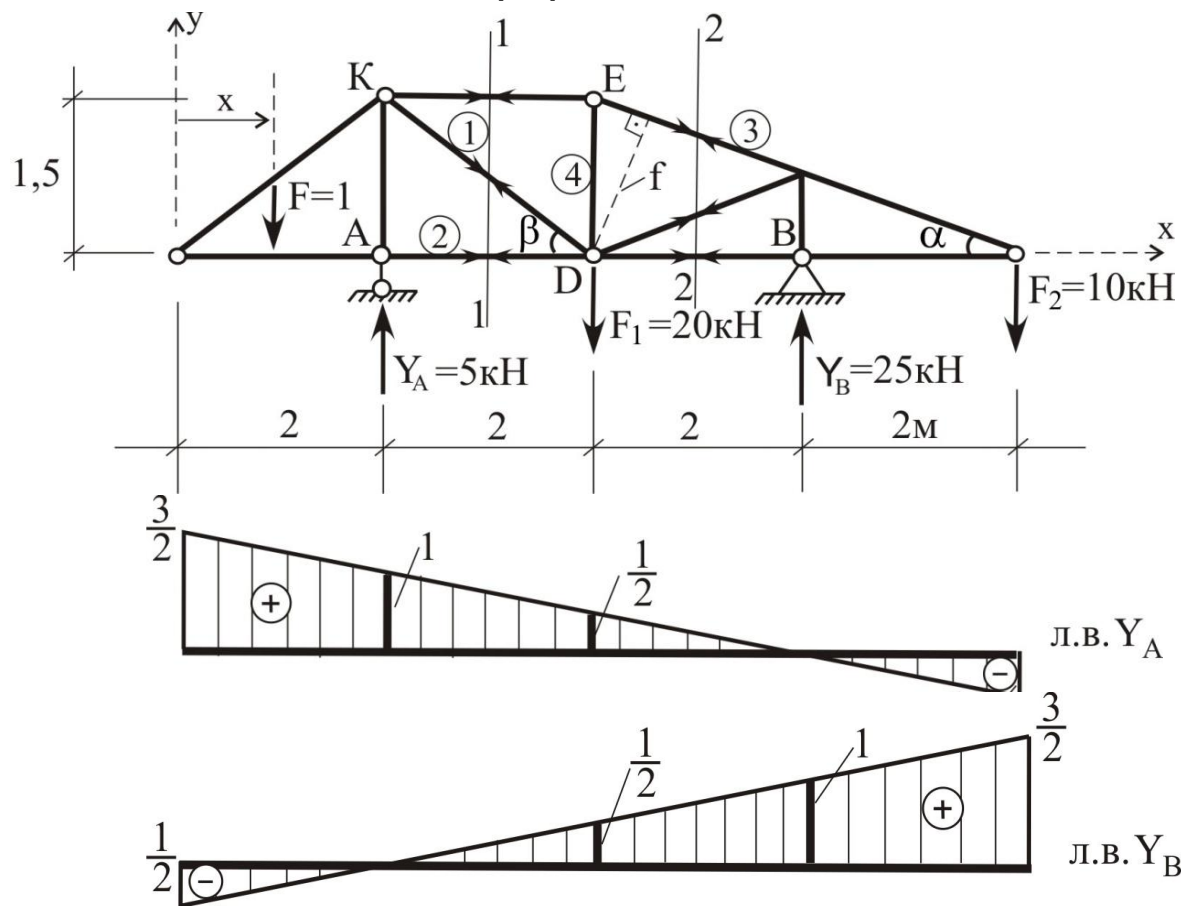


Расчет фермы



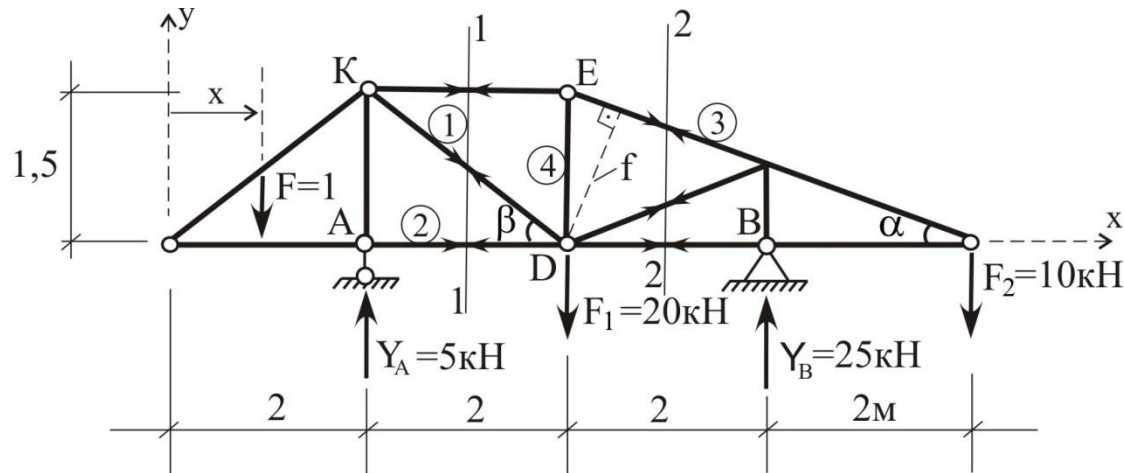
1. Реакции опор (загружением линий влияния)

