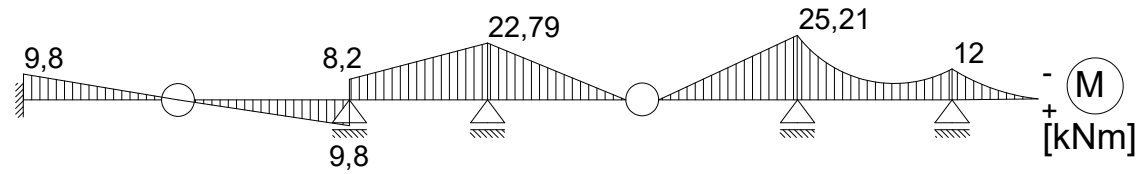


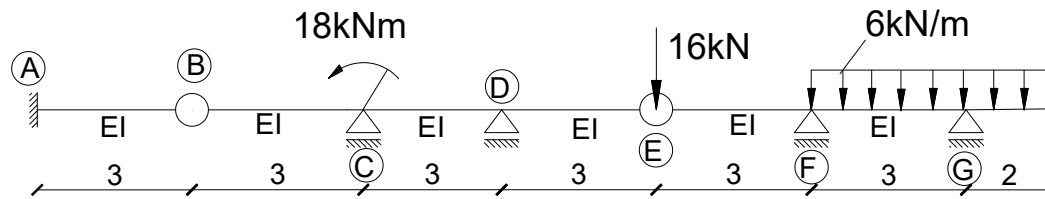
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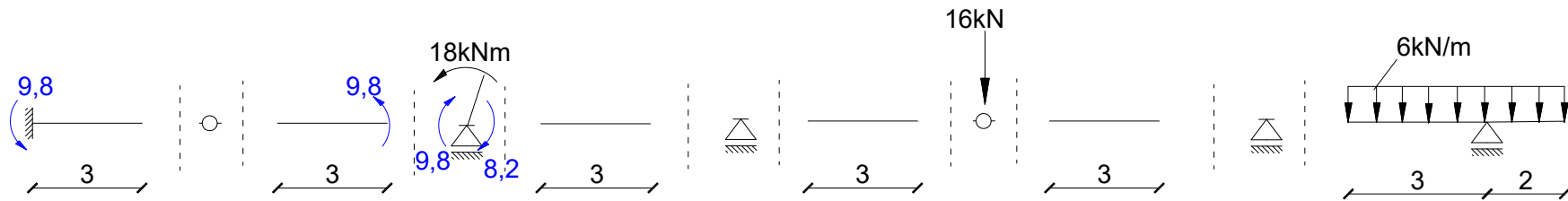
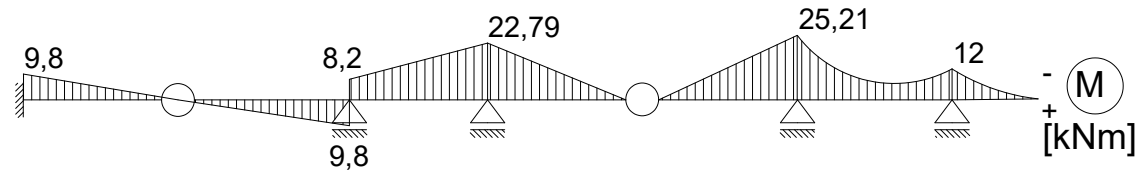


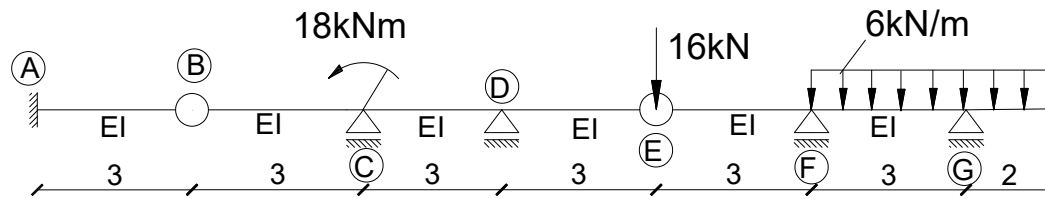
Wyznaczenie sił
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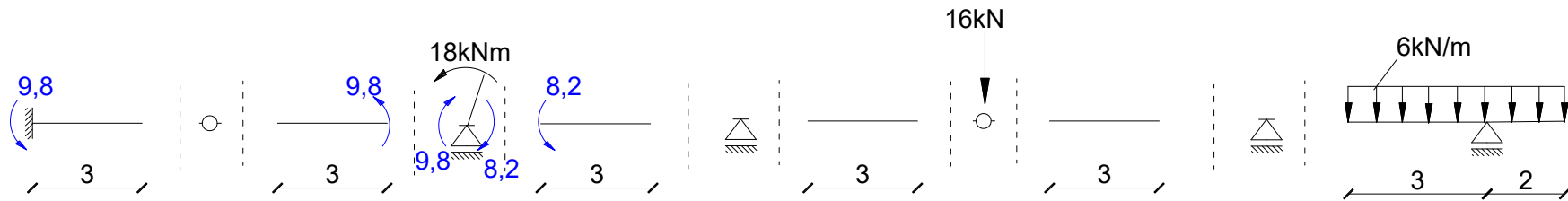
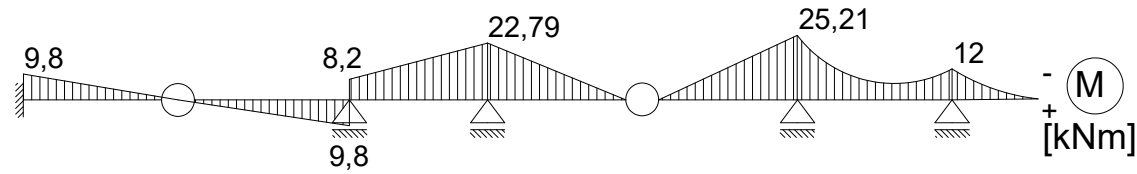


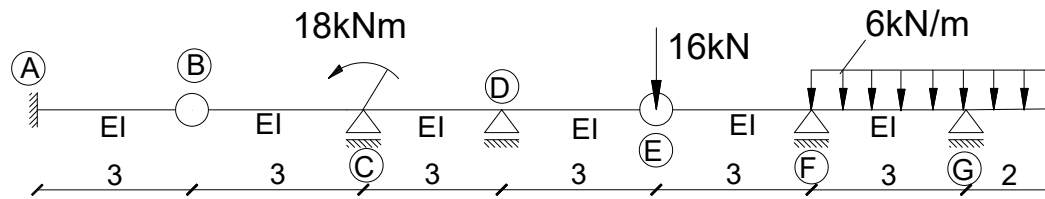
Wyznaczenie sił
tnących:



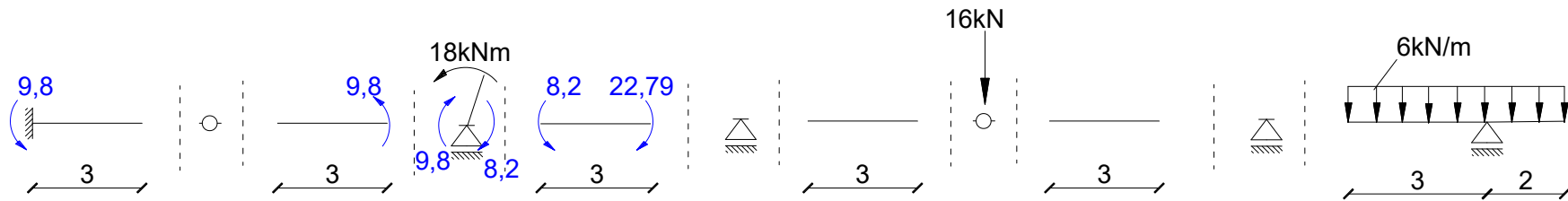
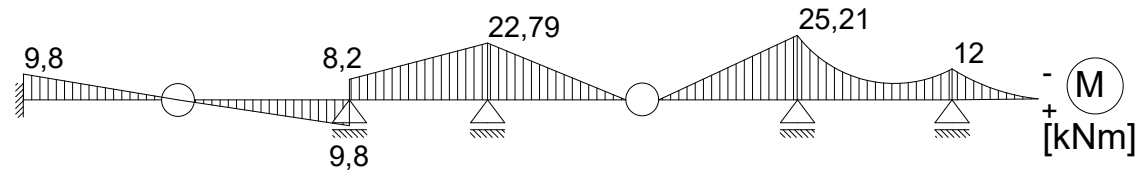


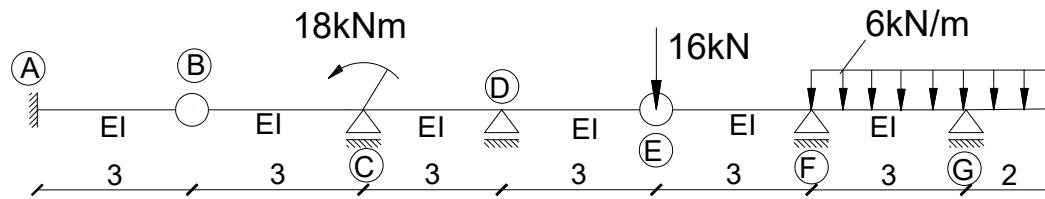
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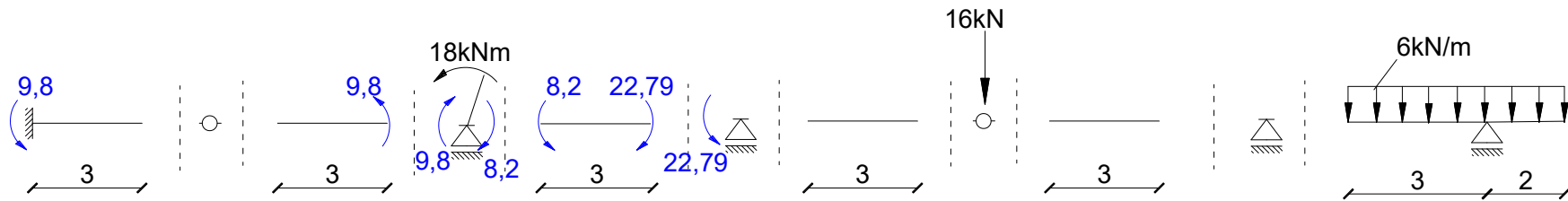
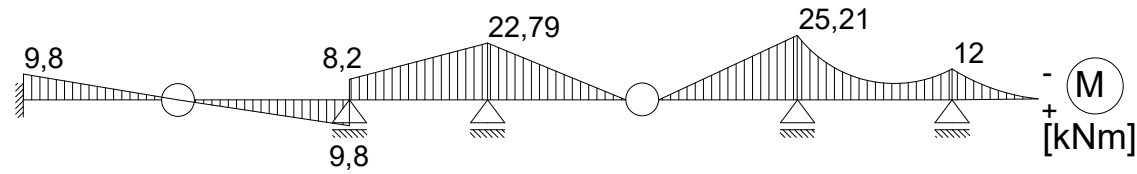


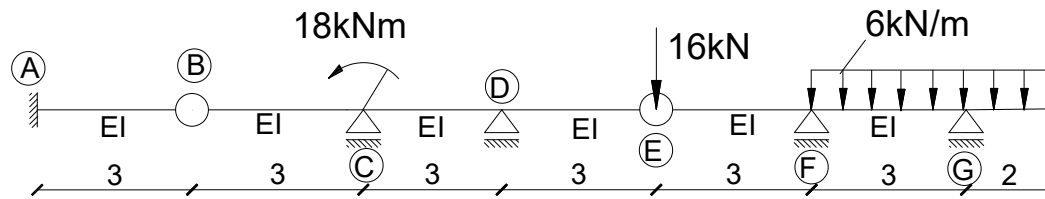
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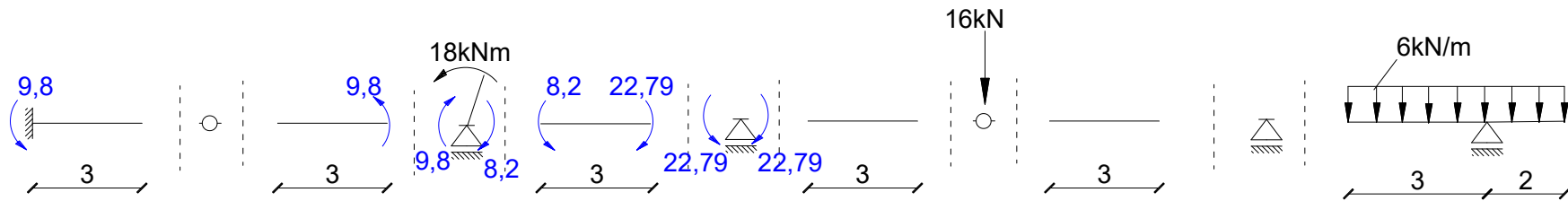
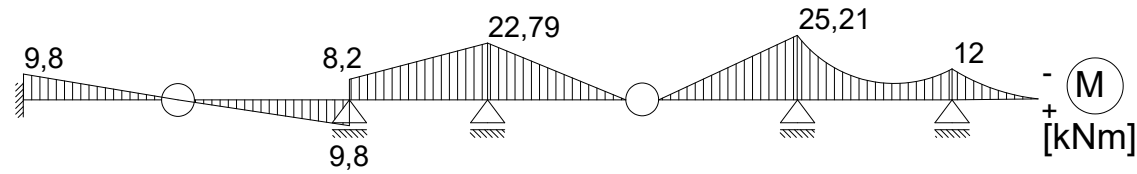


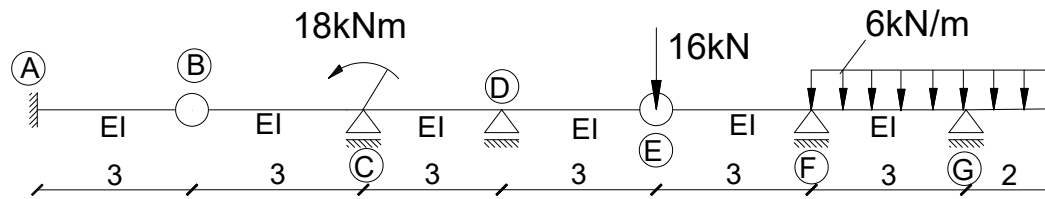
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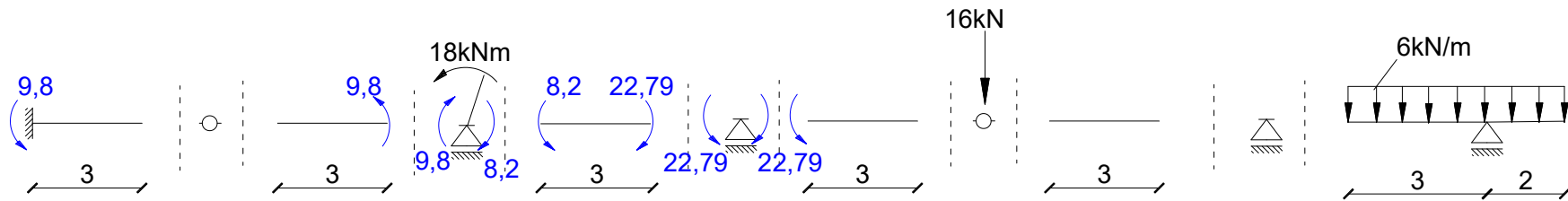
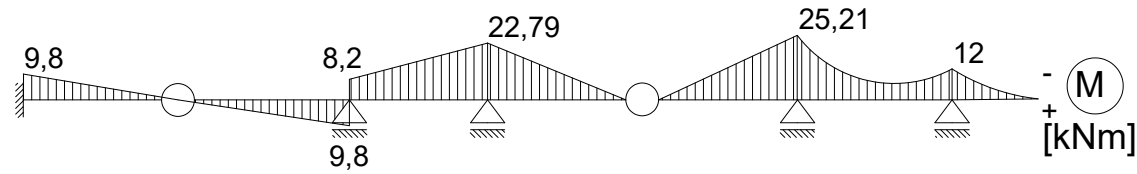


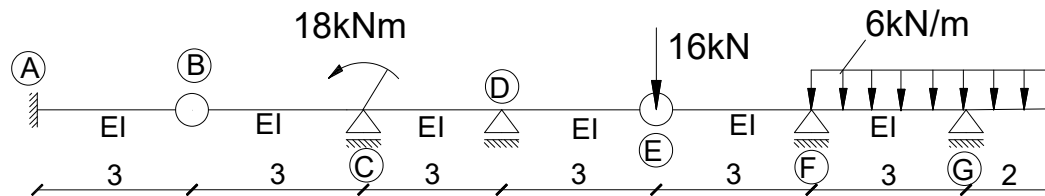
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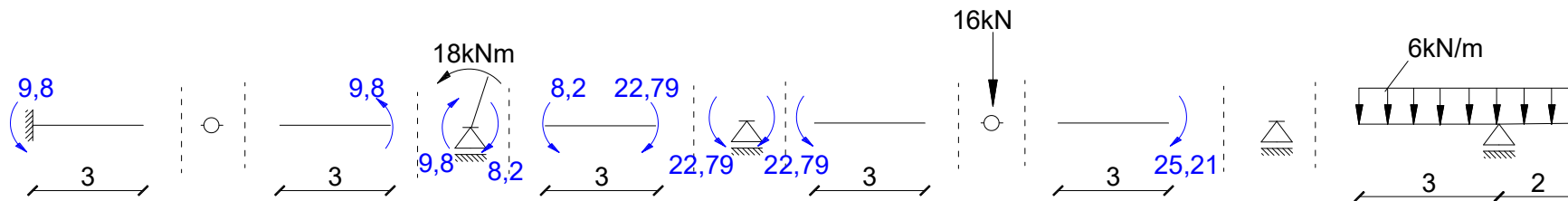
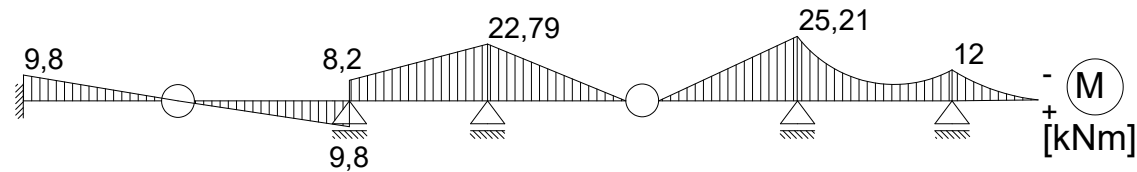


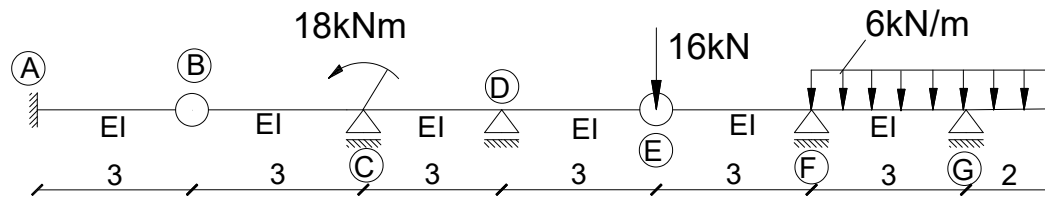
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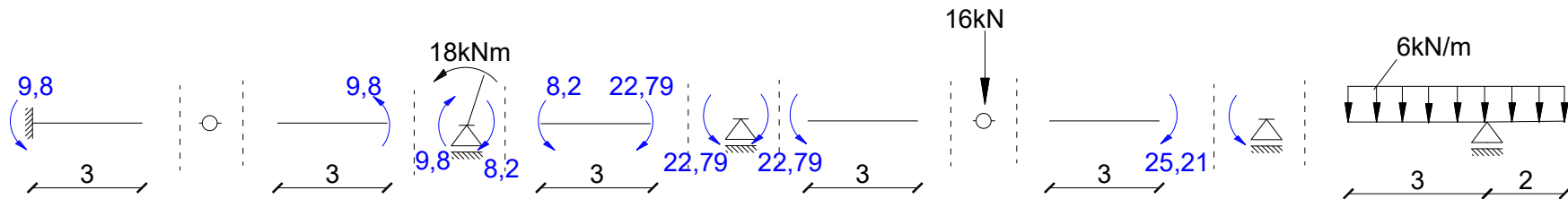
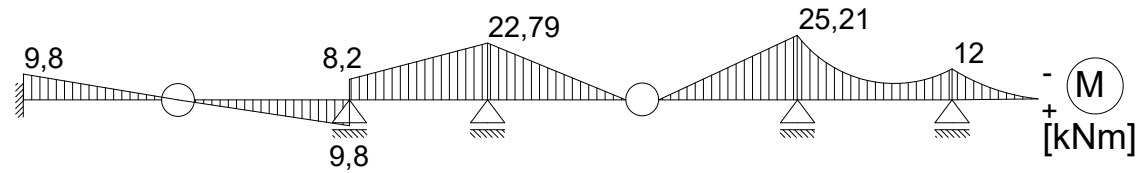


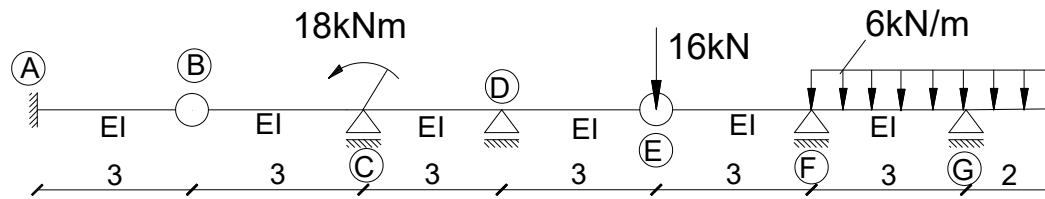
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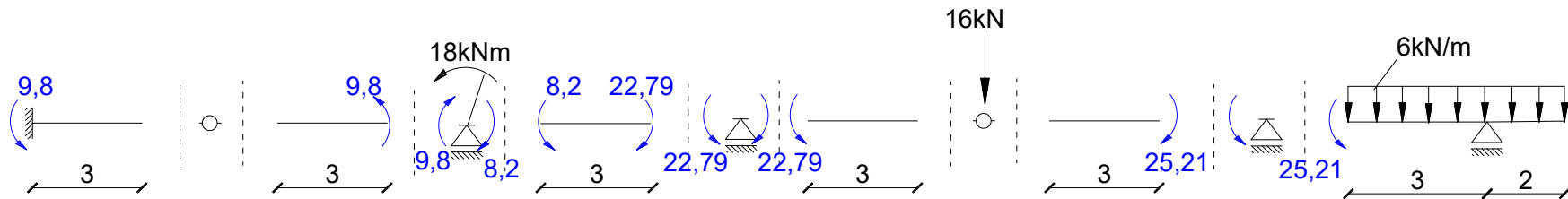
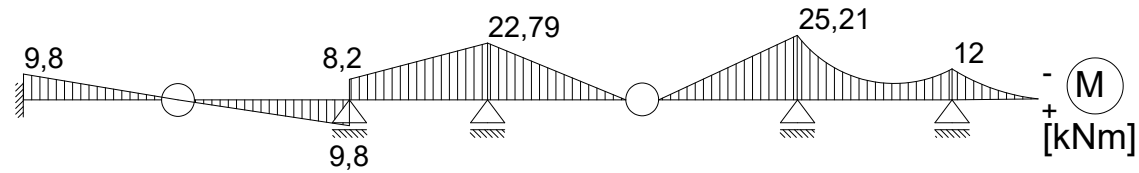


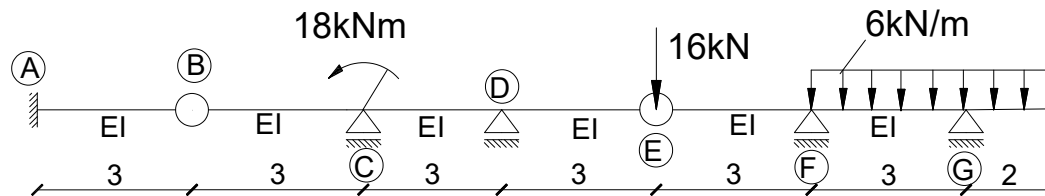
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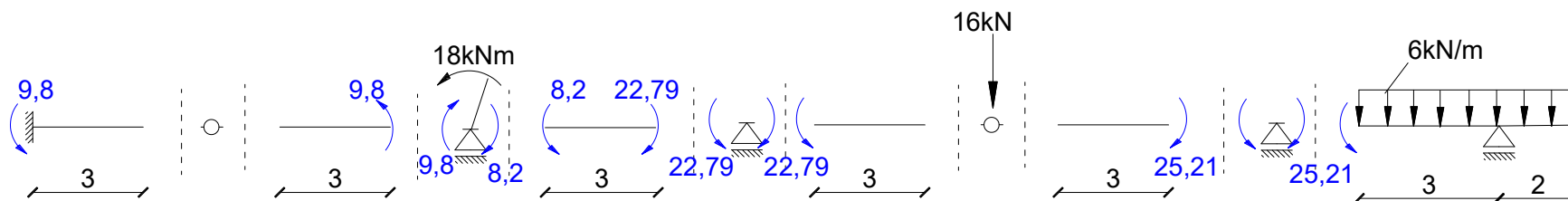
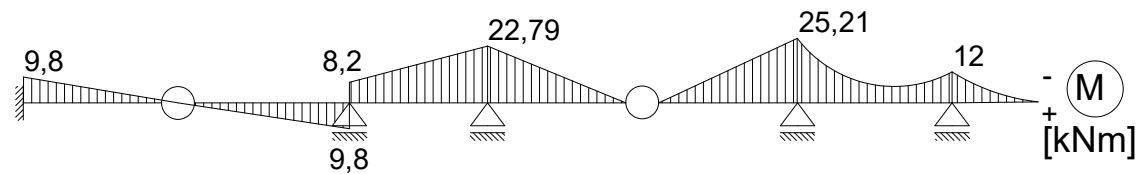


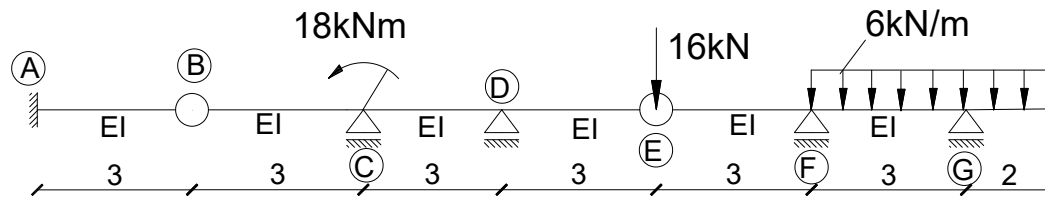
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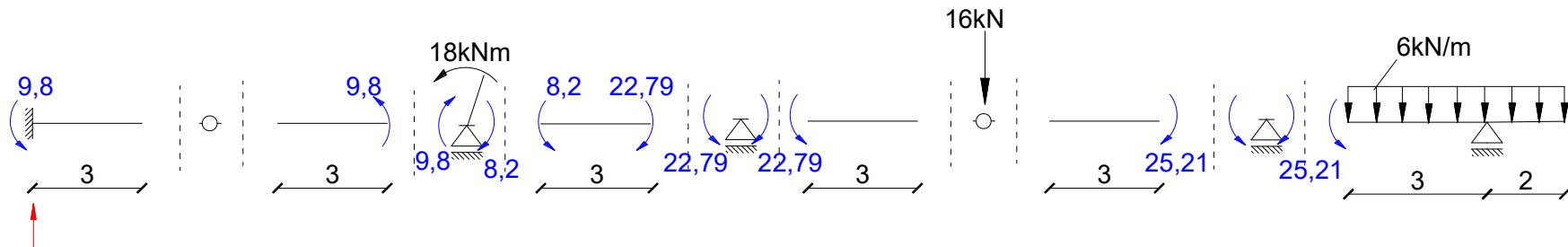
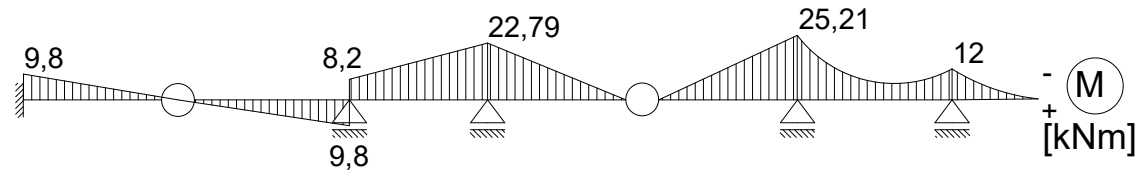


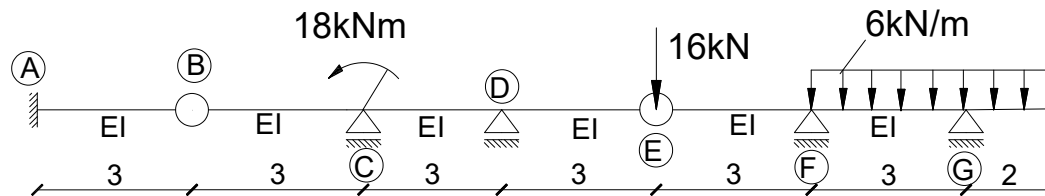
Wyznaczenie sił
tnących:



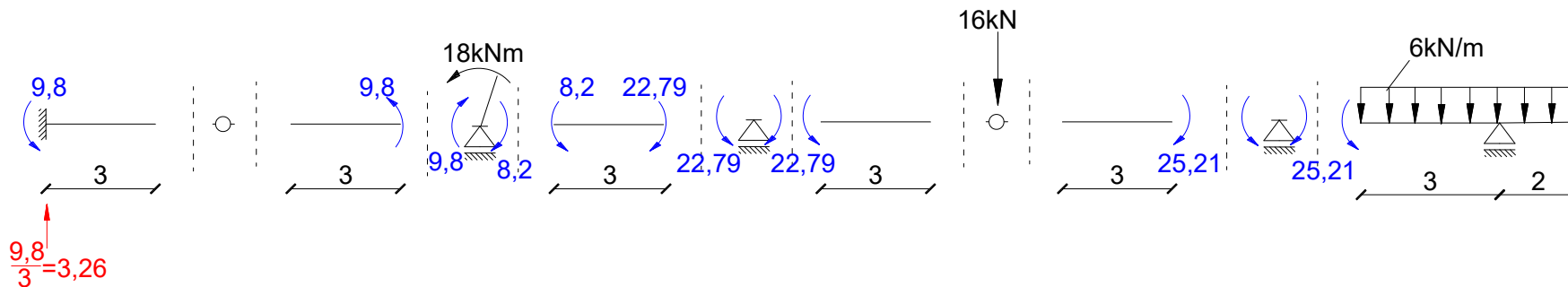
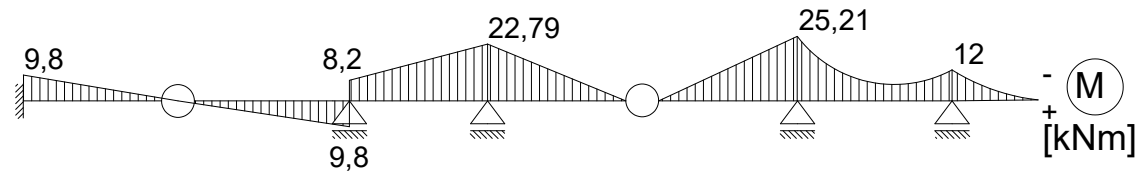


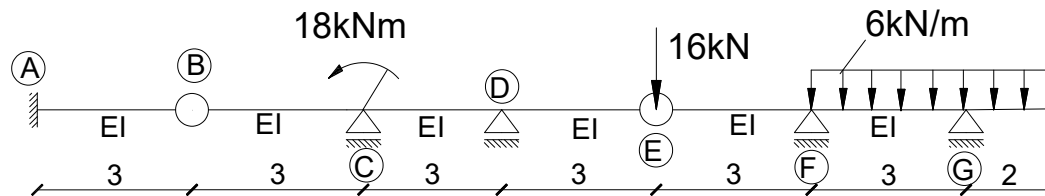
Wyznaczenie sił tnących:



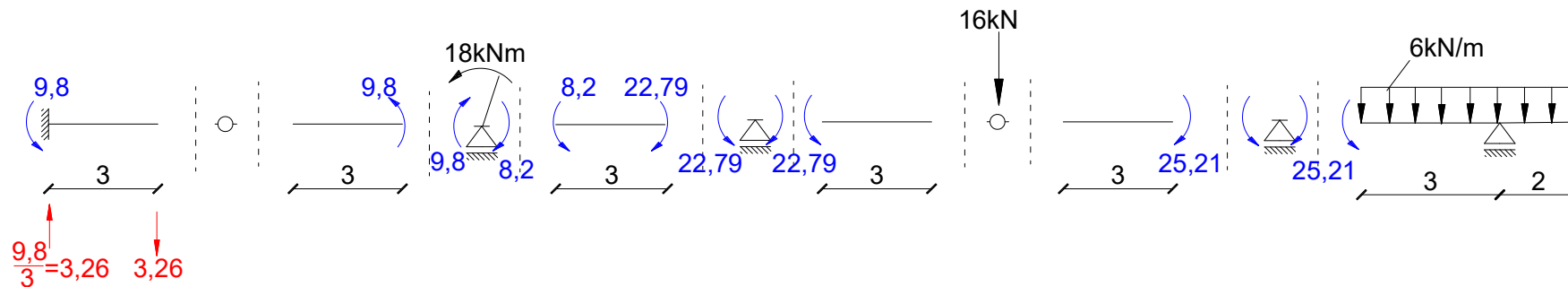
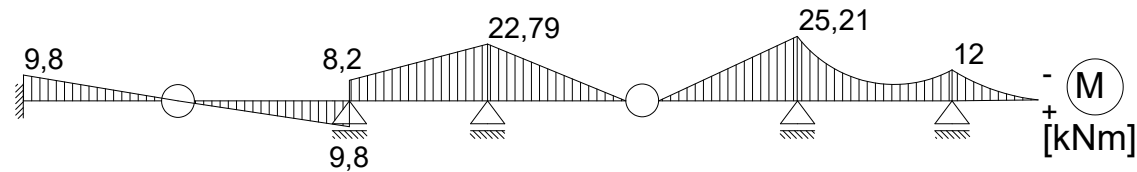


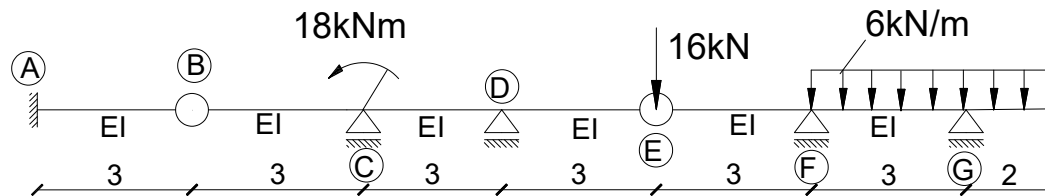
Wyznaczenie sił
tnących:



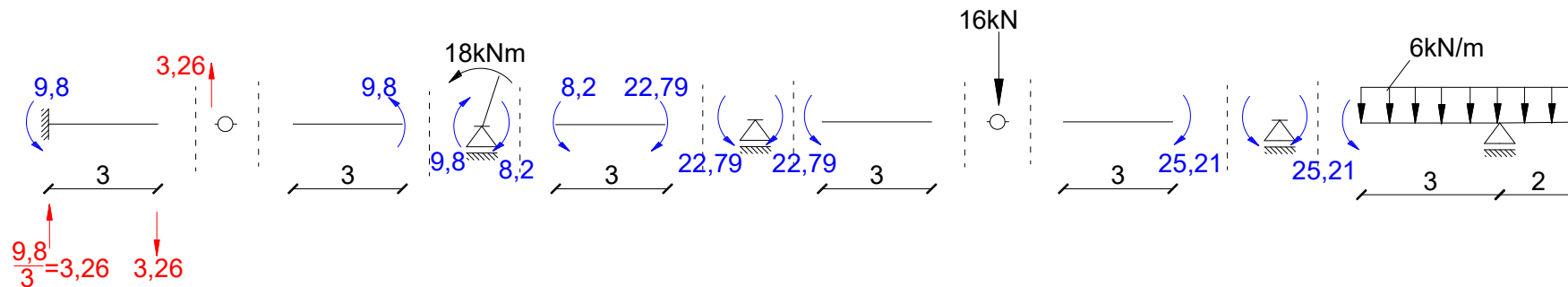
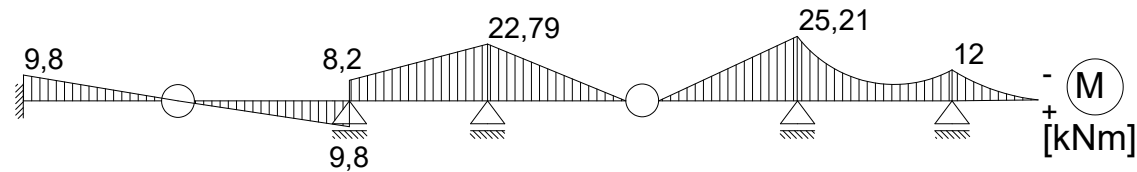


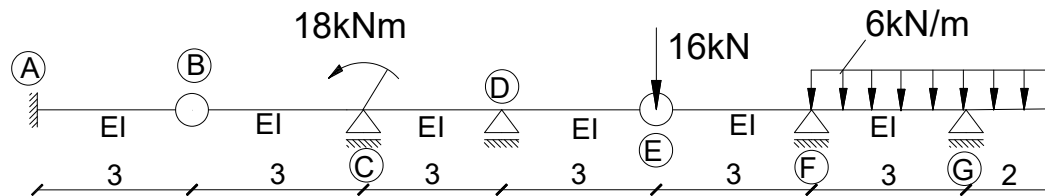
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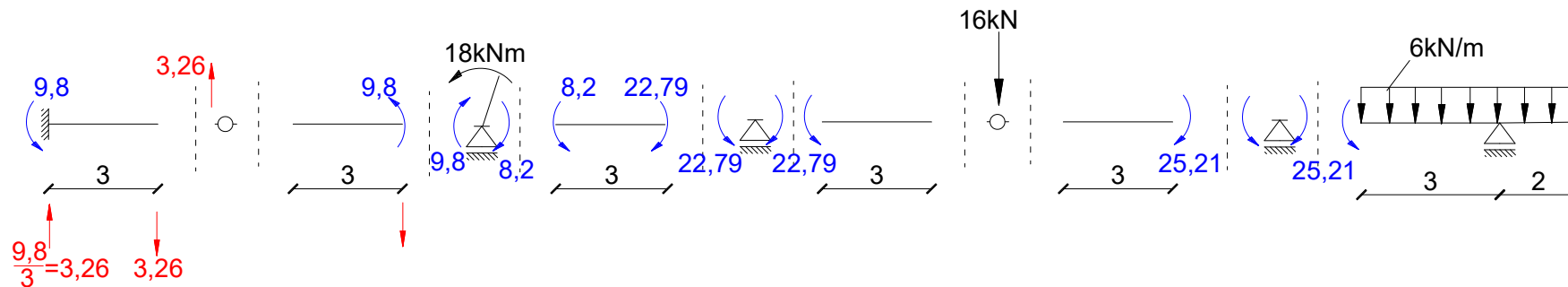
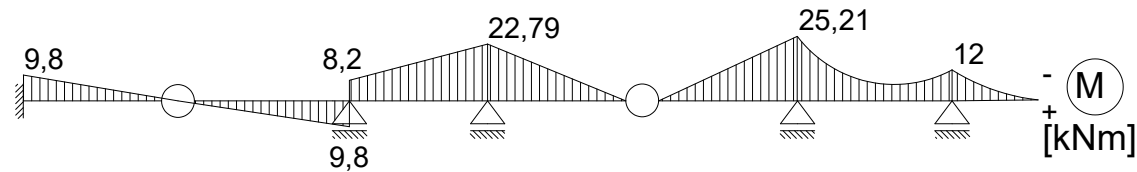


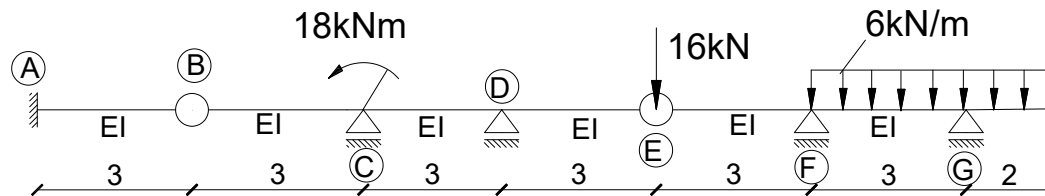
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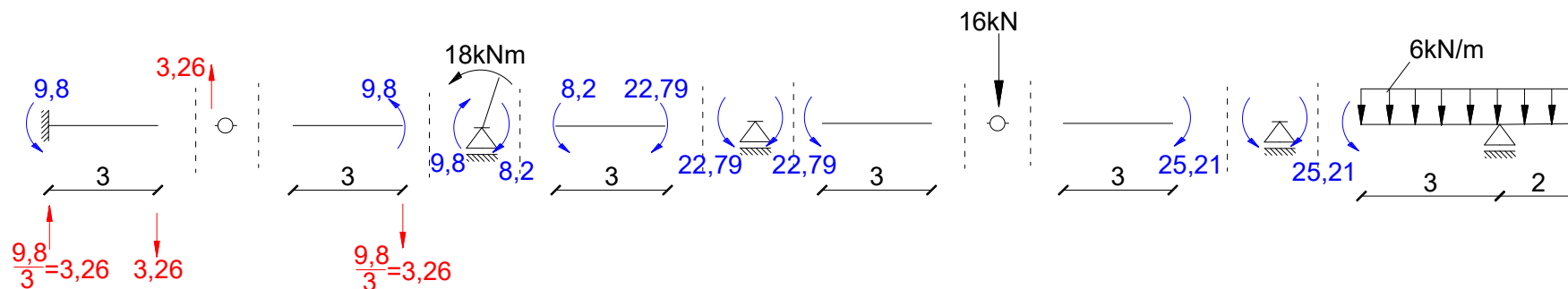
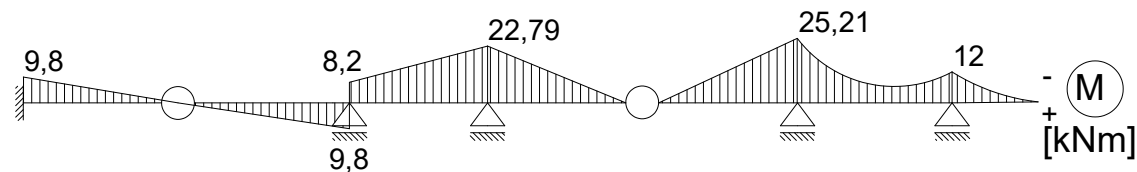


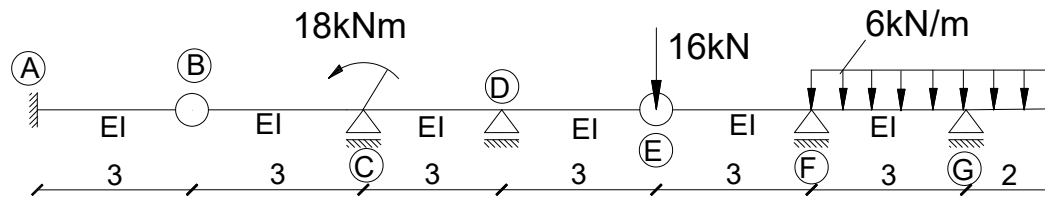
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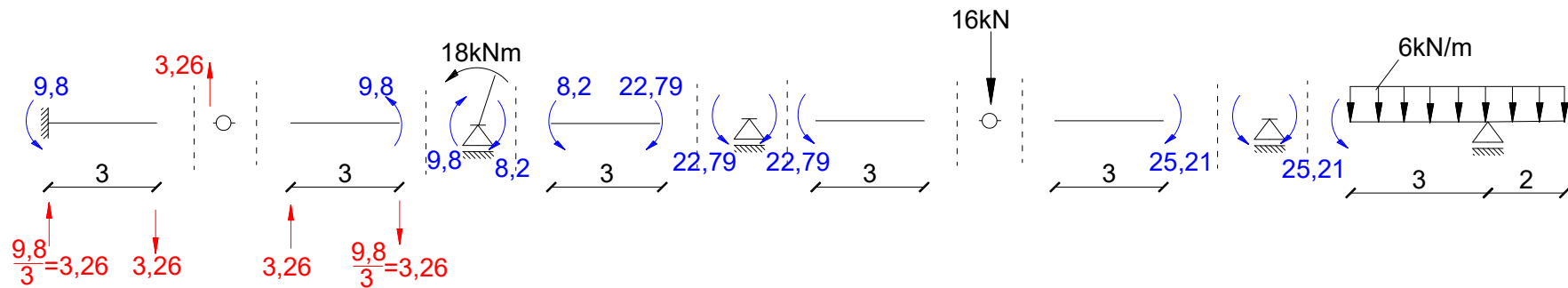
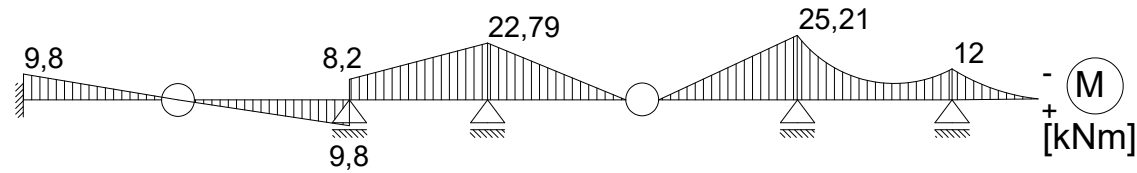