$$Y_A = 20 \cdot \frac{1}{4} - 10 \cdot \frac{1}{2} = 5 \text{ кН},$$

$$Y_B = 20 \cdot \frac{1}{2} + 10 \cdot \frac{3}{2} = 25 \text{ кН}$$

Проверка: $\sum Y = Y_A + Y_B - F_1 - F_2 = 5 + 25 - 20 - 10 = 0.$

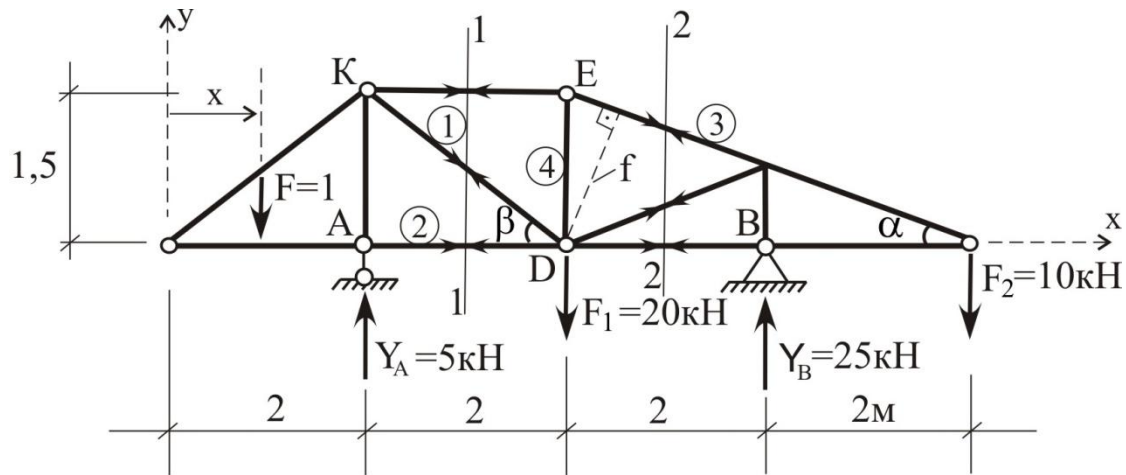
2. Определение усилий в отмеченных стержнях фермы



Сечение 1-1:

$$\sum Y^{\text{лев}} = 0: -N_1 \cdot \sin \beta + Y_A = 0 \rightarrow N_1 = \frac{5}{0.6} = \frac{25}{3} \approx 8.33(\text{кН}).$$

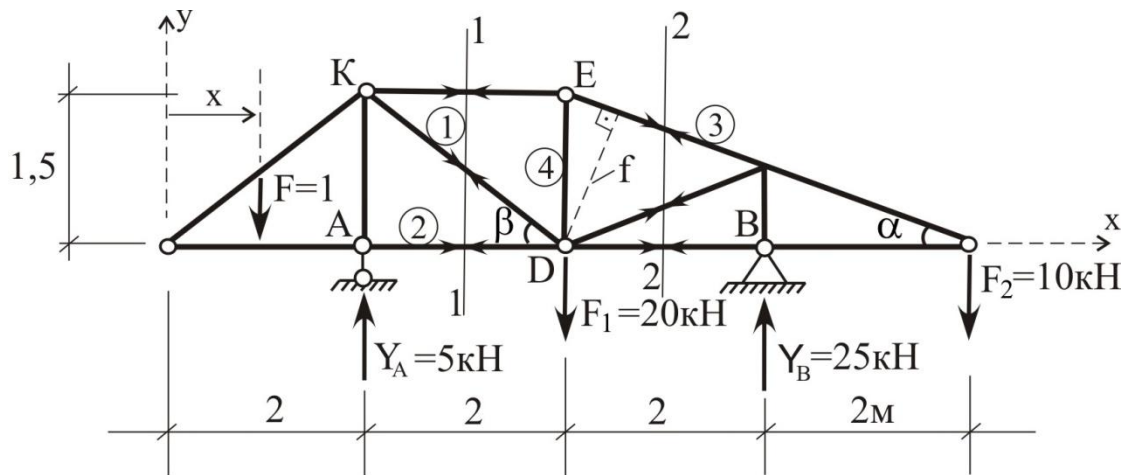
$$\sum M_K^{\text{лев}} = 0: N_2 \cdot 1.5 = 0 \rightarrow N_2 = 0,$$



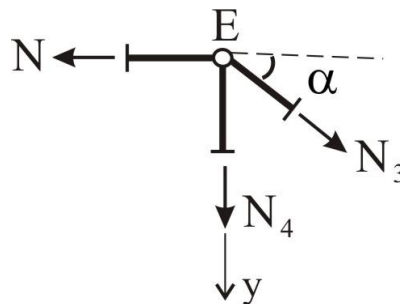
Сечение 2-2:

$$(\sin \alpha = \frac{1.5}{\sqrt{1.5^2 + 4^2}} \approx 0.351, \quad f = 4 \cdot \sin \alpha = 4 \cdot 0.351 = 1.404 \text{ м})$$

$$\sum M_D^{\text{прав}} = 0: \quad N_3 \cdot f + Y_B \cdot 2 - F_2 \cdot 4 = 0 \quad \rightarrow \quad N_3 = \frac{40 - 50}{1.404} \approx -7.12 (\text{кН}),$$

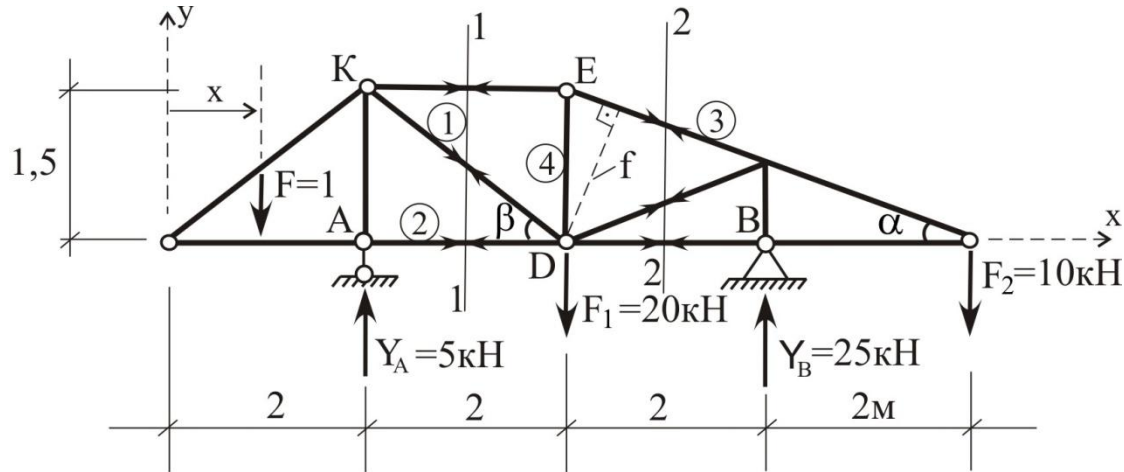


Узел E:



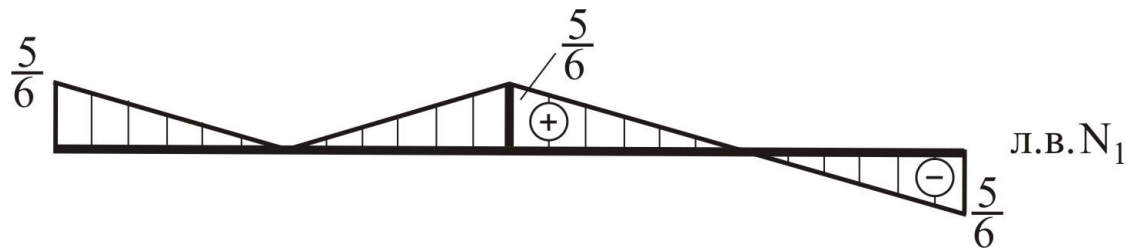
$$\sum Y = 0: \quad N_4 + N_3 \cdot \sin \alpha = 0 \quad \rightarrow \quad N_4 = -0.351 \cdot N_3 \approx 1.25(\text{кН}),$$