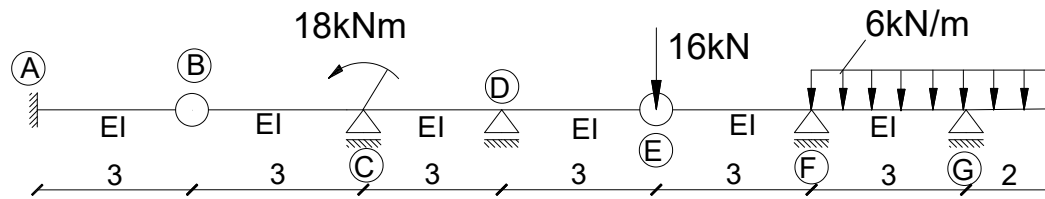
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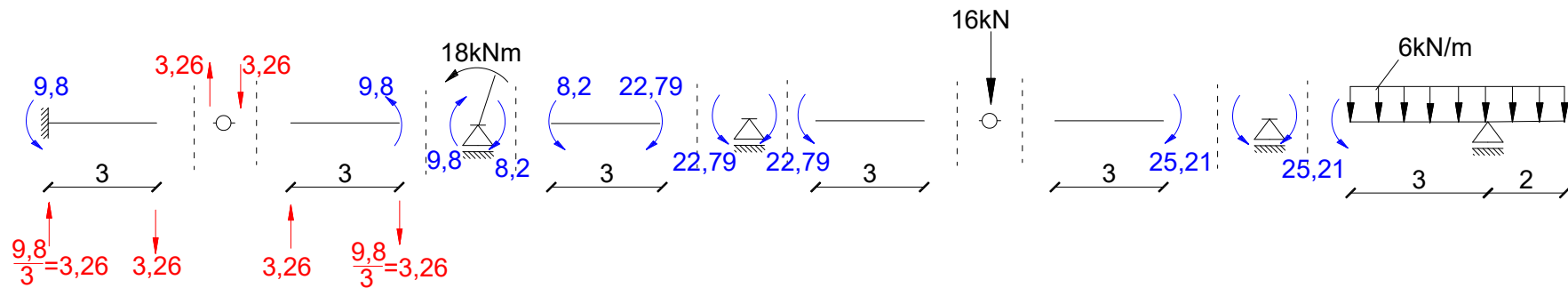
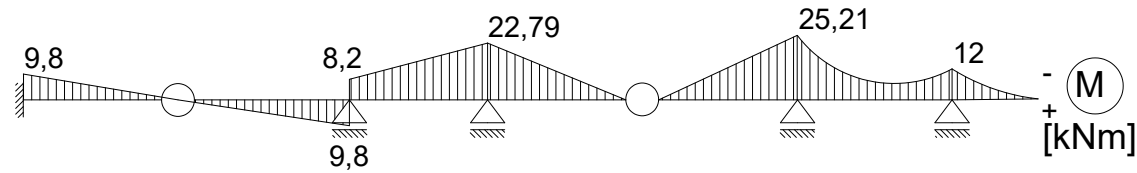


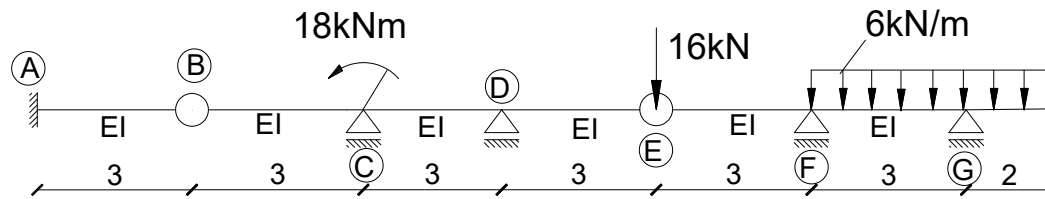
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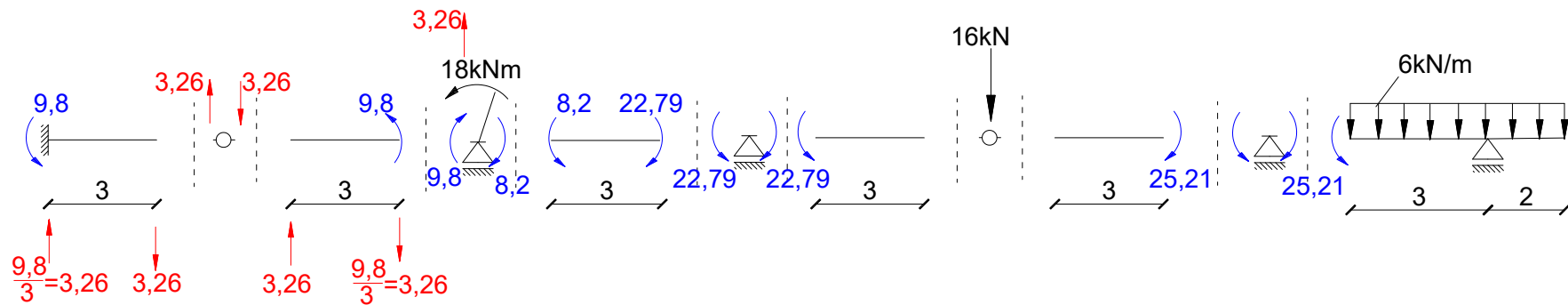
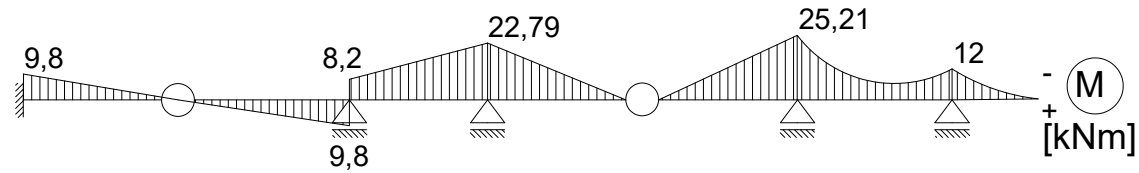


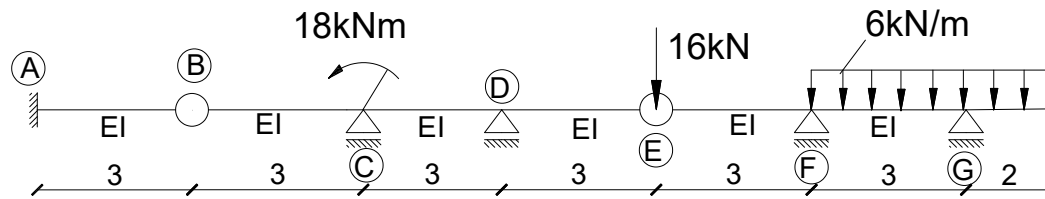
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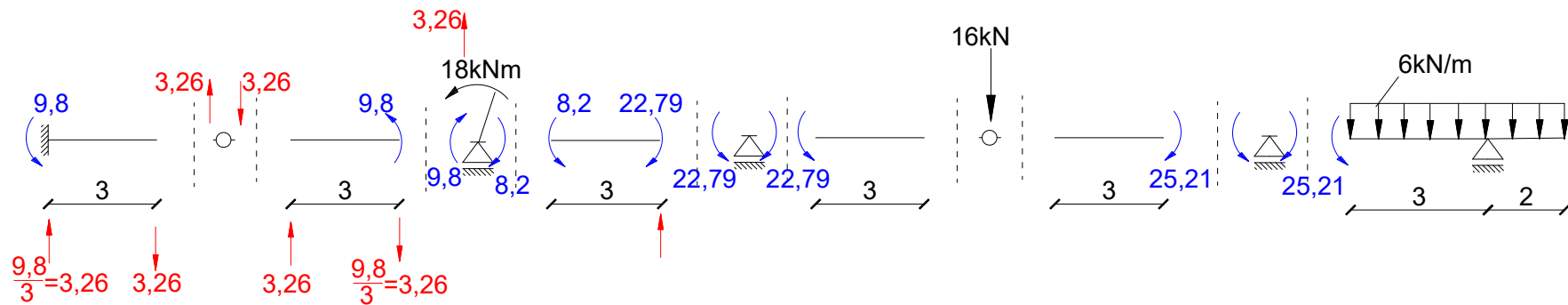
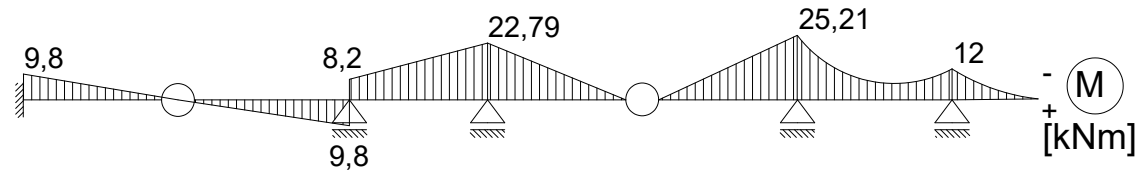


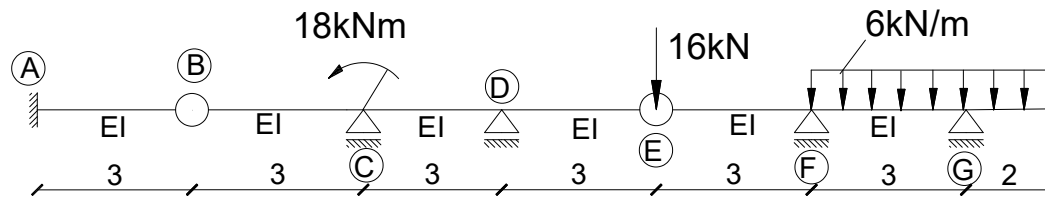
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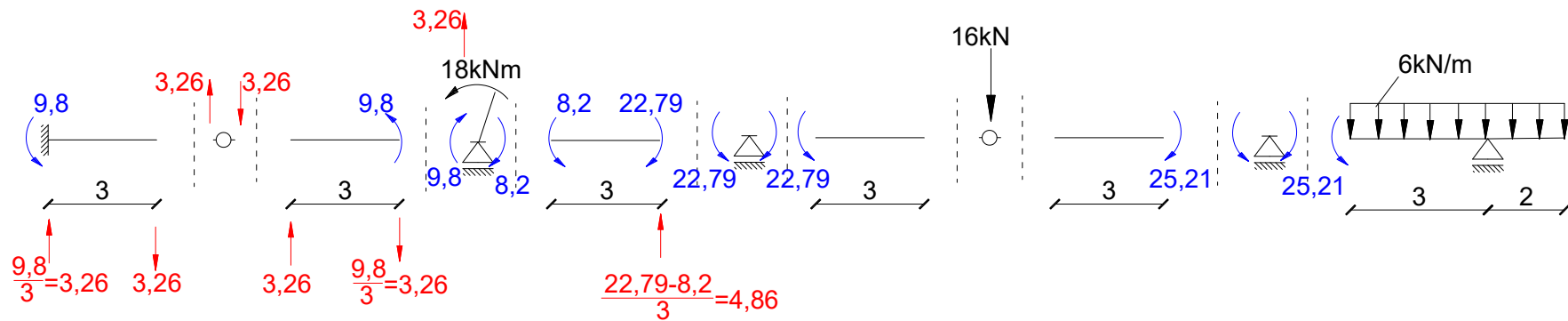
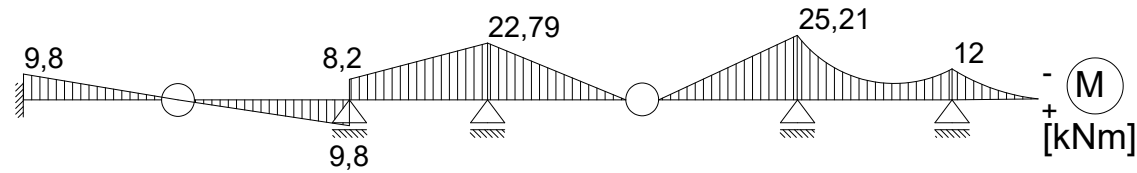


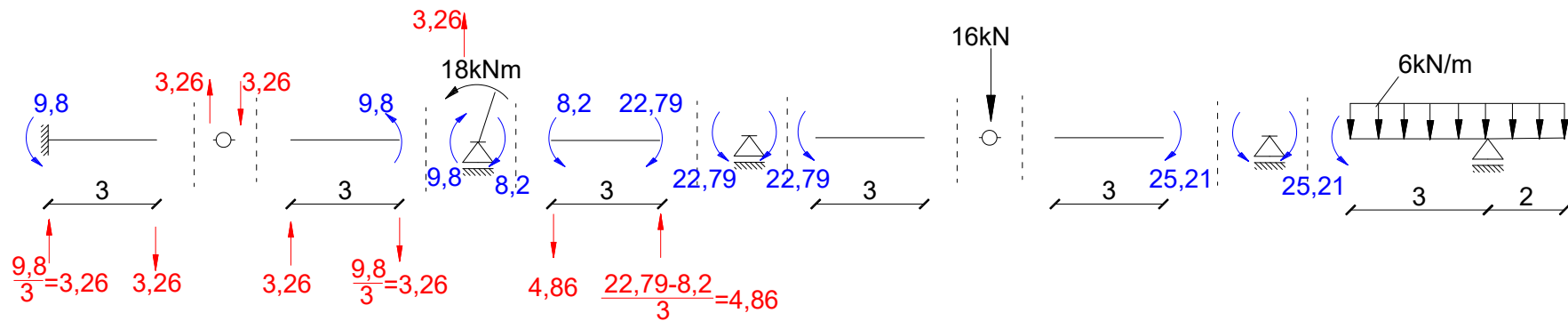
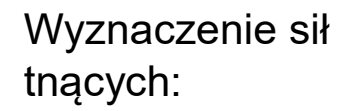
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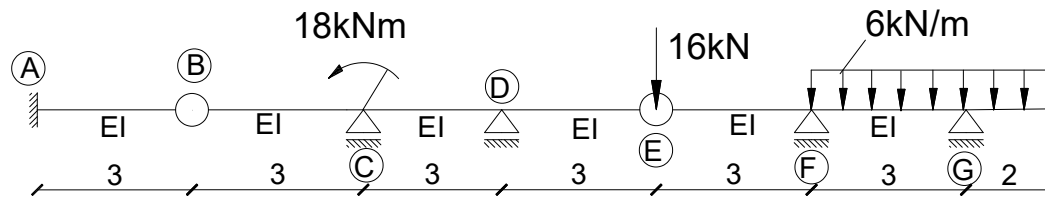




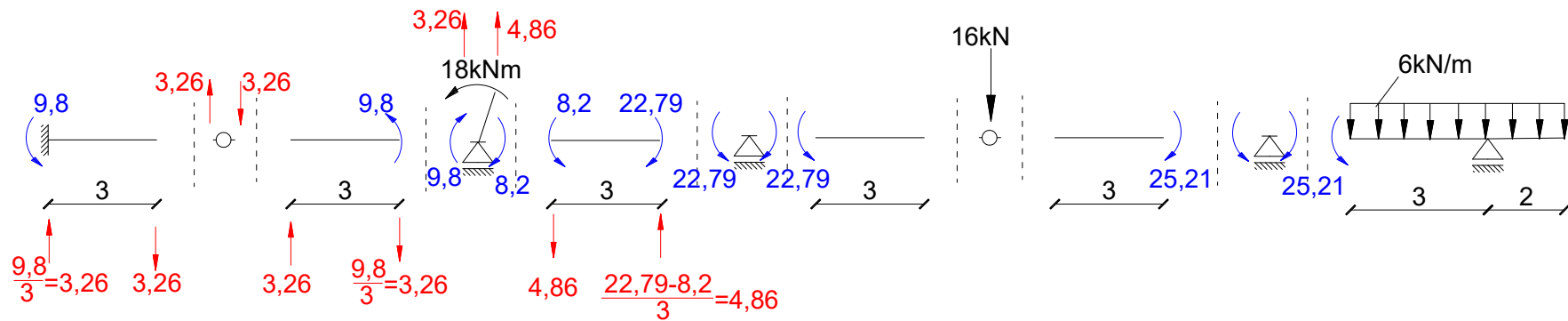
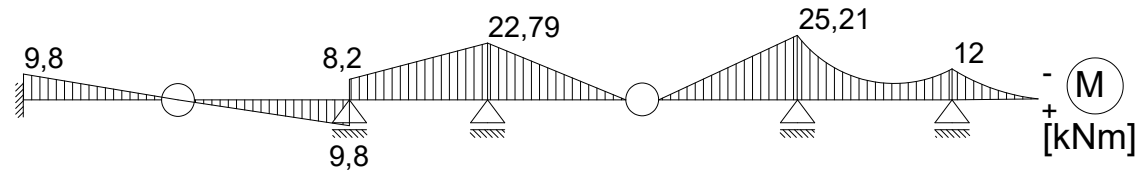
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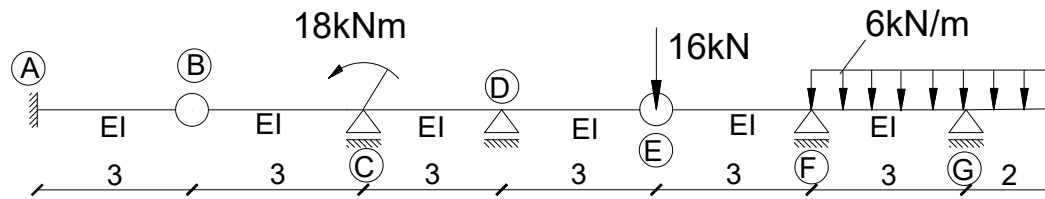




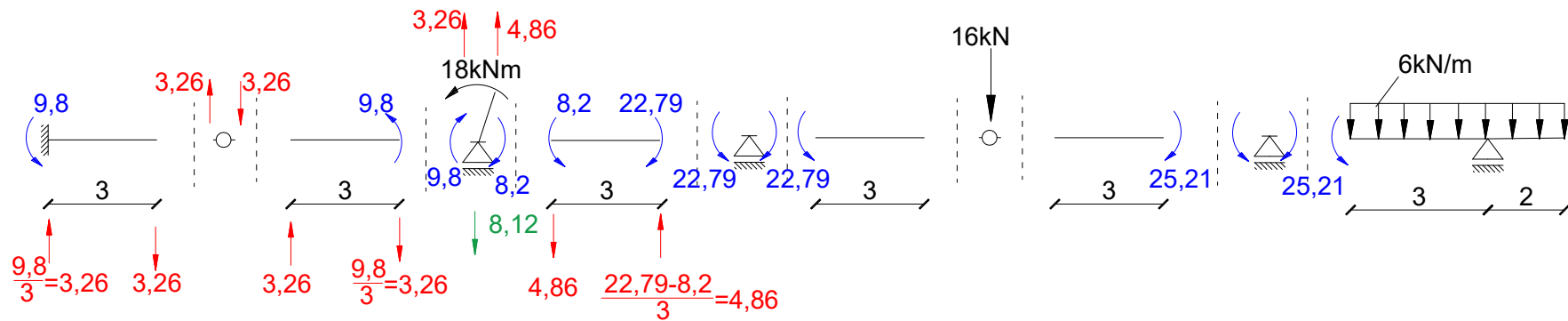
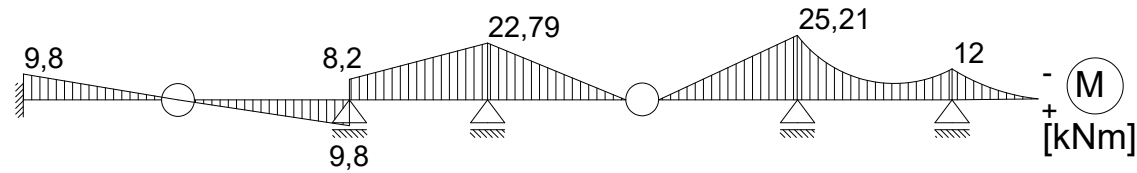


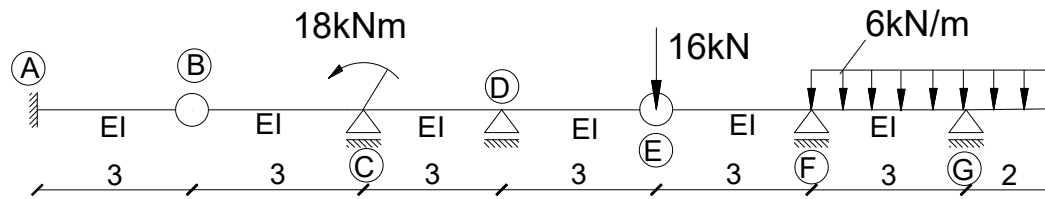
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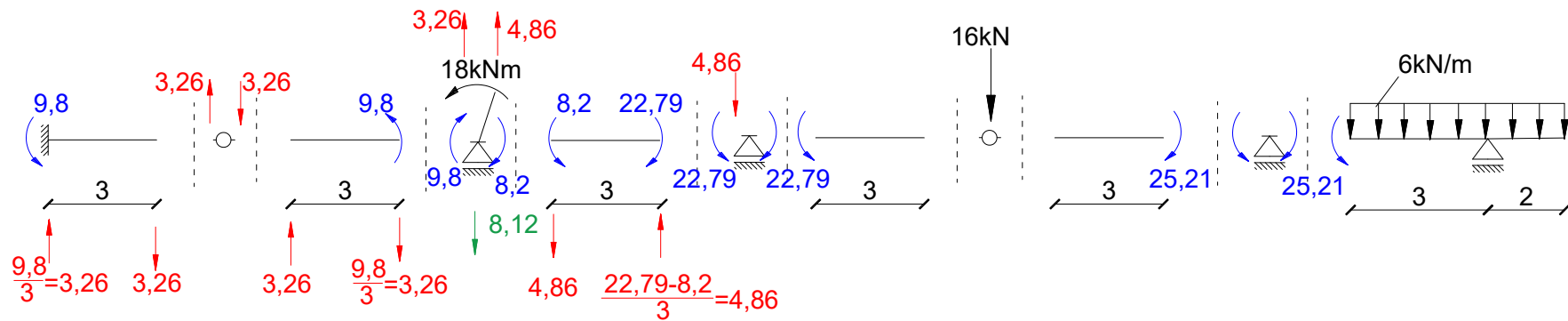
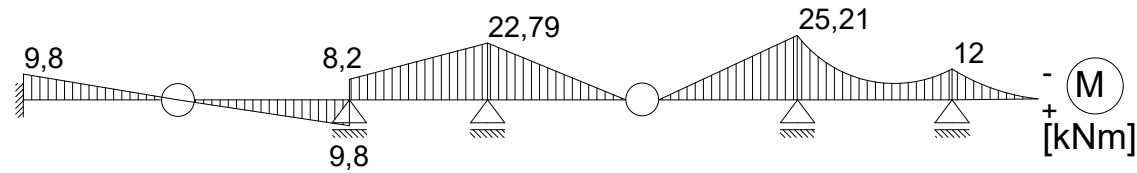