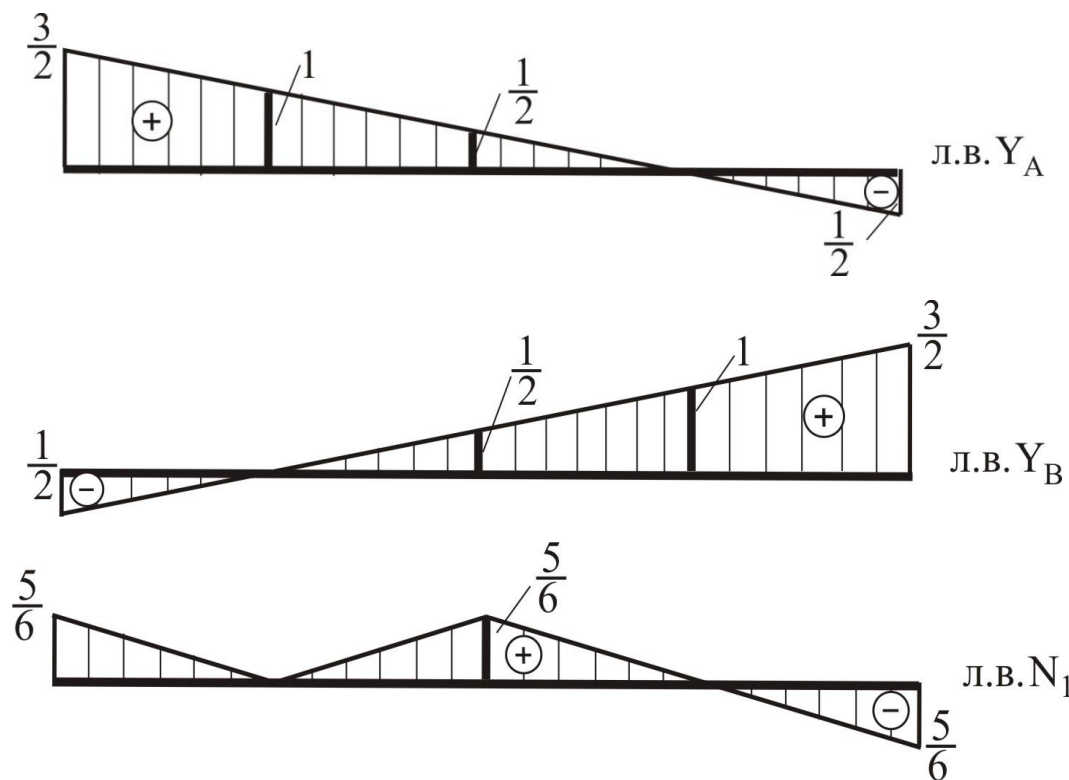
3. Построение и загрузка линий влияния



$$0 \leq x \leq 2: \sum Y^{\text{прав}} = 0: N_1 \cdot \sin \beta + Y_A = 0 \rightarrow N_1 = -\frac{5}{3} \cdot Y_B,$$

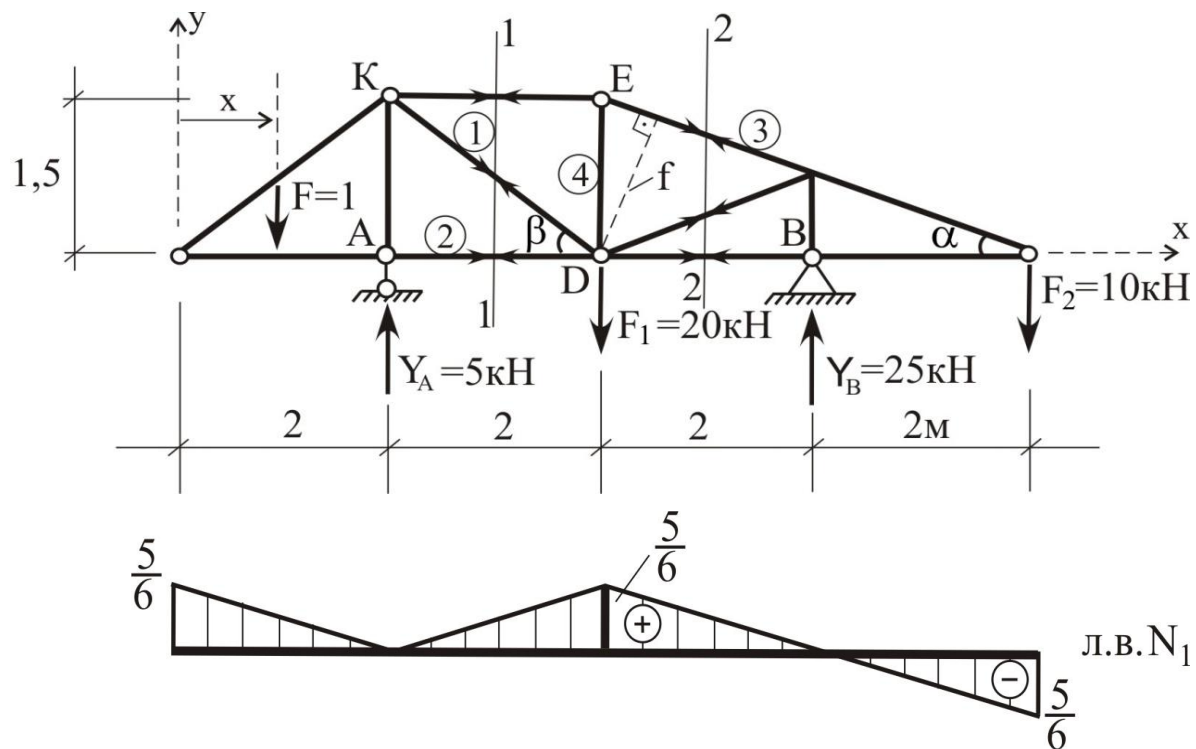
$$4 \leq x \leq 8: \sum Y^{\text{лев}} = 0: -N_1 \cdot \sin \beta + Y_A = 0 \rightarrow N_1 = \frac{5}{3} \cdot Y_B,$$





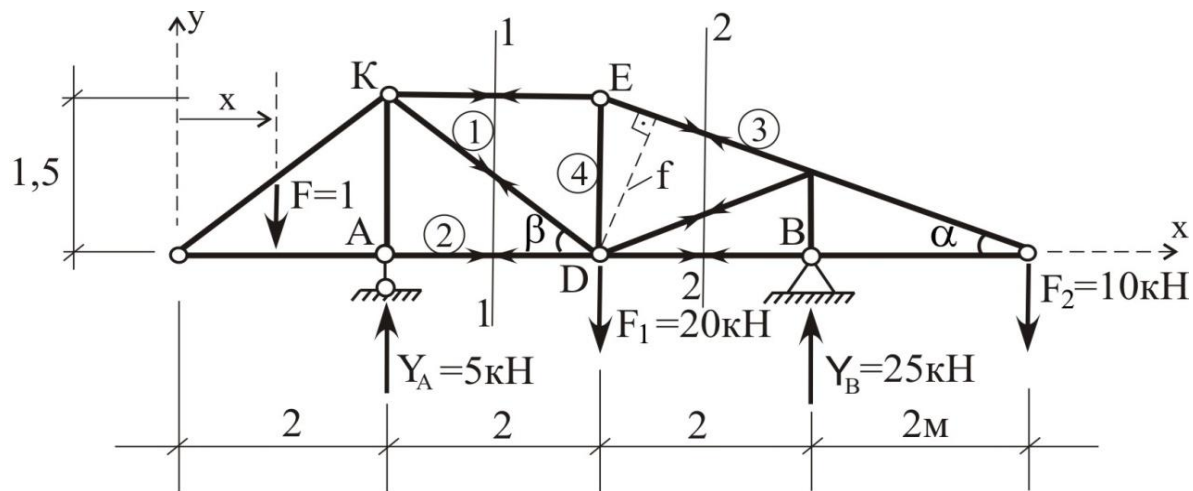
$$0 \leq x \leq 2: \sum Y^{\text{прав}} = 0: N_1 \cdot \sin \beta + Y_A = 0 \rightarrow N_1 = -\frac{5}{3} \cdot Y_B,$$

$$4 \leq x \leq 8: \sum Y^{\text{лев}} = 0: -N_1 \cdot \sin \beta + Y_A = 0 \rightarrow N_1 = \frac{5}{3} \cdot Y_B,$$