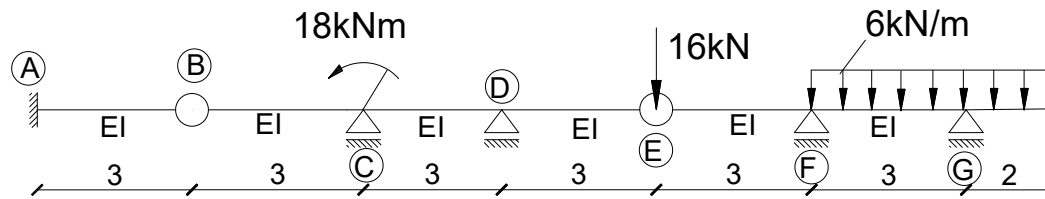
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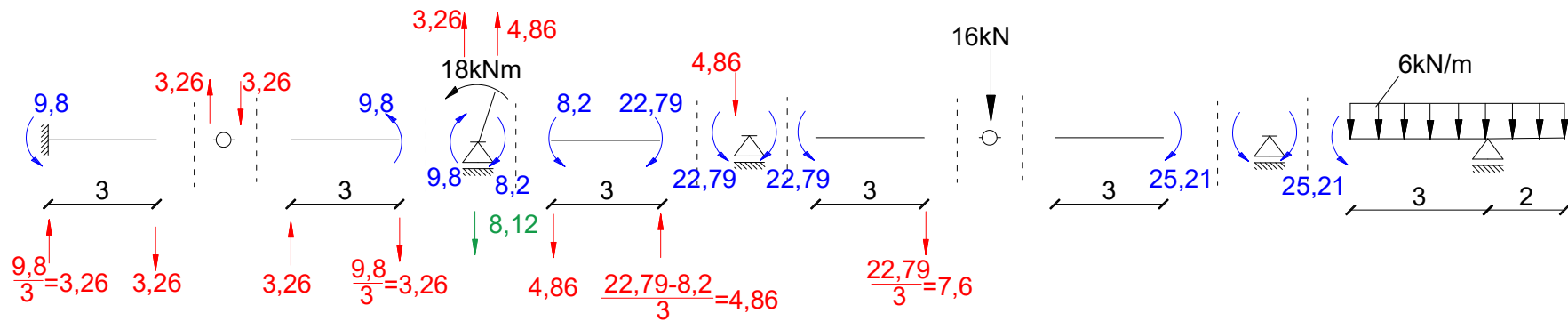
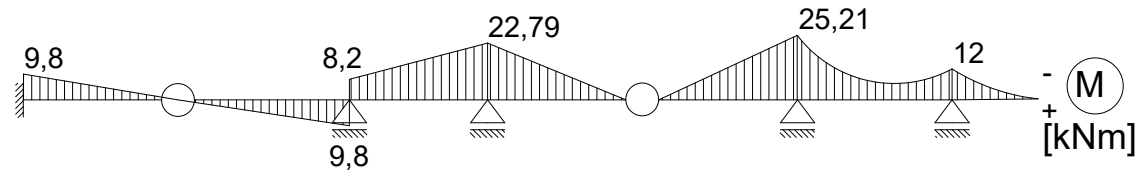


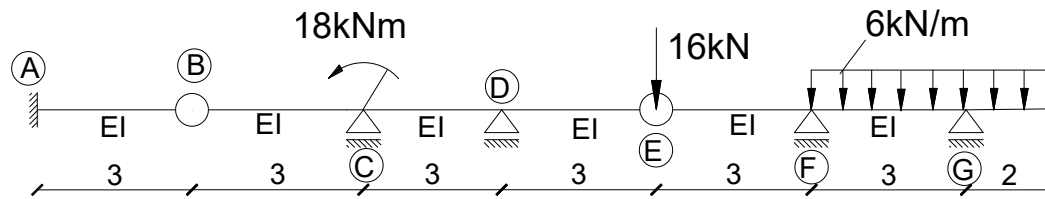
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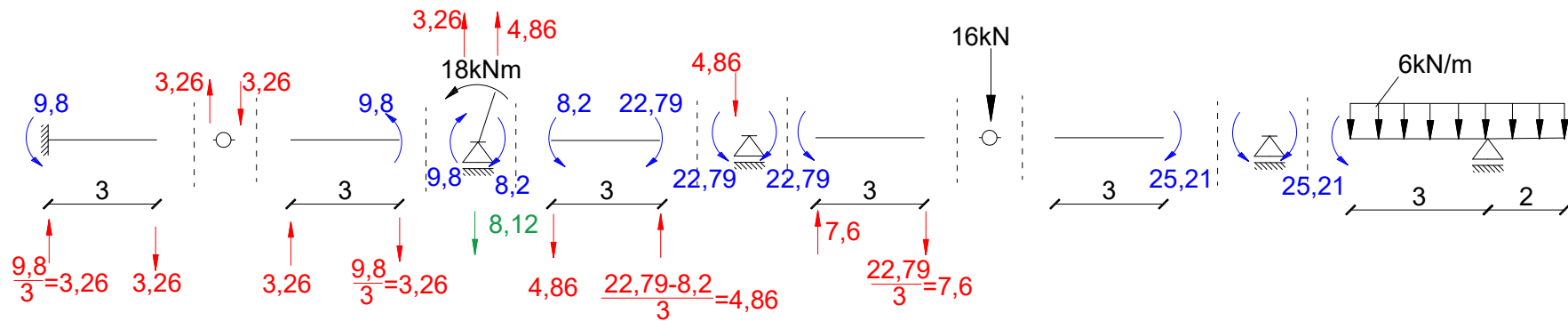
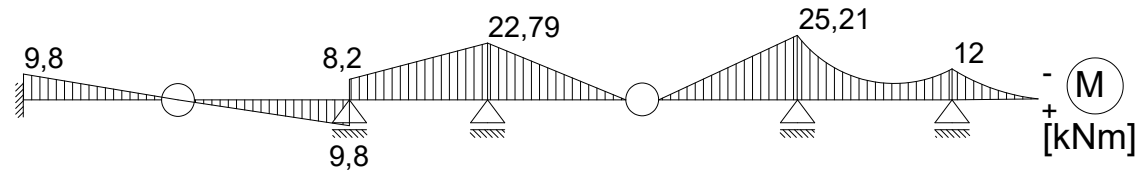


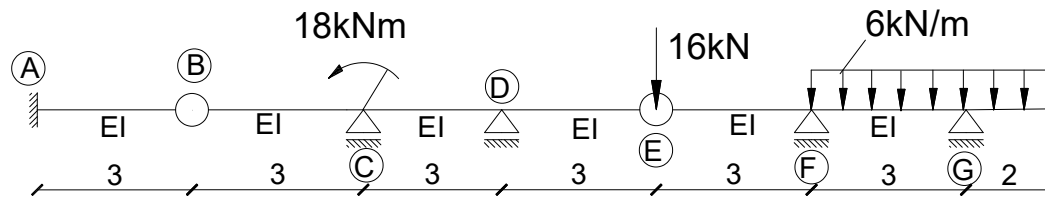
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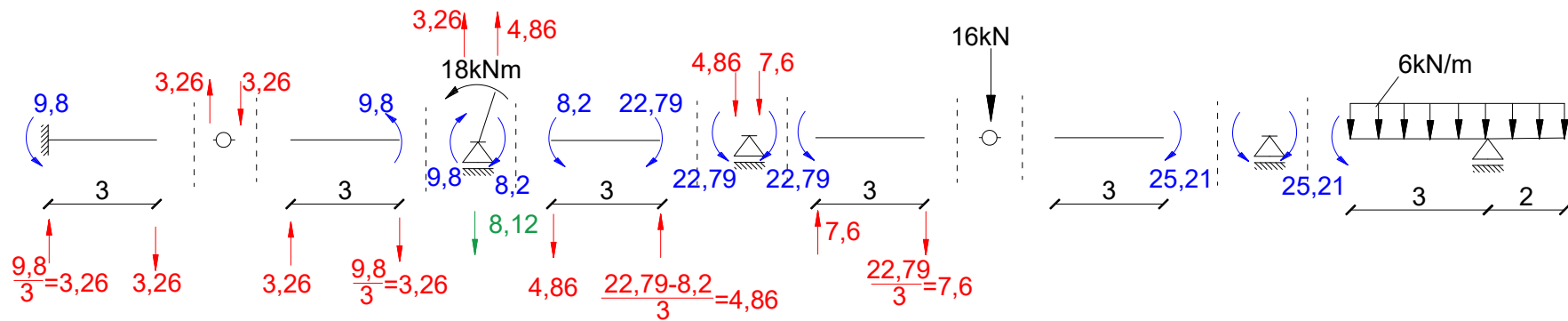
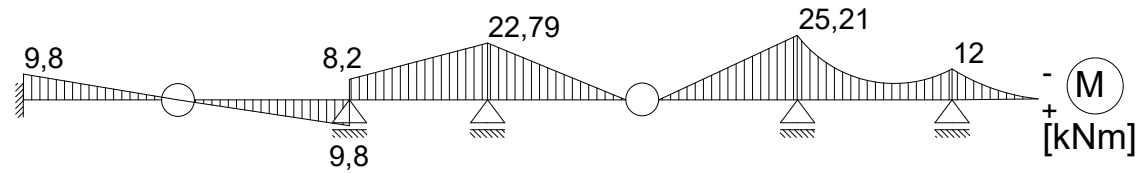


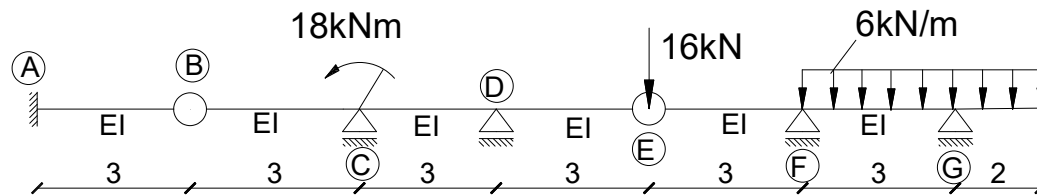
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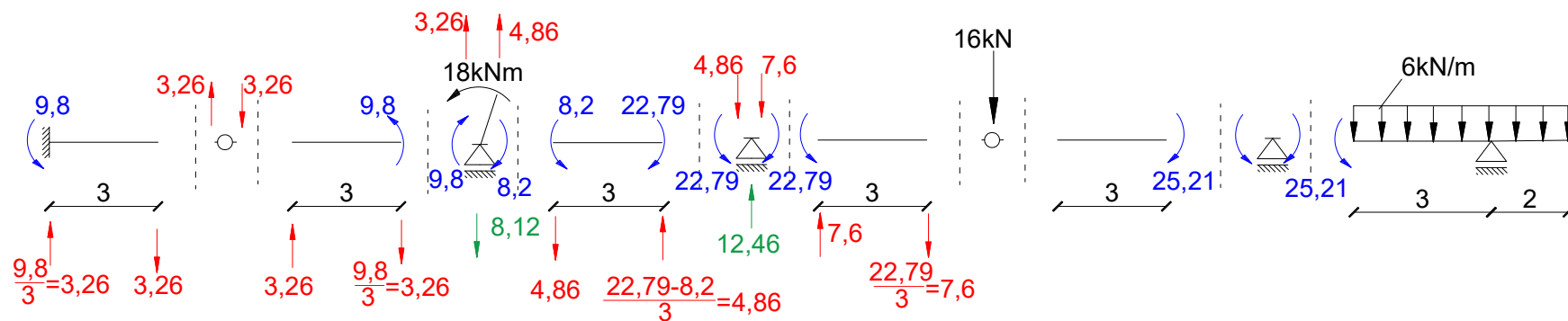
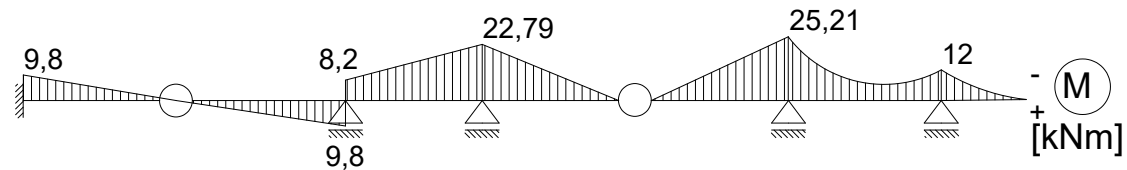


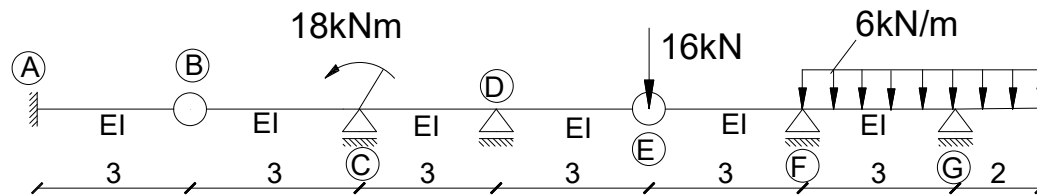
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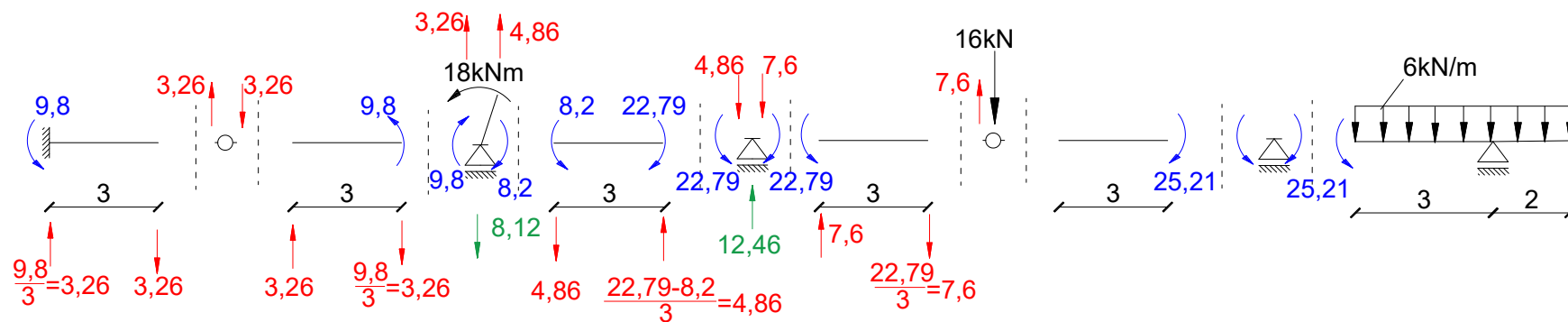
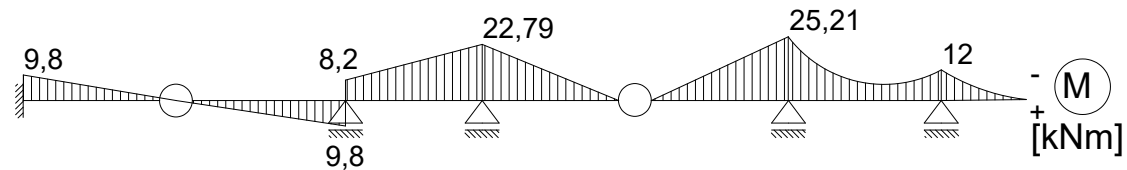


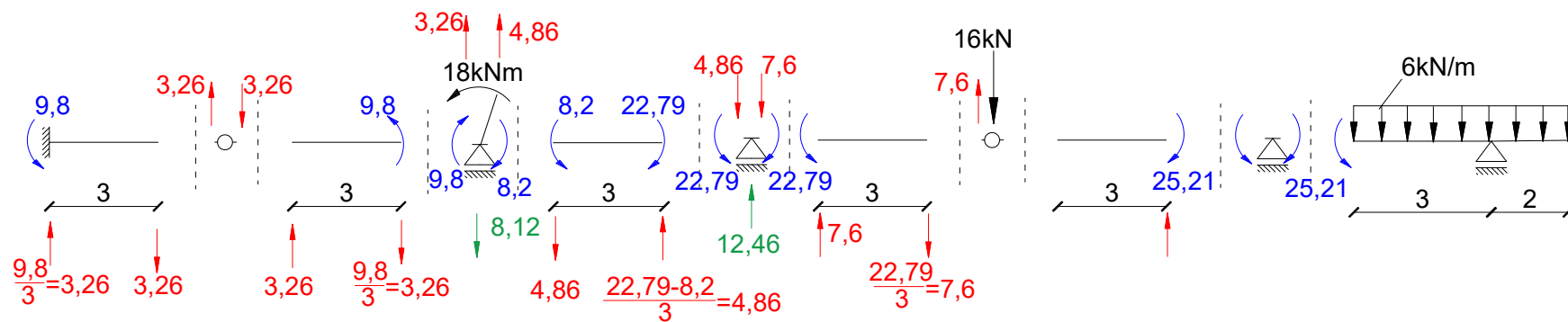
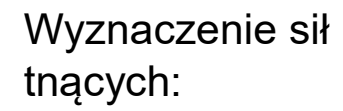
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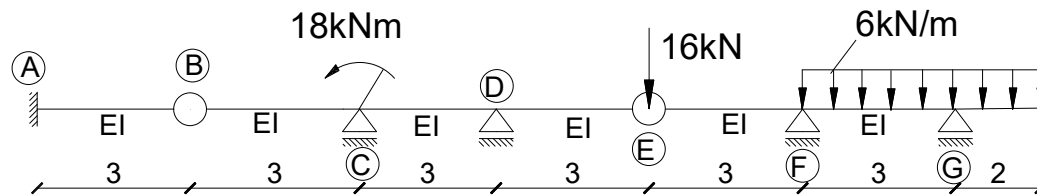




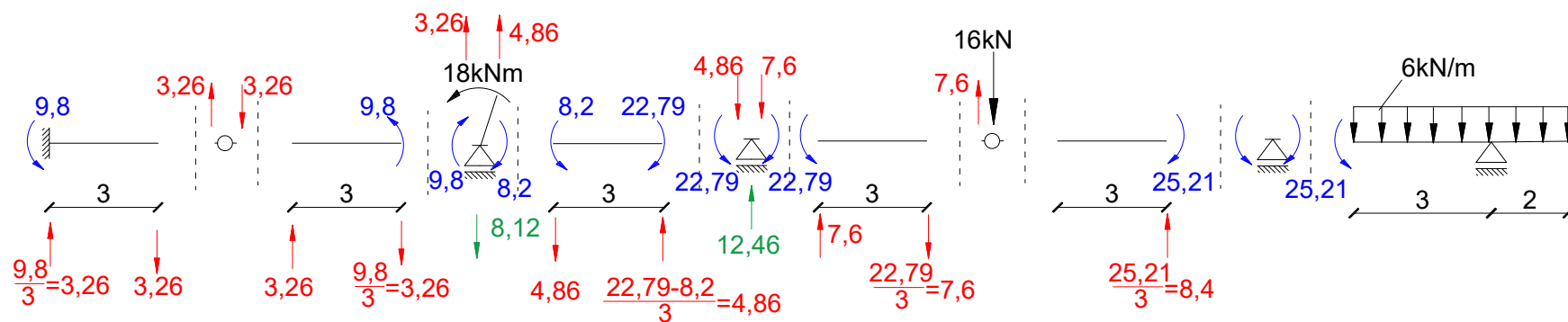
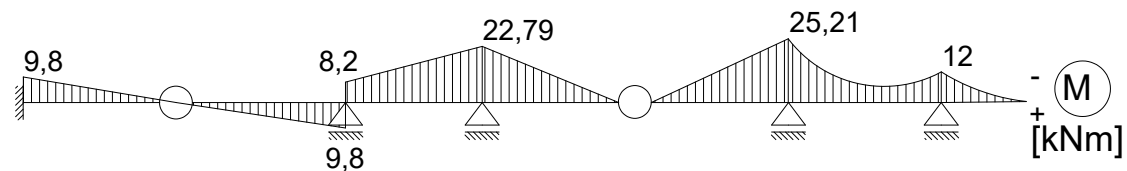
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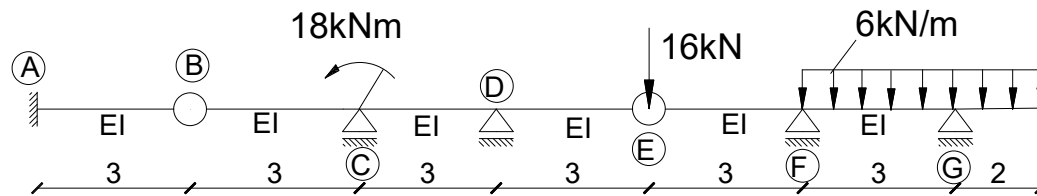




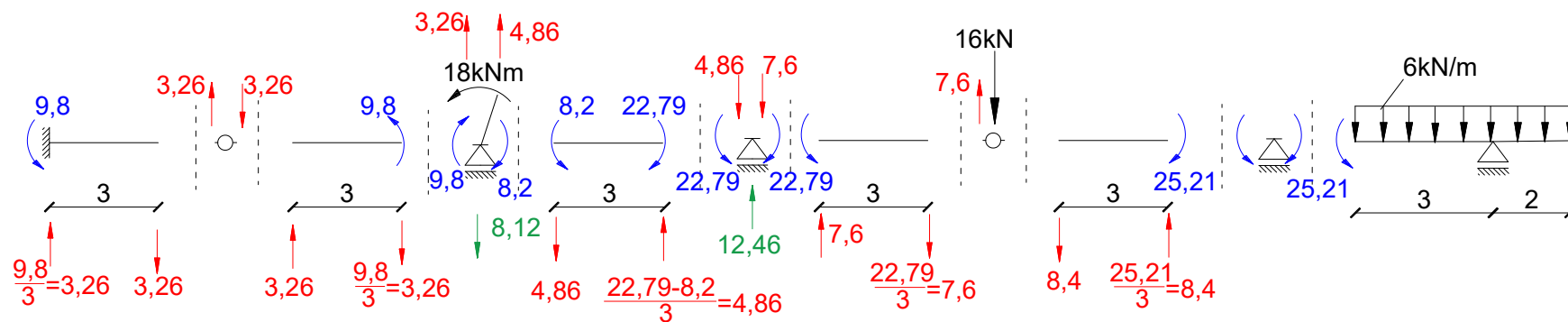
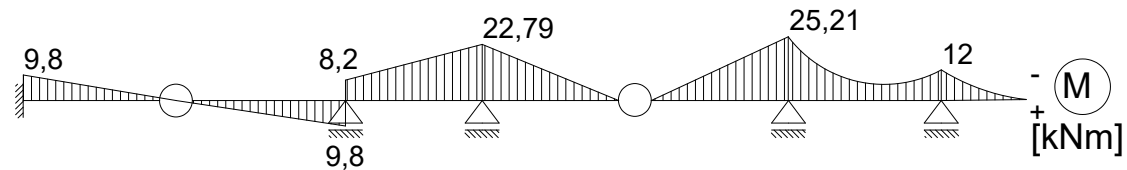