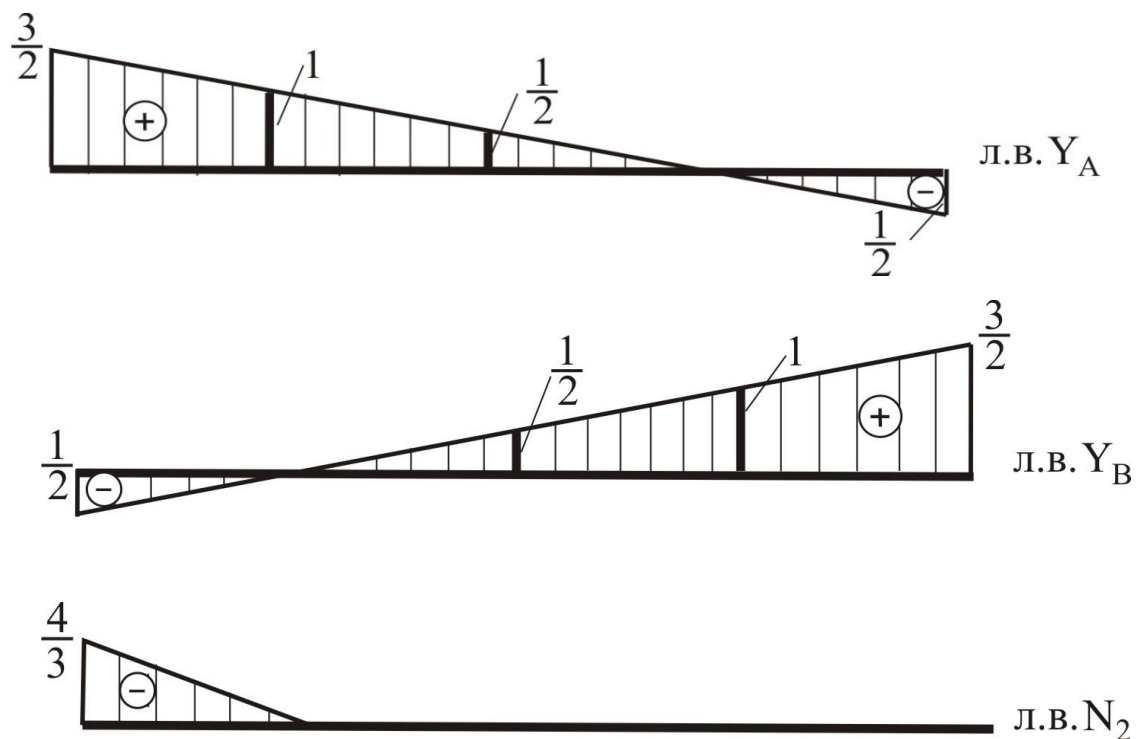
Загружены
е

$$N_1 = \frac{5}{6} \cdot (20 - 10) = \frac{50}{6} \approx 8.33(\text{кН});$$



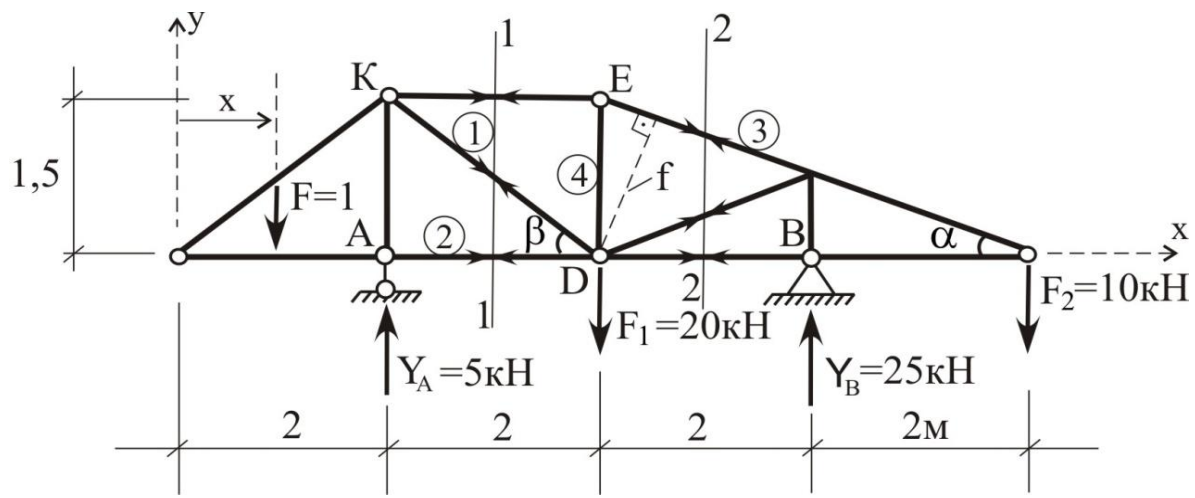
$$0 \leq x \leq 2: \sum M_K^{\text{прав}} = 0: N_2 \cdot \frac{3}{2} - Y_B \cdot 4 = 0 \rightarrow N_2 = \frac{8}{3} \cdot Y_B - \text{левая ветвь линии влияния,}$$

$$4 \leq x \leq 8: \sum M_K^{\text{лев}} = 0: N_2 \cdot \frac{3}{2} = 0 \rightarrow N_2 = 0 - \text{правая ветвь линии влияния.}$$