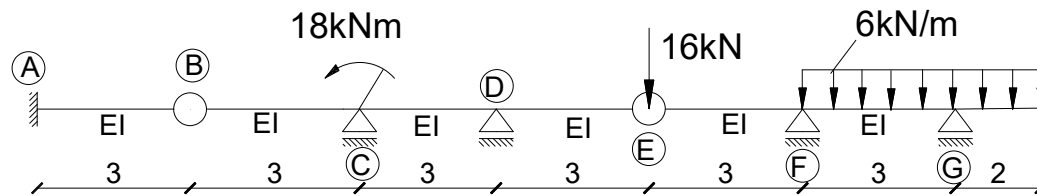
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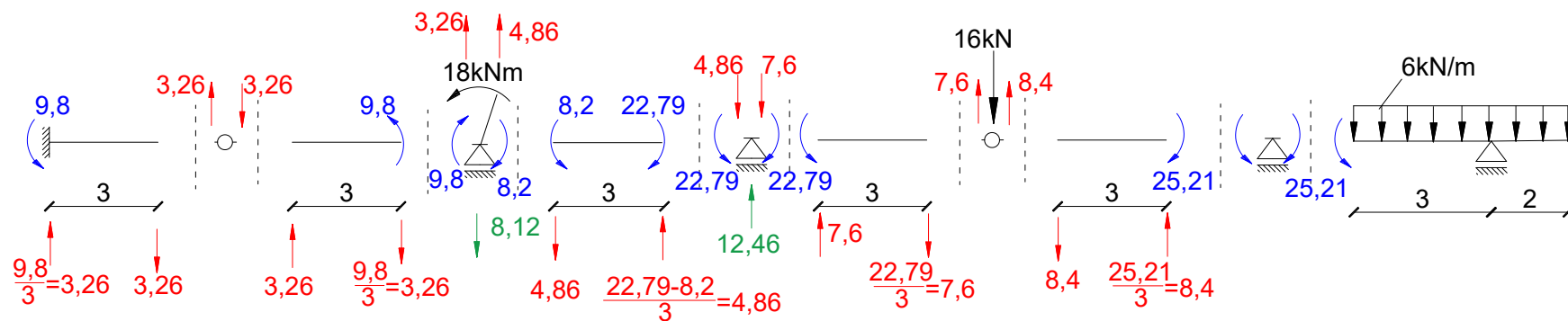
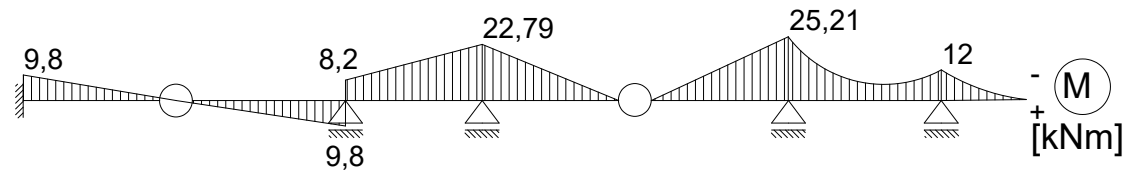


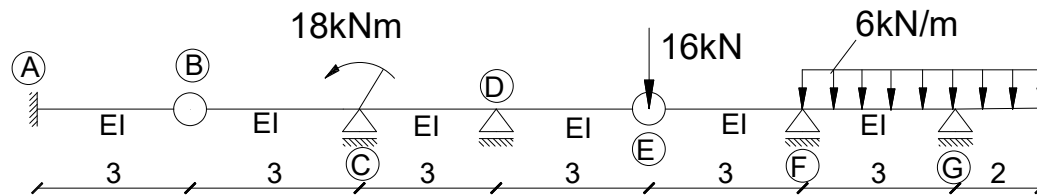
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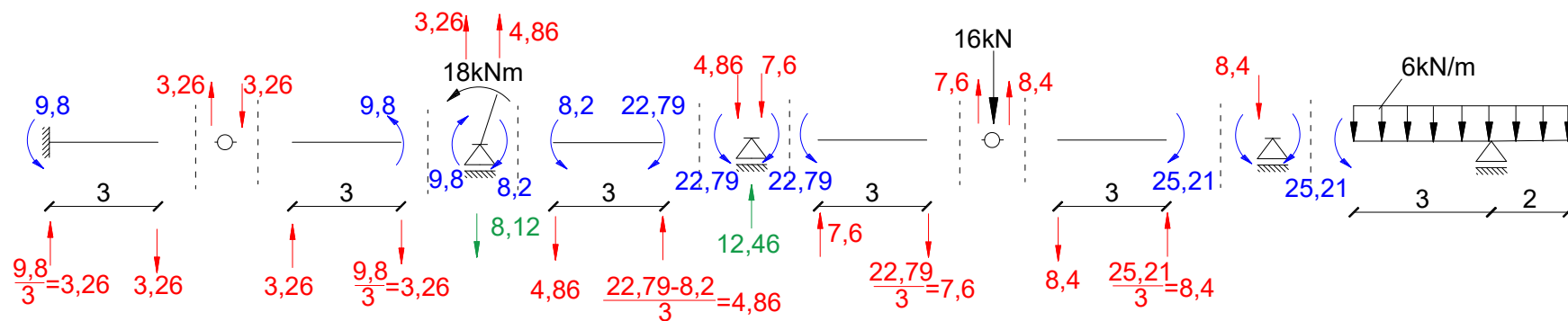
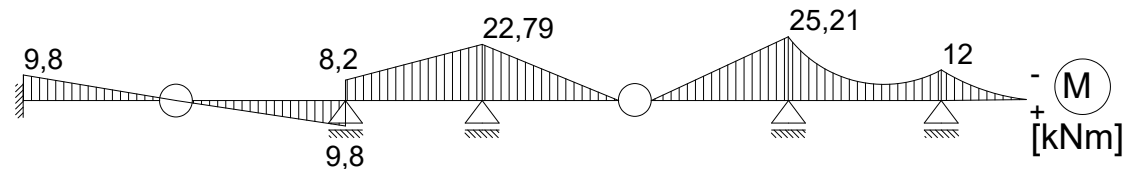


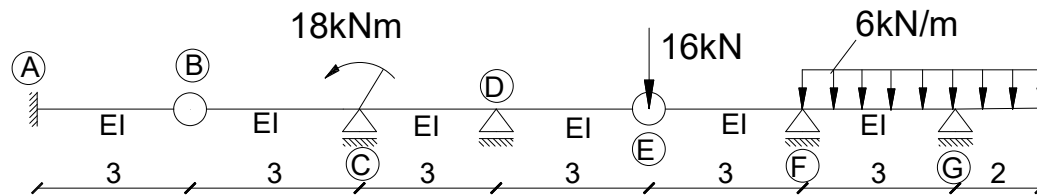
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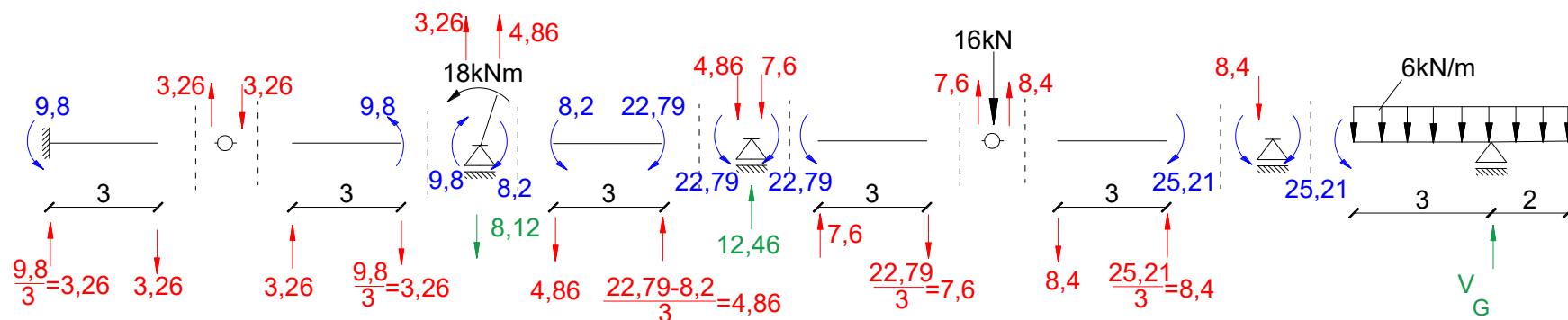
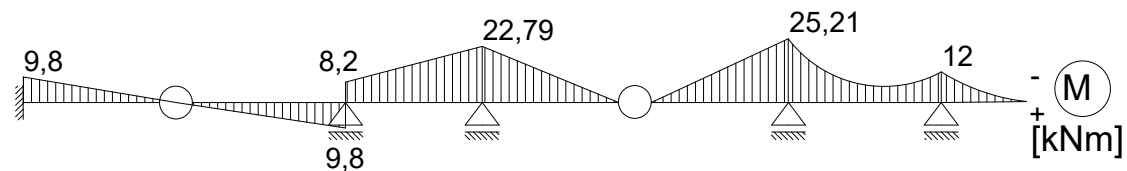


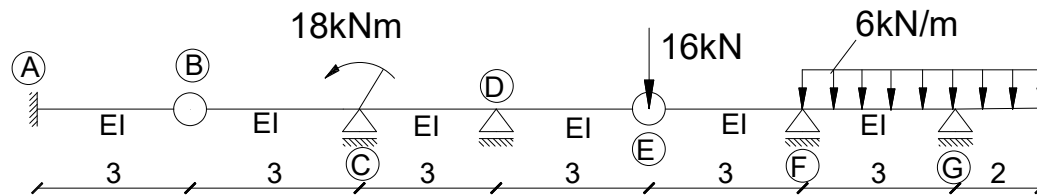
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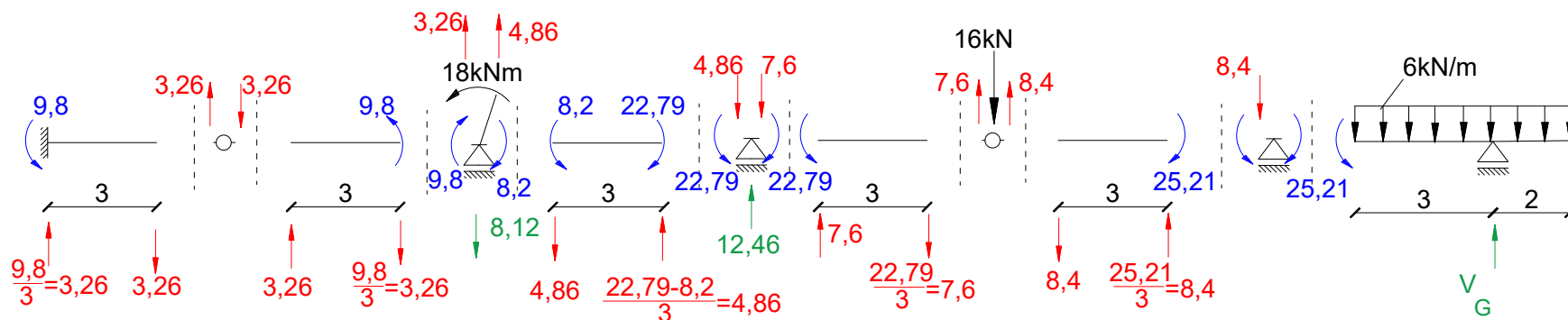
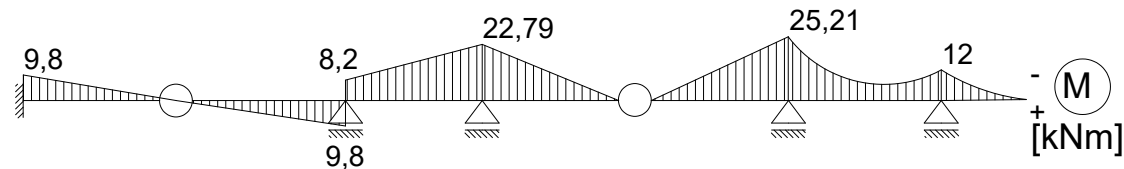


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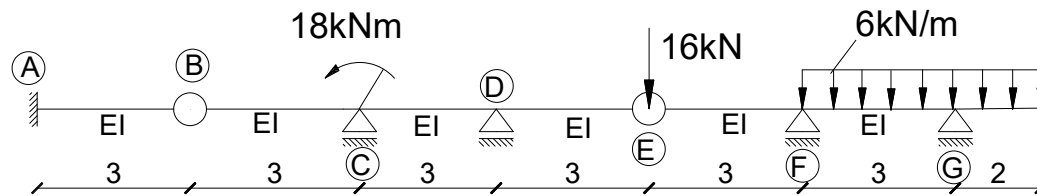




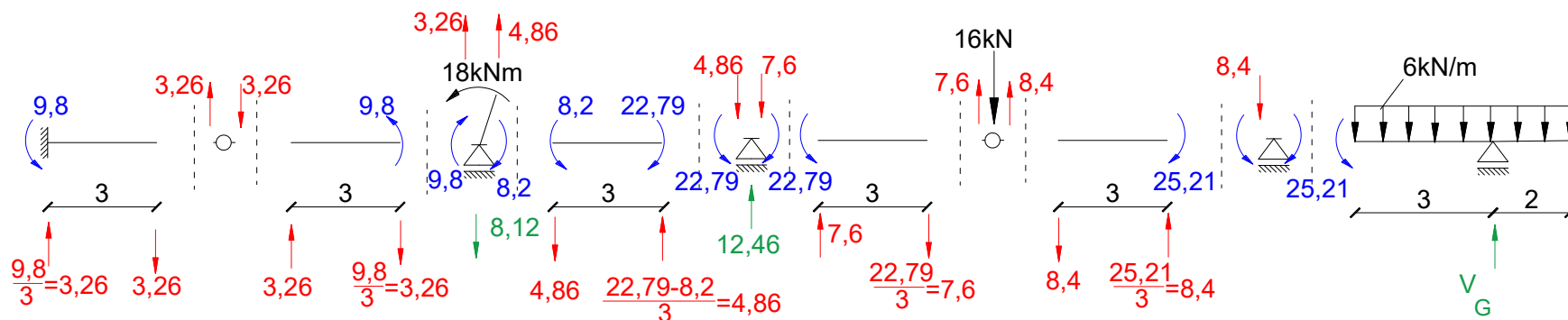
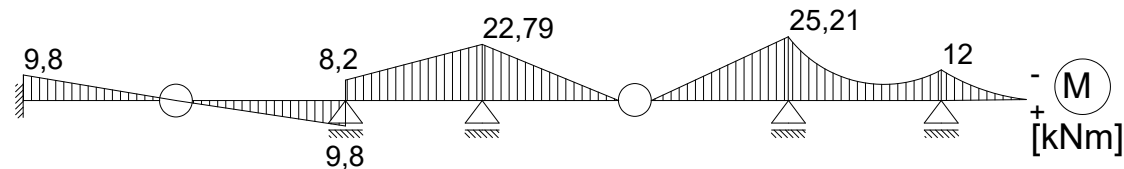
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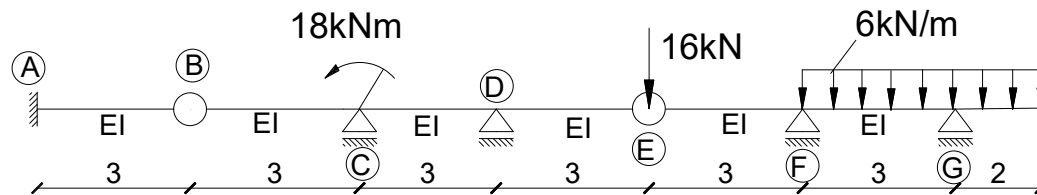
$$\sum M_F = -25,21 + 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0$$



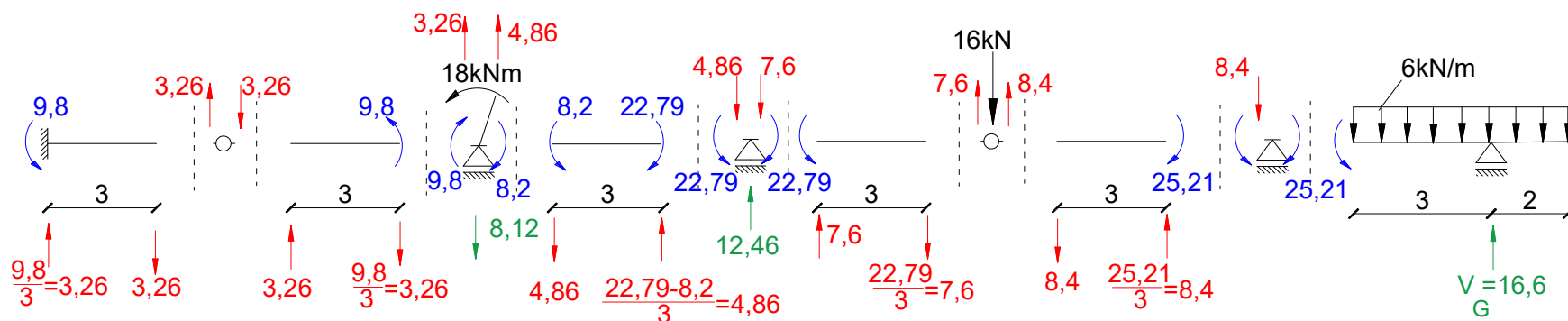
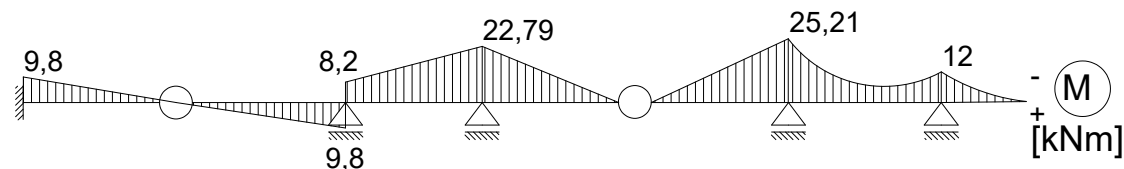
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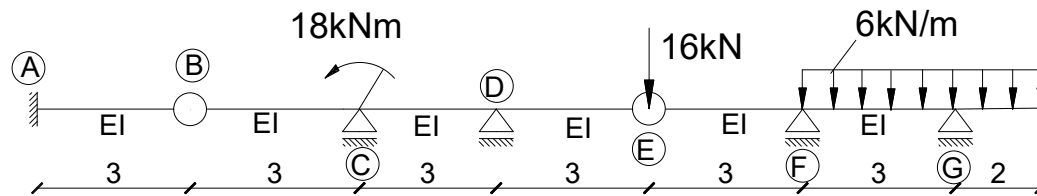
$$\sum M_F = -25,21 + 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0 \rightarrow V_G = 16,6 \text{ kN}$$



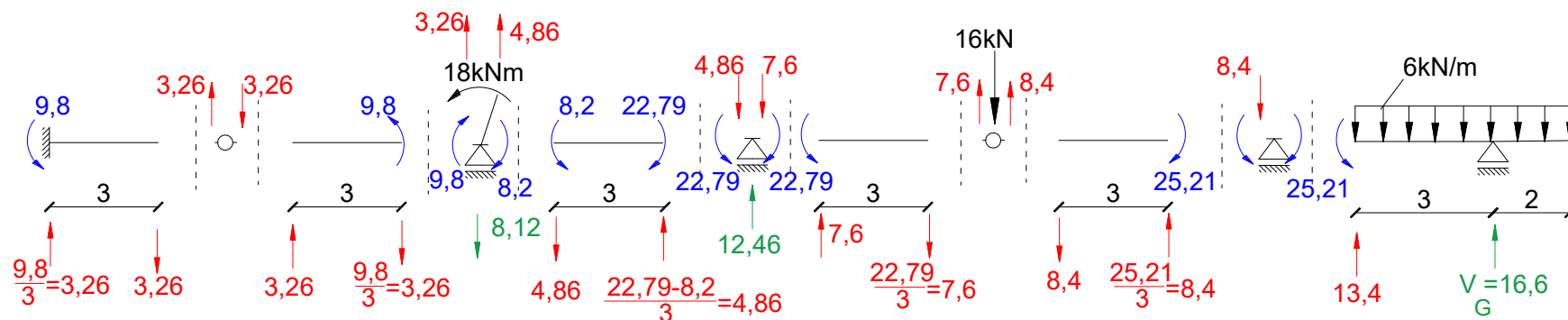
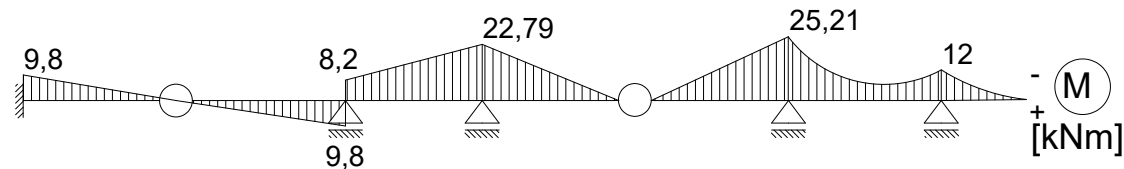
Wyznaczenie sił tnących:



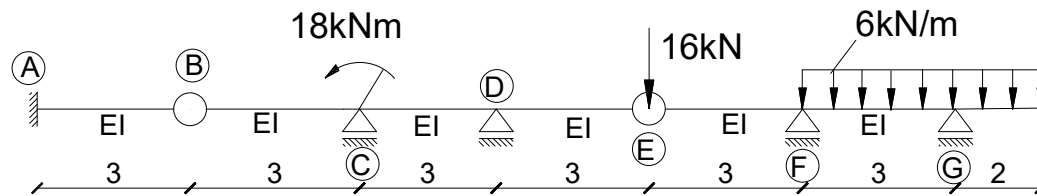
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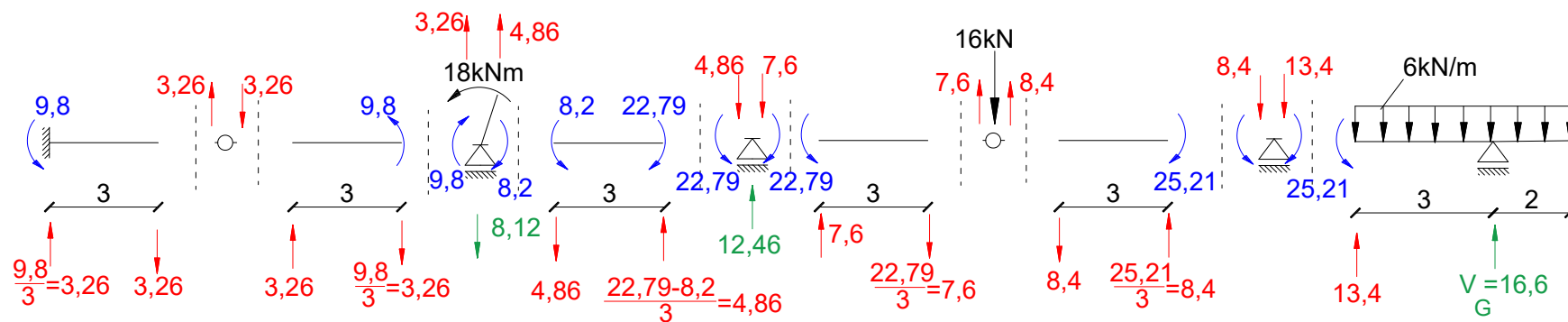
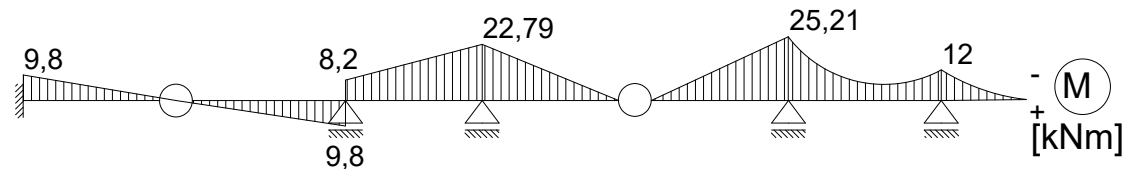
Wyznaczenie sił tnących:



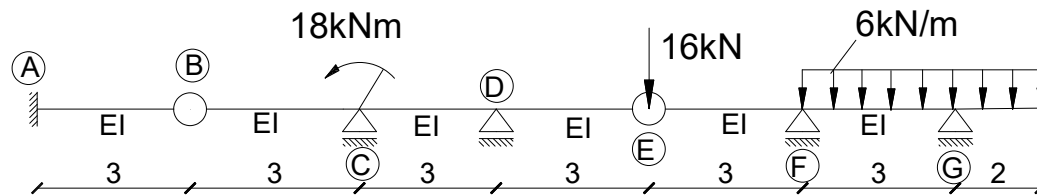
$$\sum M_F = -25,21 + 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0 \rightarrow V_G = 16,6 \text{ kN}$$



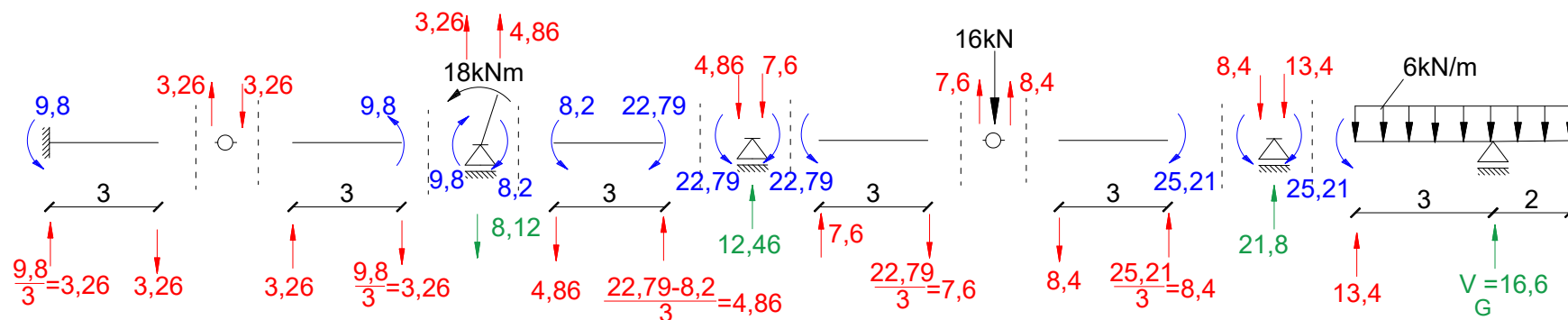
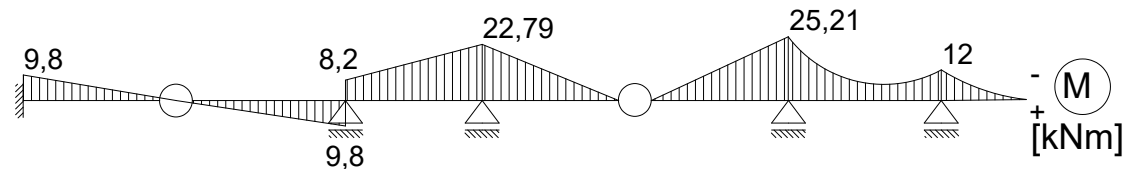
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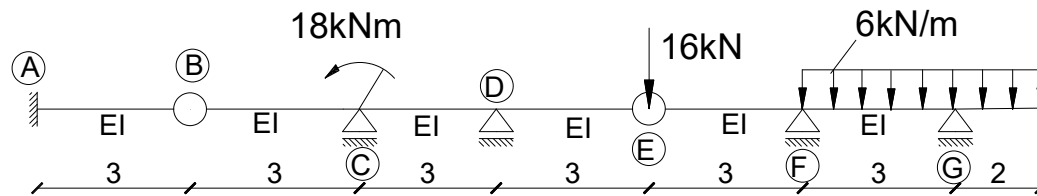
$$\sum M_F = -25,21 + 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0 \rightarrow V_G = 16,6 \text{ kN}$$



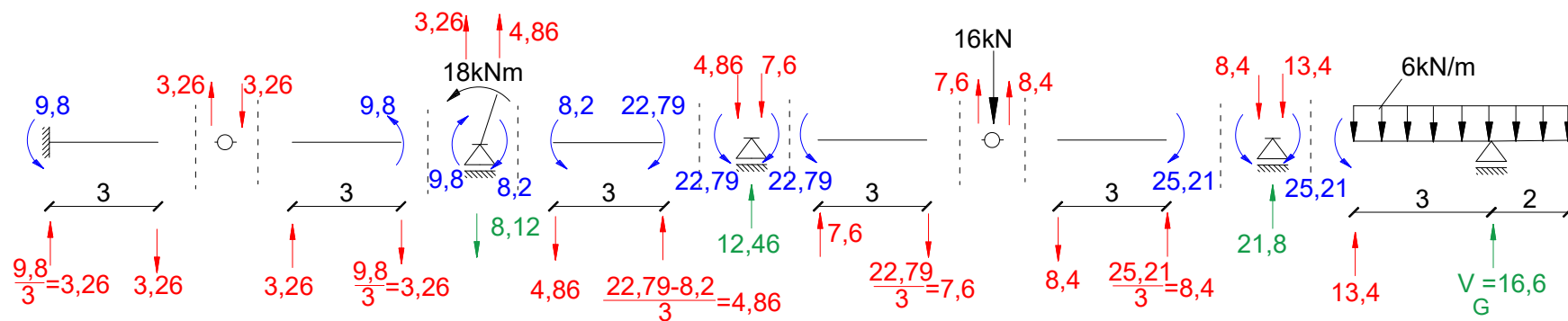
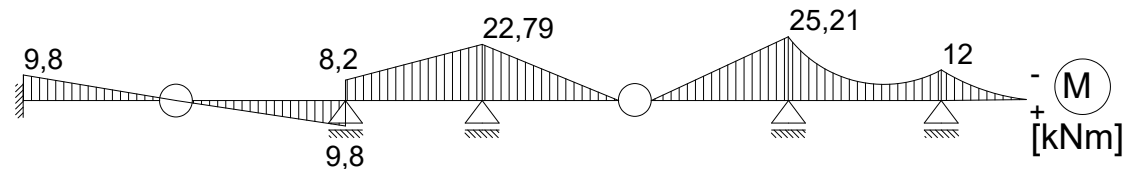
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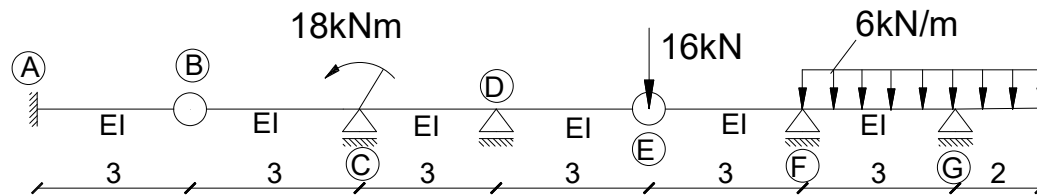


$$\sum M_F = -25,21 + 6 \cdot 5 \cdot 2,5 - V_G \cdot 3 = 0 \rightarrow V_G = 16,6 \text{ kN}$$

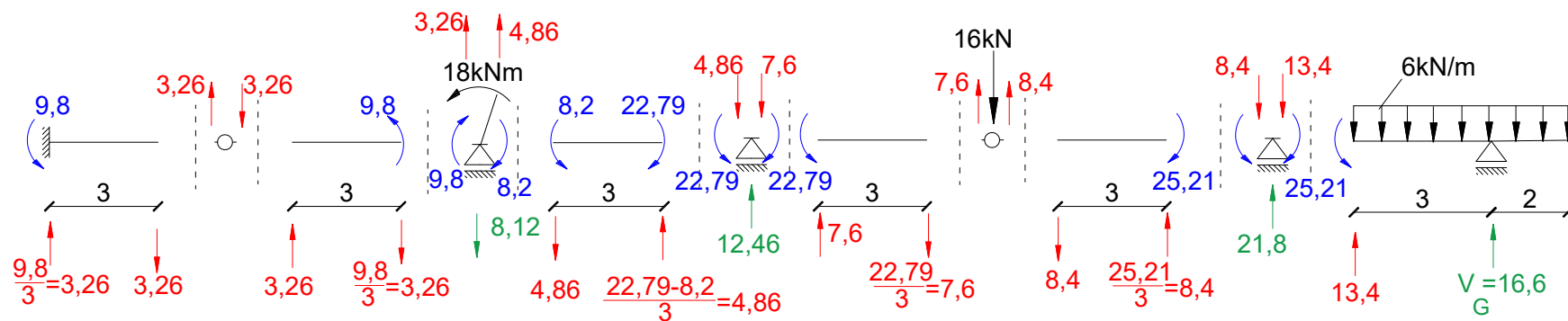
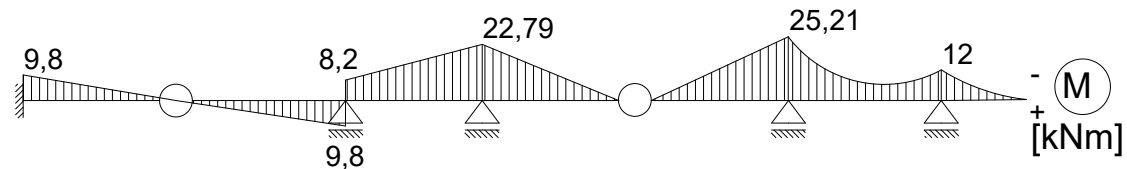


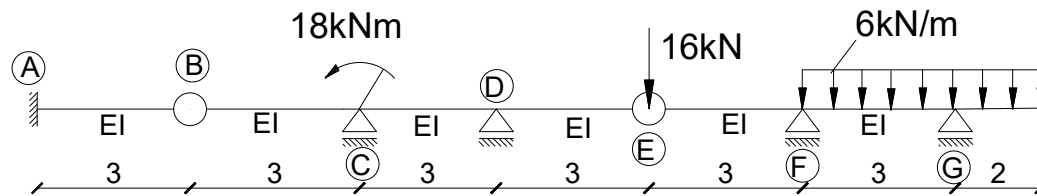
Wyznaczenie sił tnących:



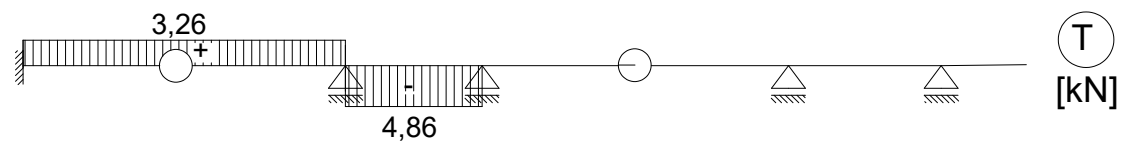
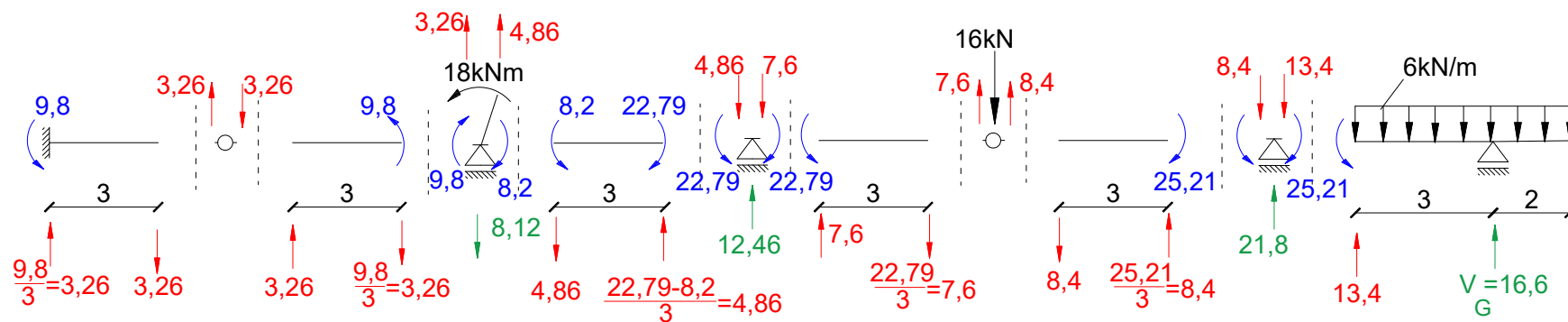
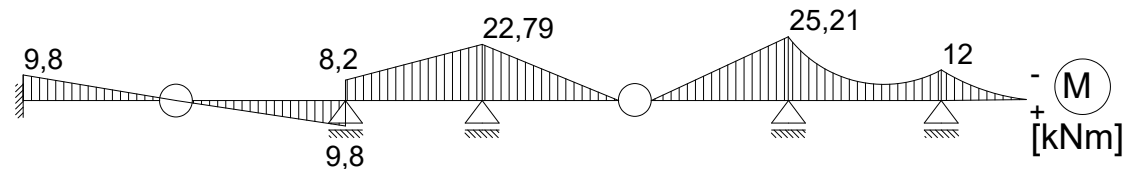


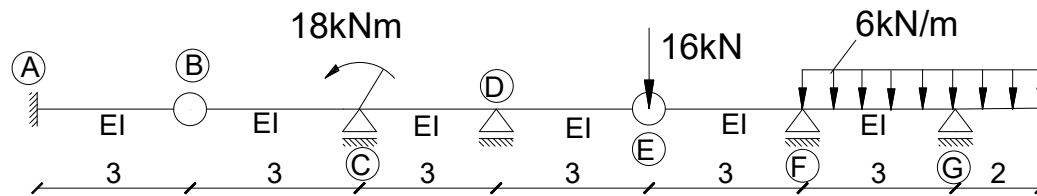
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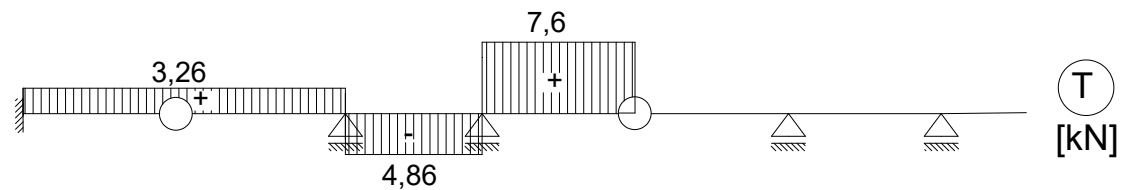
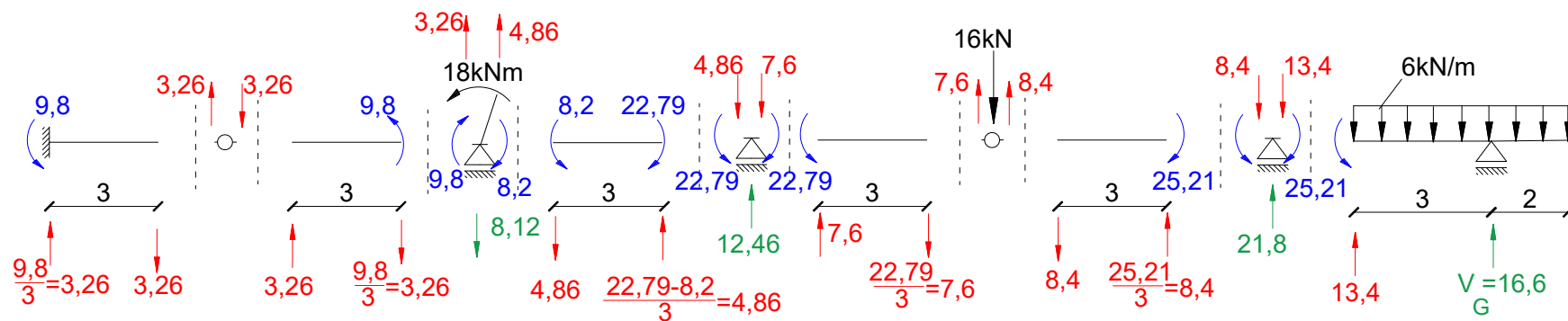
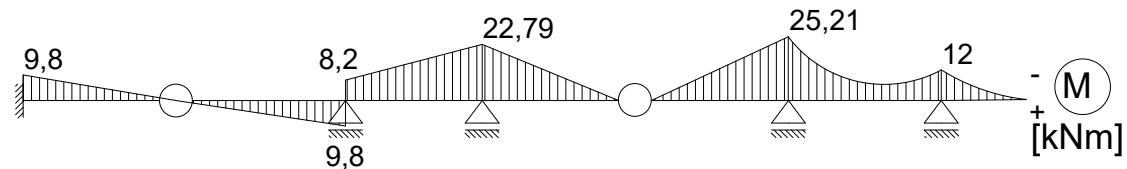


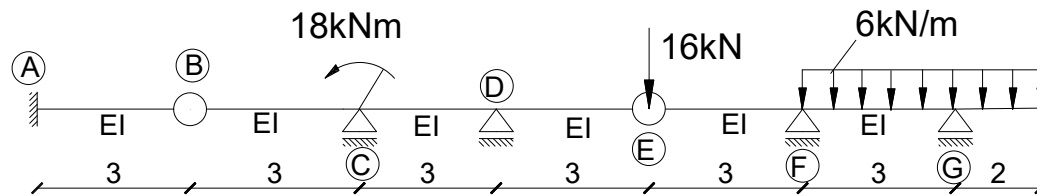
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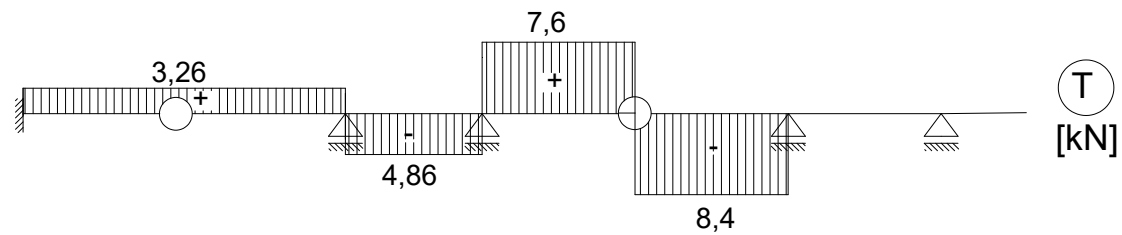
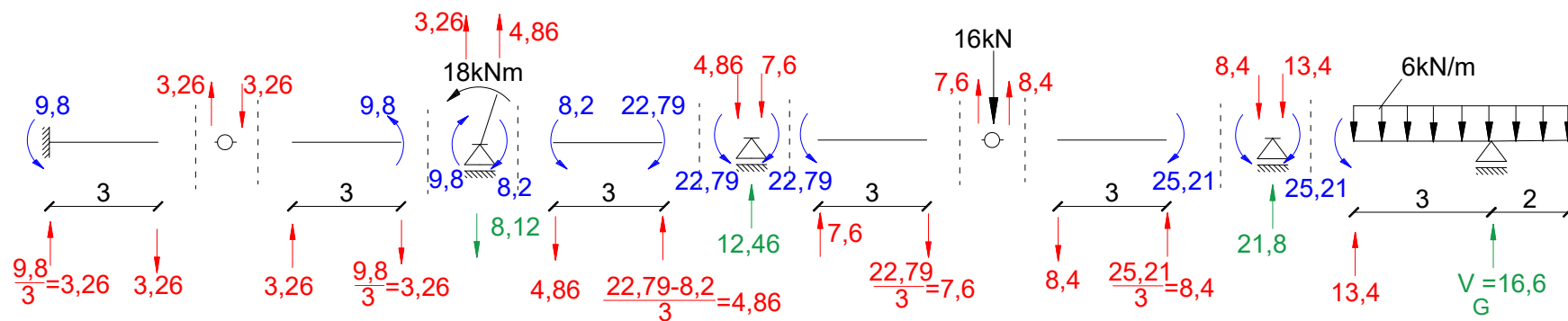
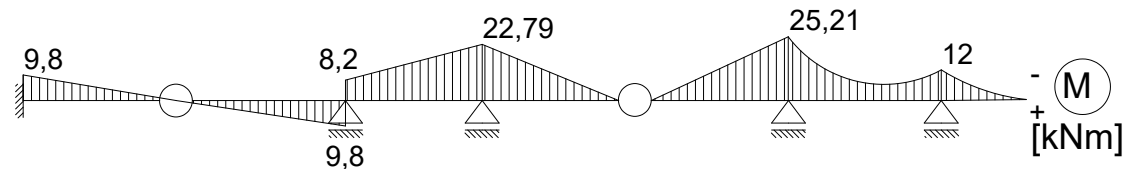