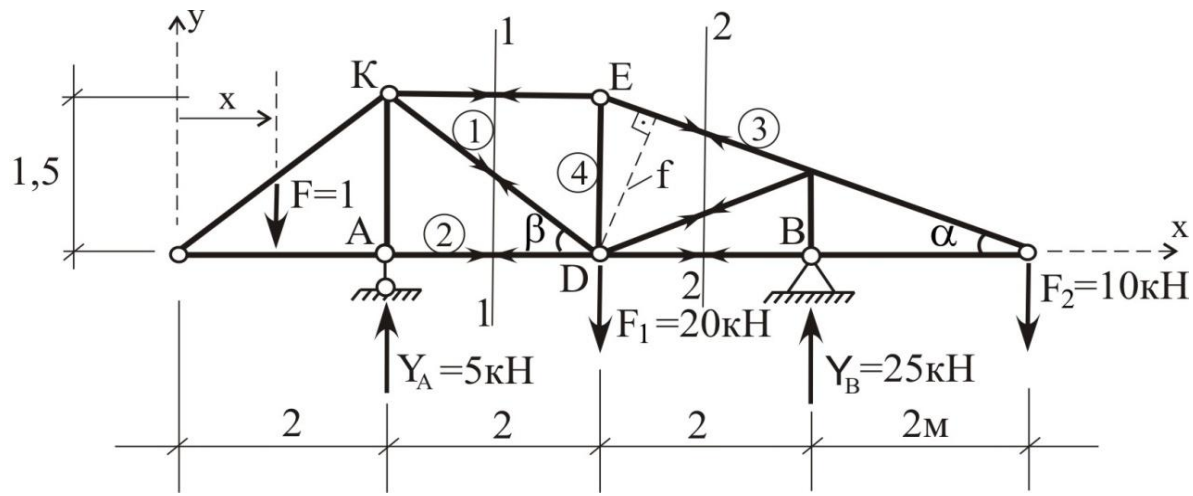
$$0 \leq x \leq 2: \sum M_K^{\text{прав}} = 0: N_2 \cdot \frac{3}{2} - Y_B \cdot 4 = 0 \rightarrow N_2 = \frac{8}{3} \cdot Y_B - \text{левая ветвь линии влияния,}$$

$$4 \leq x \leq 8: \sum M_K^{\text{лев}} = 0: N_2 \cdot \frac{3}{2} = 0 \rightarrow N_2 = 0 - \text{правая ветвь линии влияния.}$$