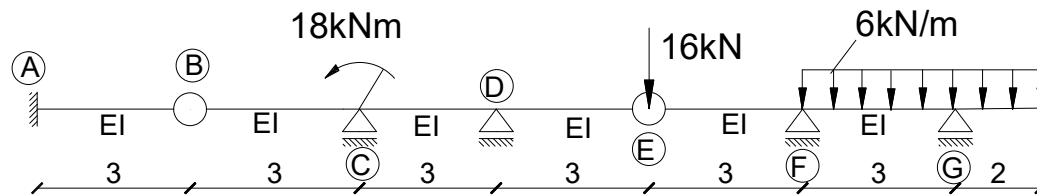
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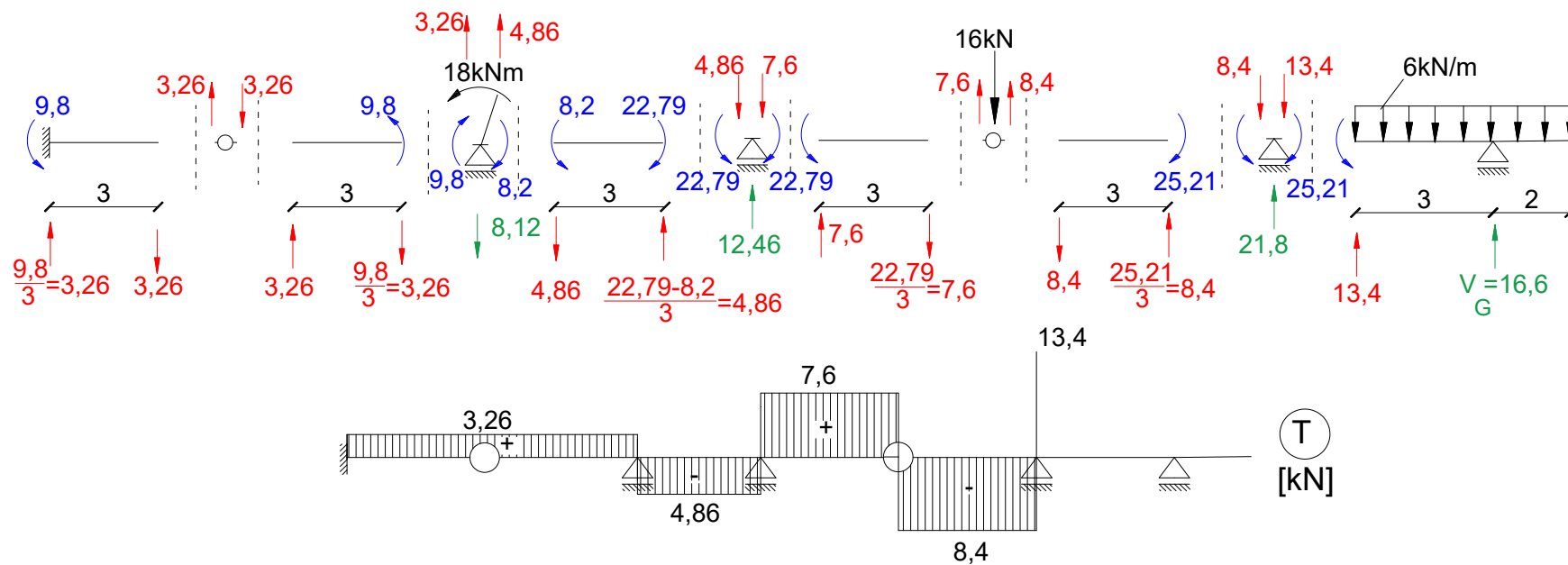
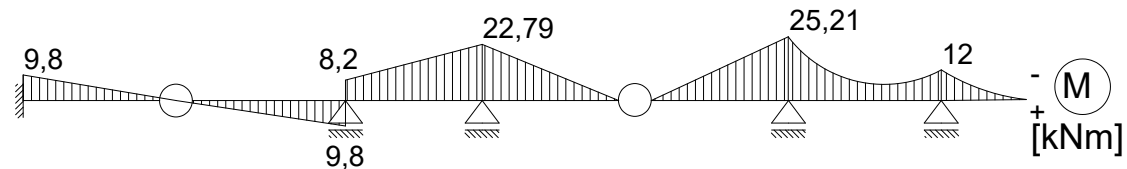


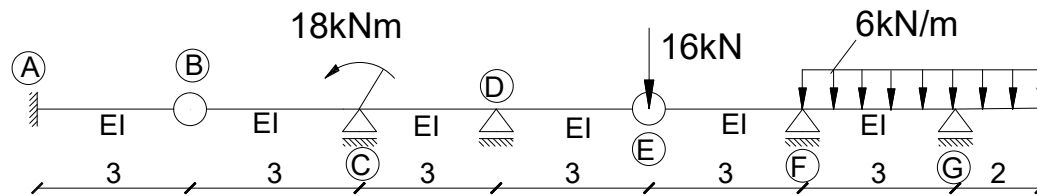
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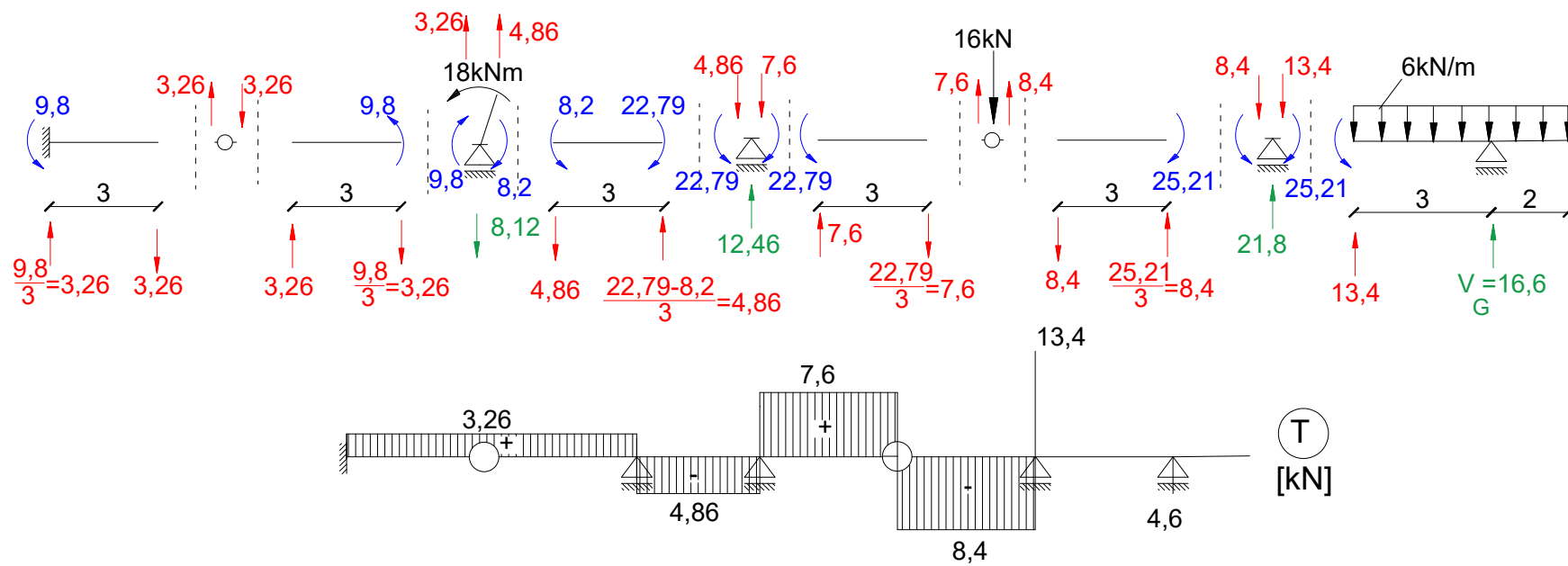
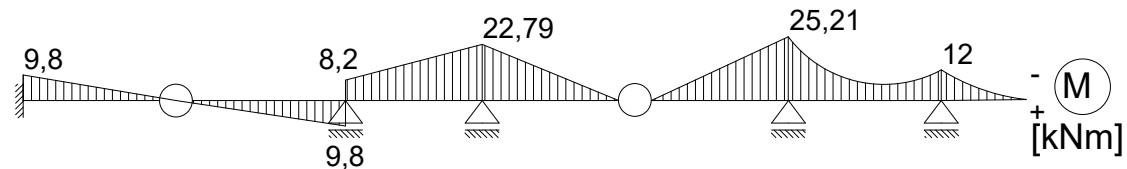


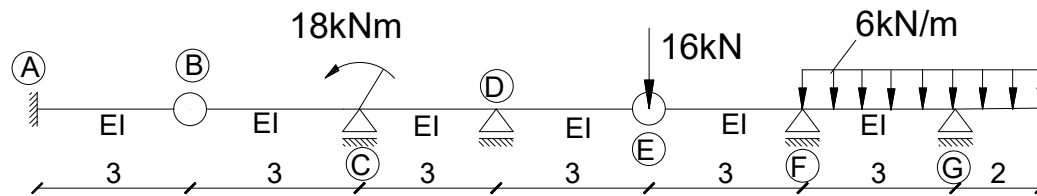
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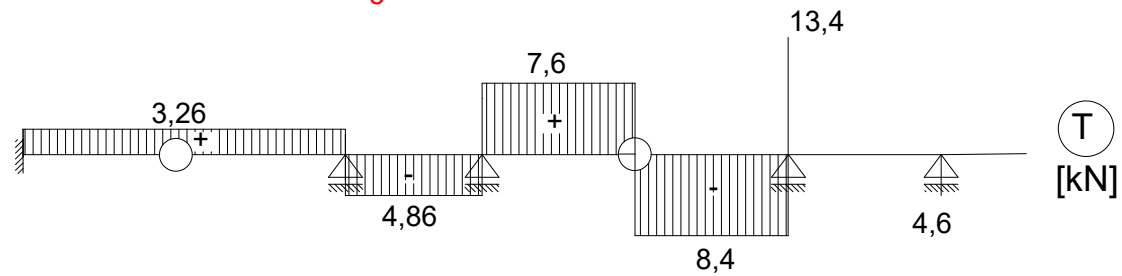
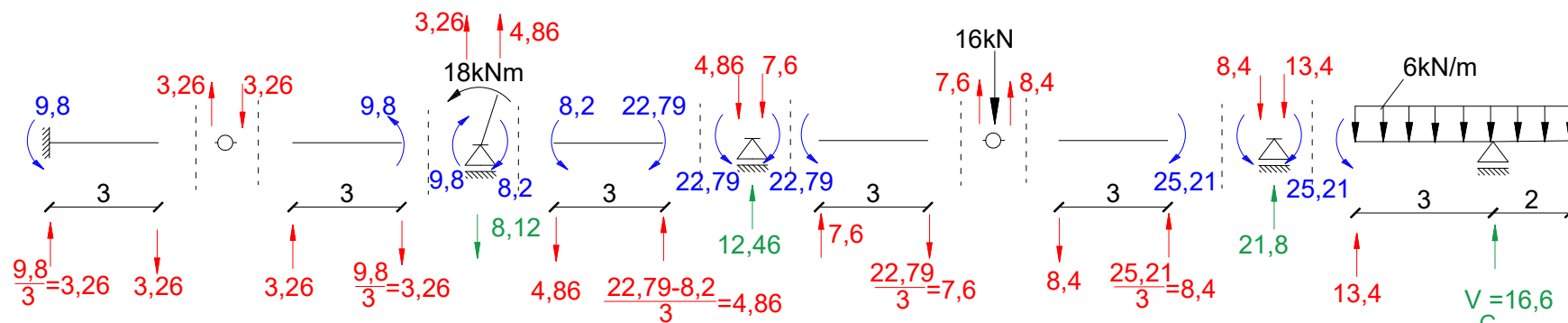
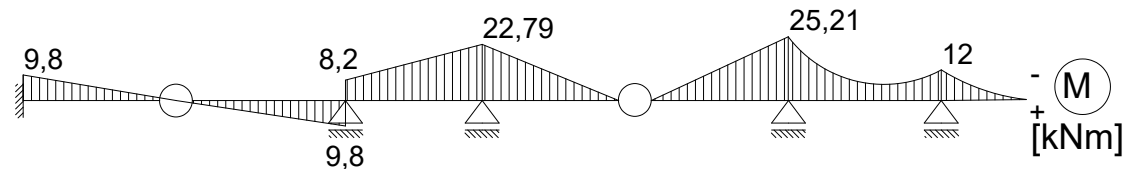


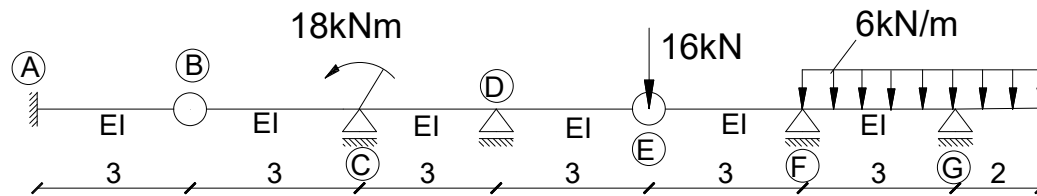
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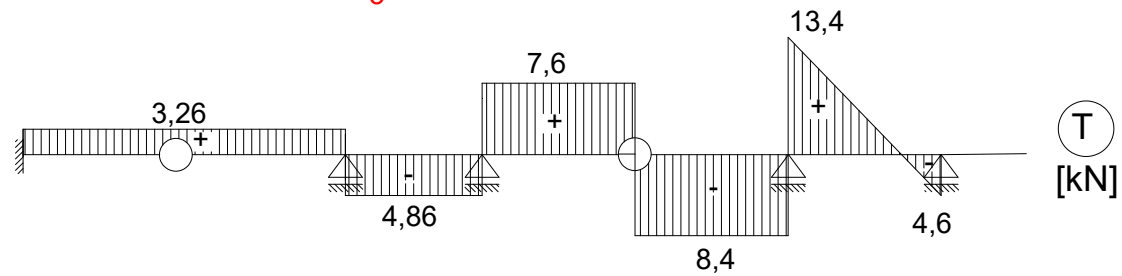
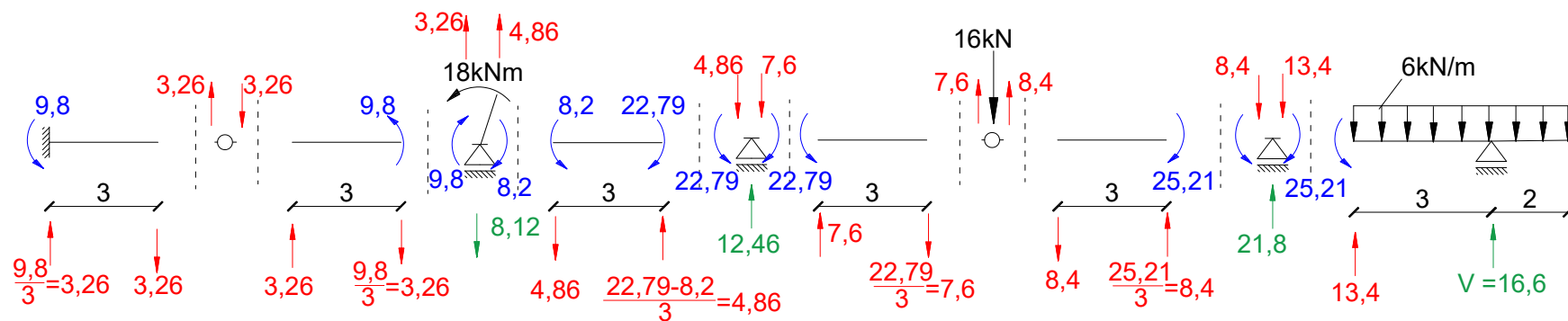
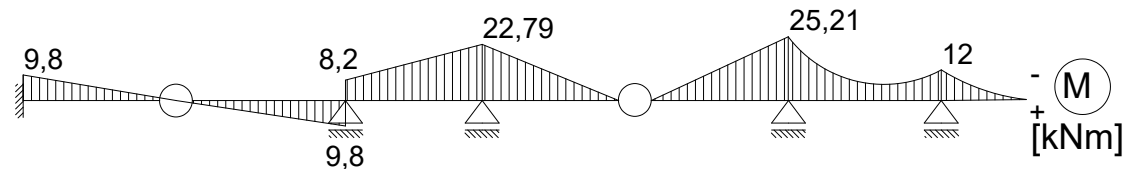


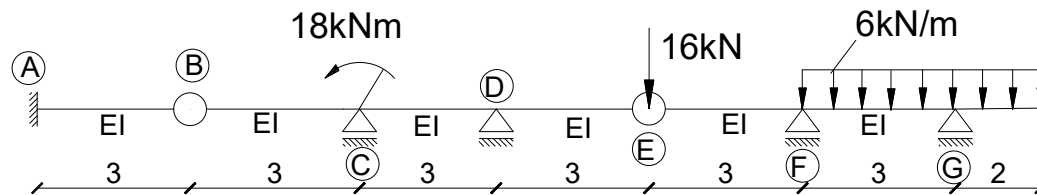
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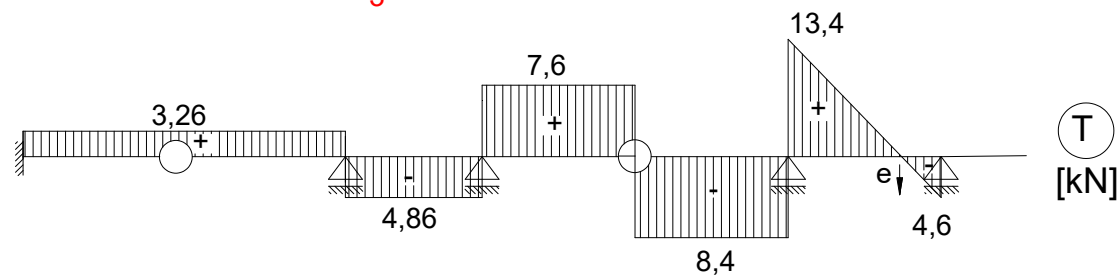
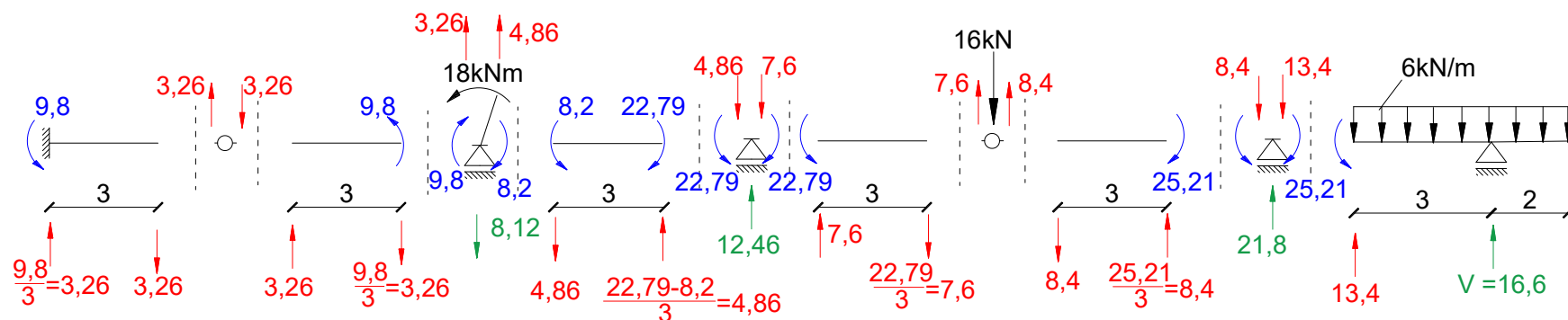
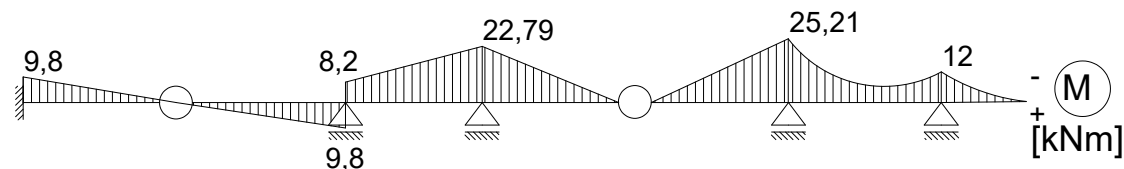


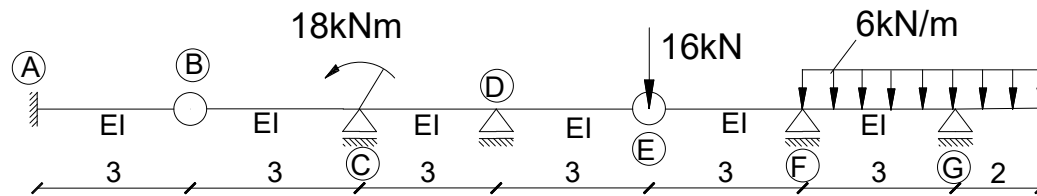
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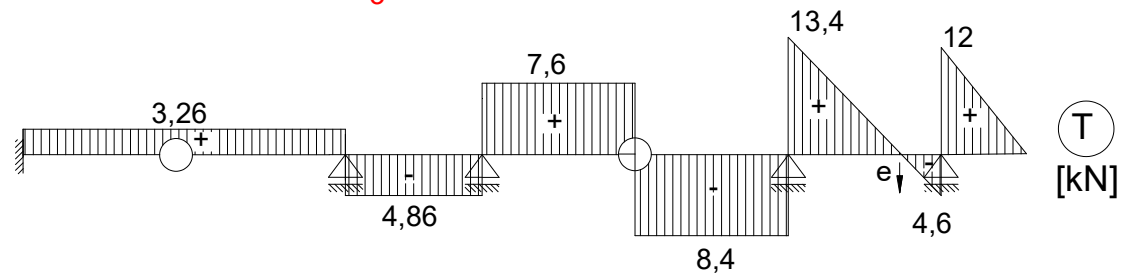
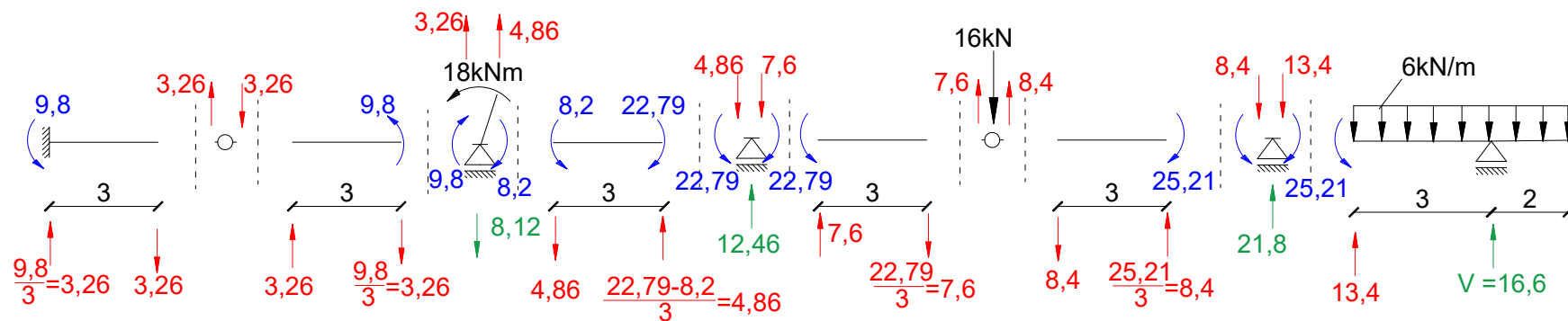
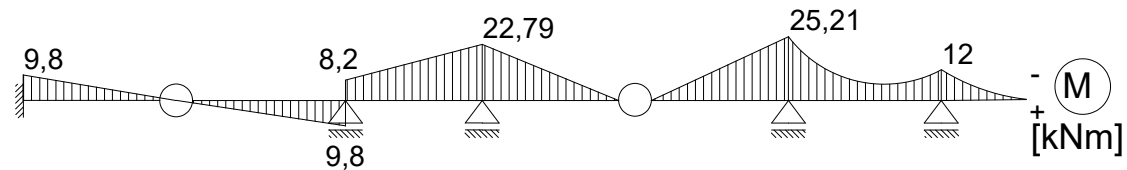


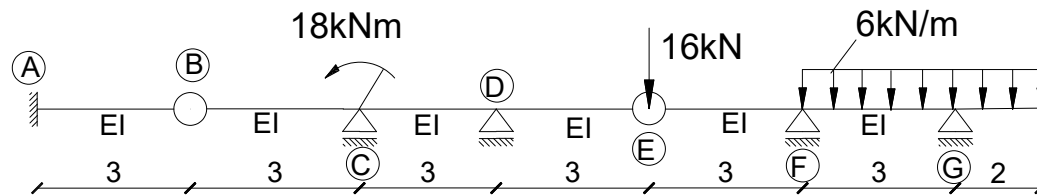
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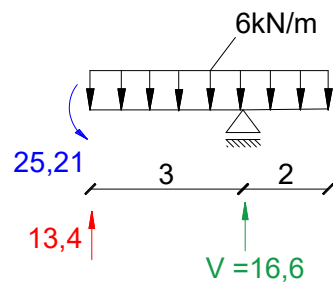
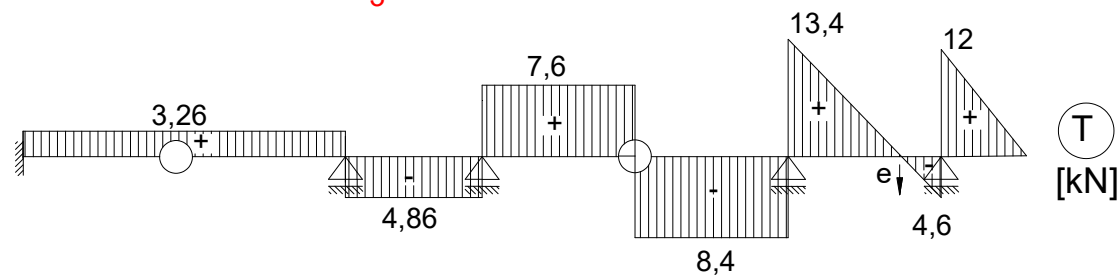
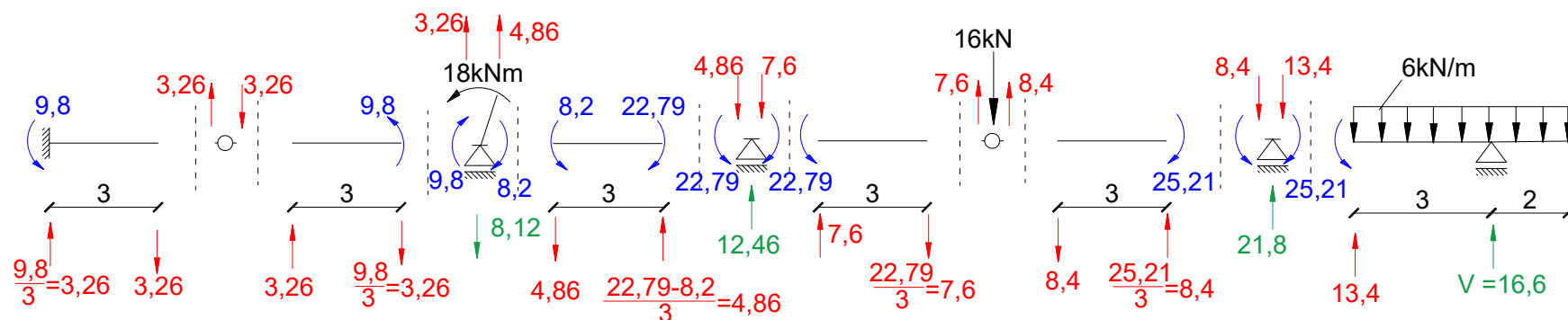
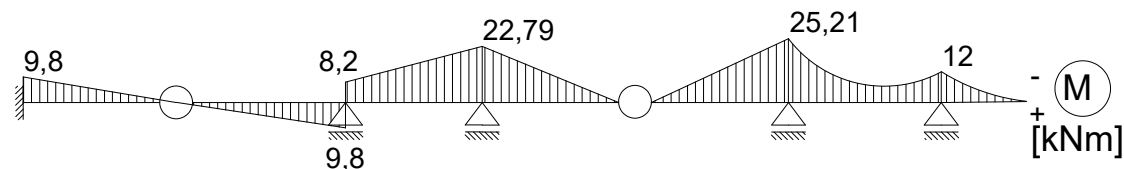


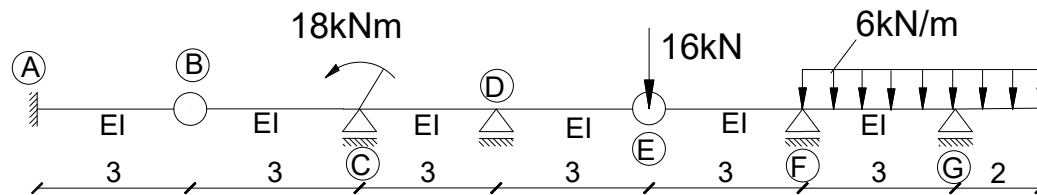
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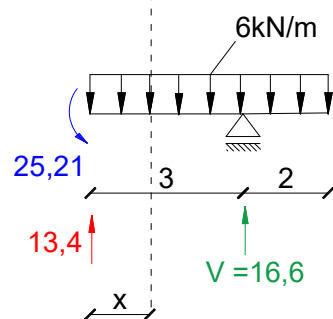
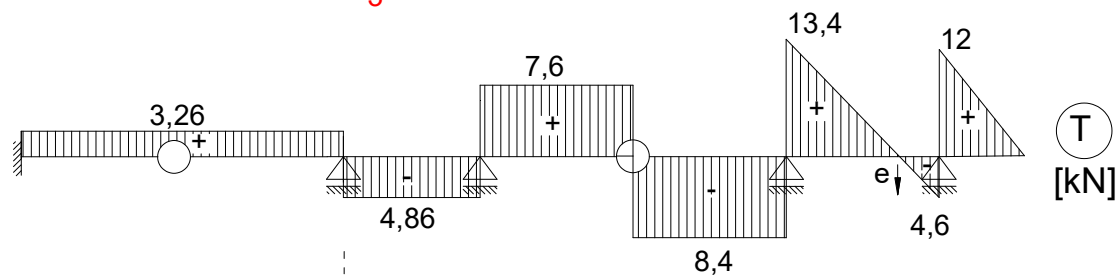
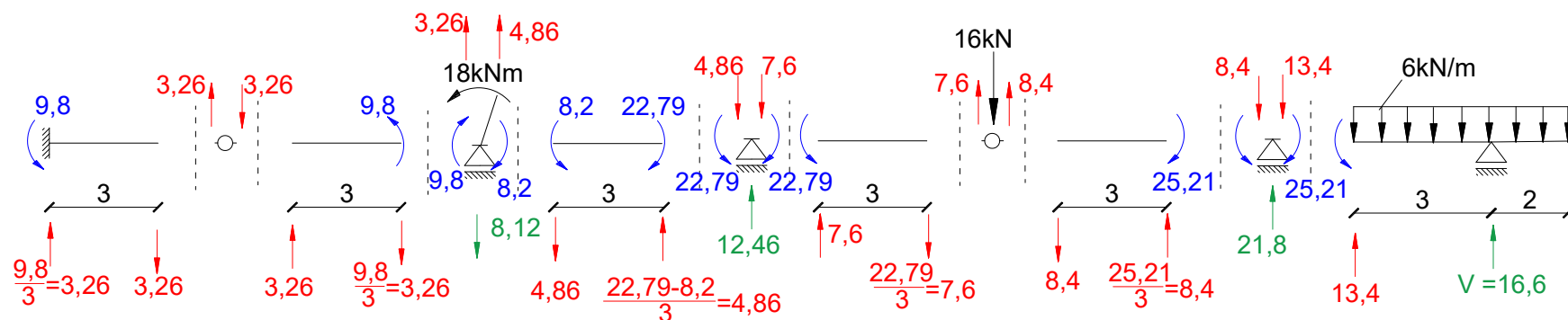
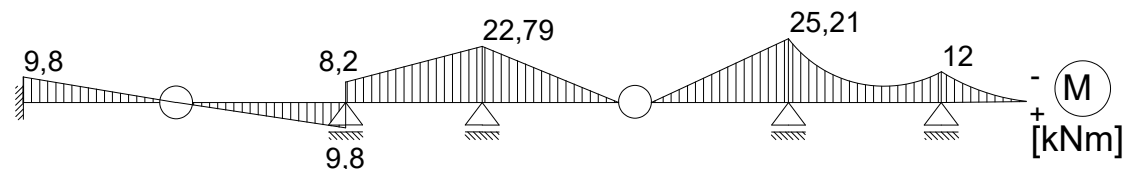


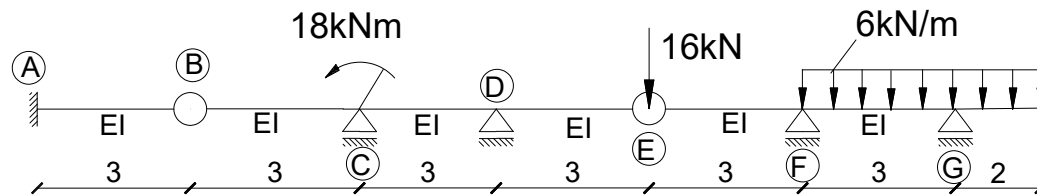
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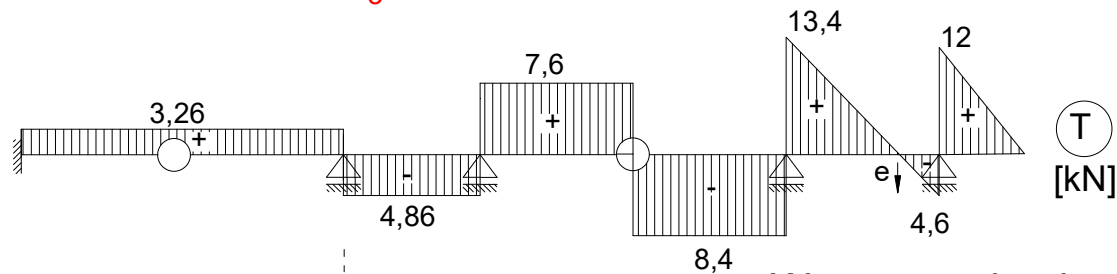
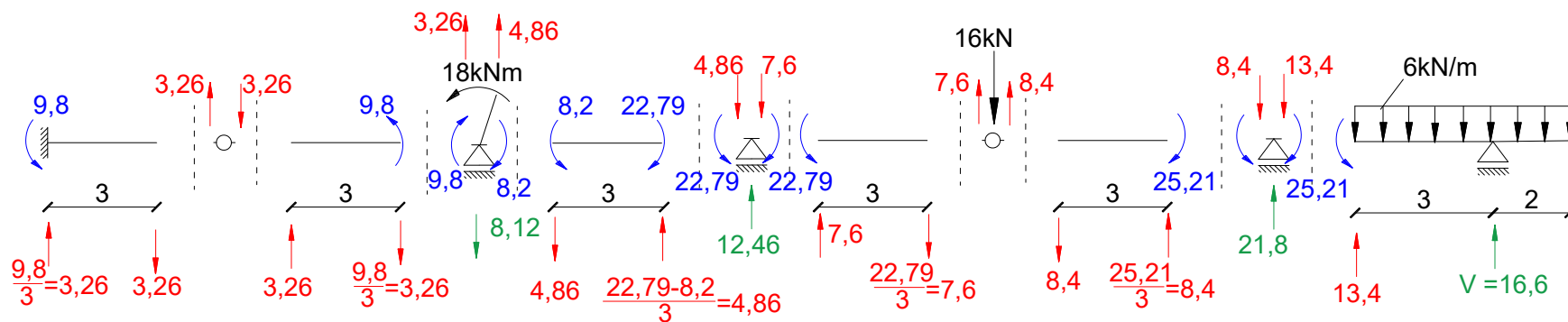
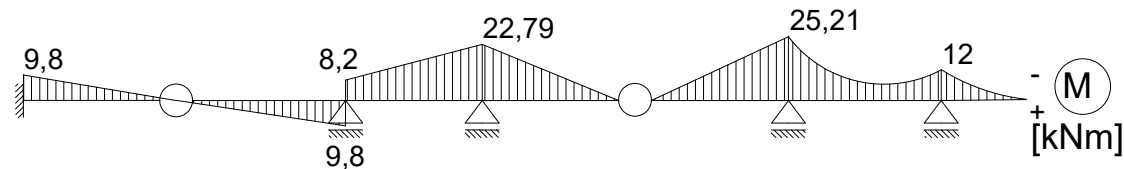


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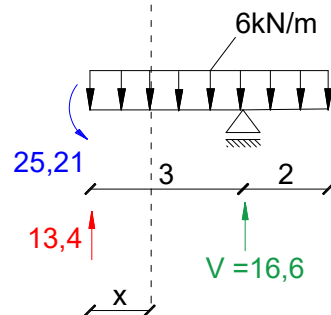


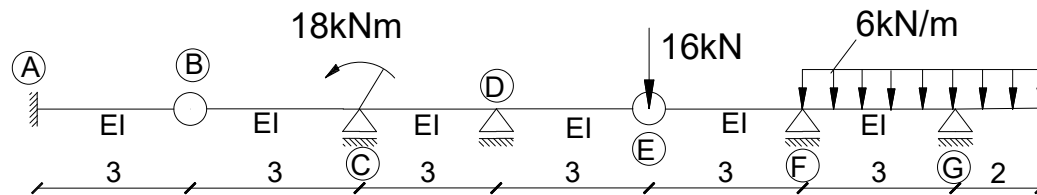


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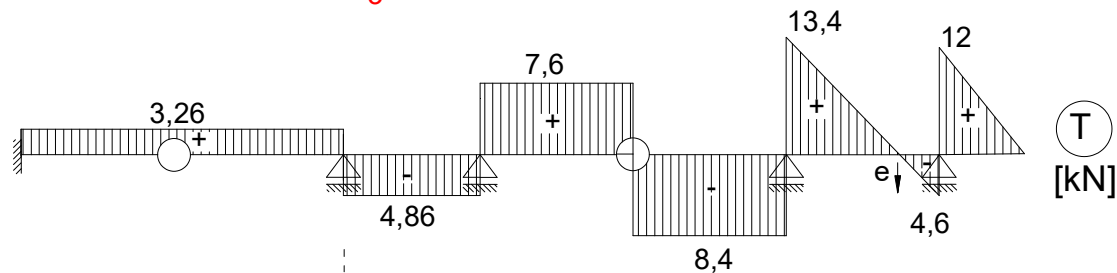
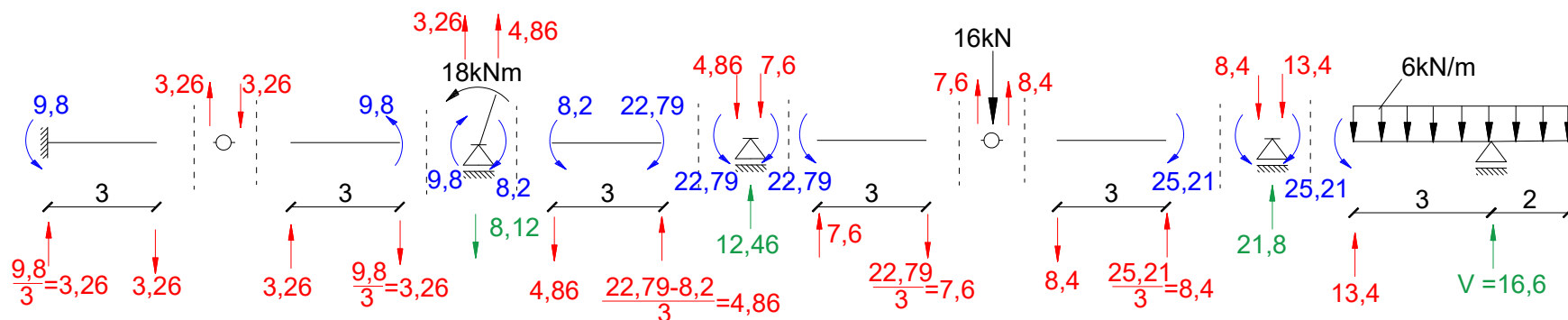
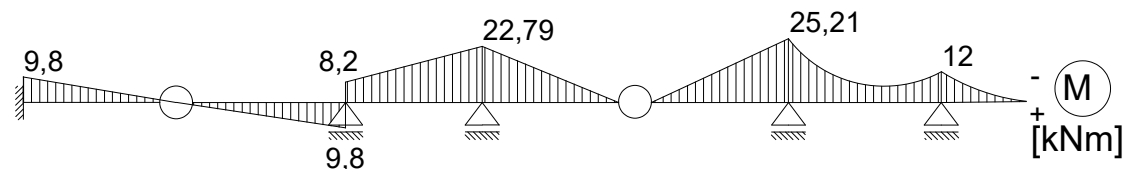


Wyznaczenie ekstremum:



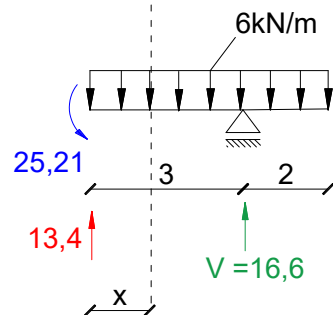


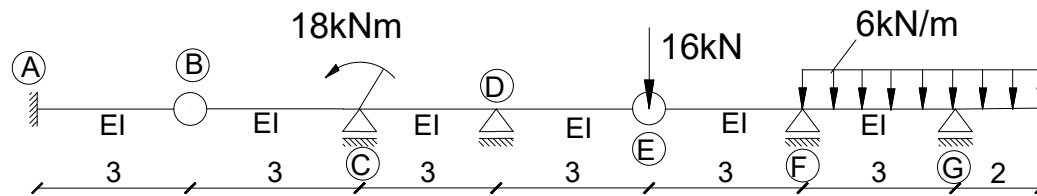
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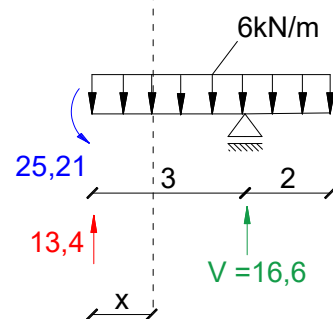
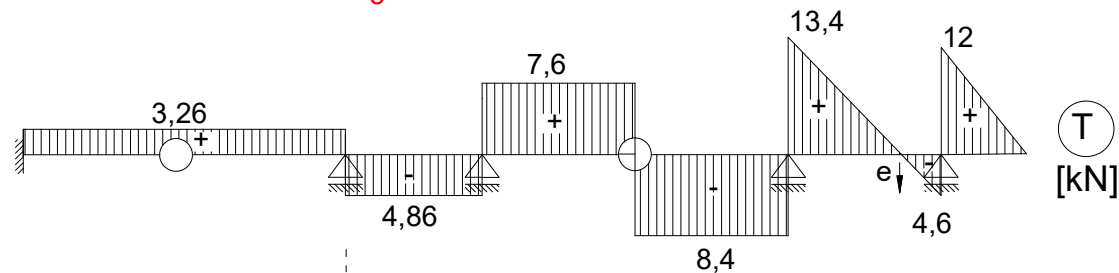
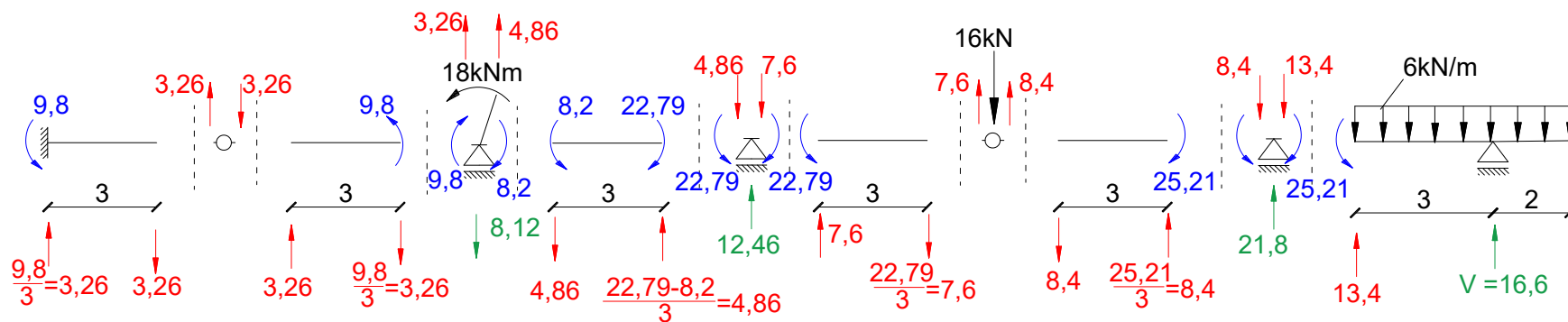
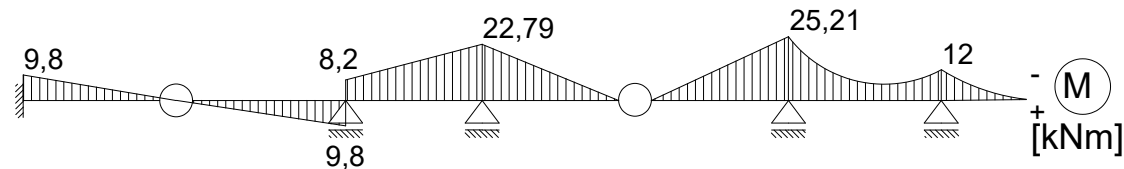
Wyznaczenie ekstremum:

$$T[x] = 13,4 - 6x = 0 \rightarrow x = \frac{13,4}{6} = 2,23m$$





Wyznaczenie sił tnących:



Wyznaczenie ekstremum:

$$T[x] = 13,4 - 6x = 0 \rightarrow x = \frac{13,4}{6} = 2,23m$$

$$M[x = 2,23] = 13,4 \cdot 2,23 - 25,21 - \frac{6 \cdot 2,23^2}{2} = -10,25kNm$$

dr inż. Hanna Weber