Загружены
е

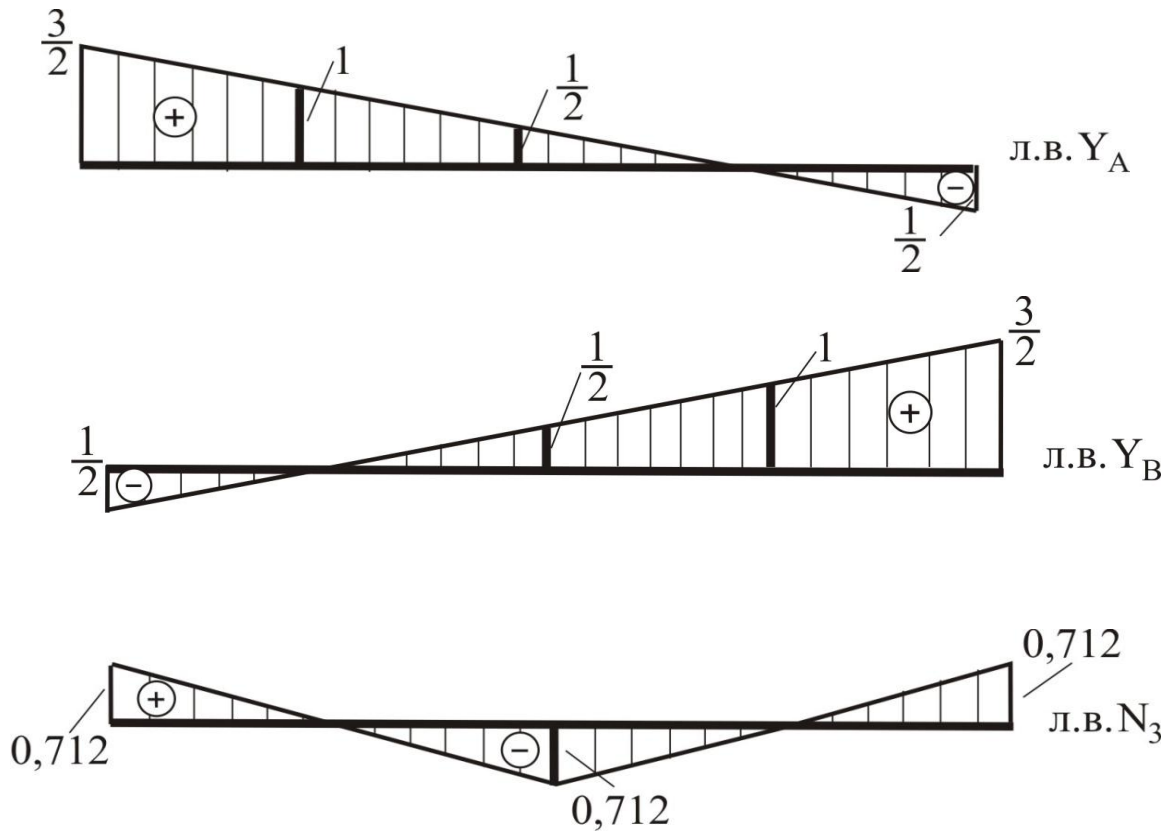
$$N_2 = 0;$$



Сечение 2-2:

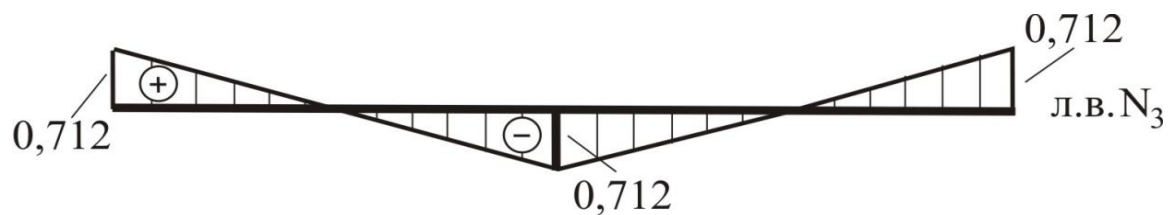
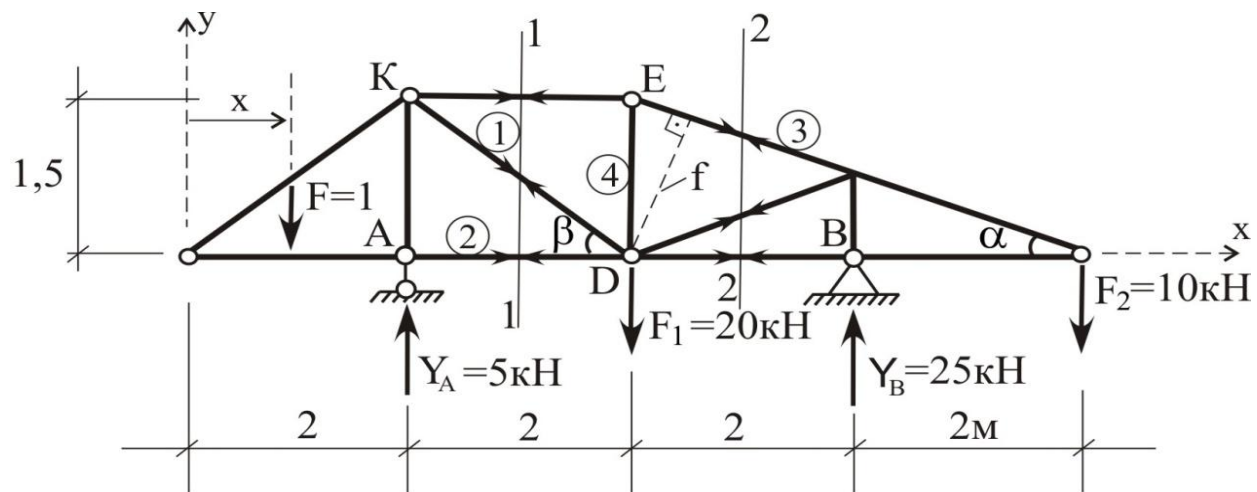
$$0 \leq x \leq 4: \sum M_D^{\text{прав}} = 0: N_3 \cdot f + Y_B \cdot 2 = 0 \rightarrow N_3 = -1.424 \cdot Y_B - \text{левая ветвь линии влияния,}$$

$$6 \leq x \leq 8: \sum M_D^{\text{лев}} = 0: N_3 \cdot f + Y_A \cdot 2 = 0 \rightarrow N_3 = -1.424 \cdot Y_A - \text{правая ветвь линии влияния.}$$



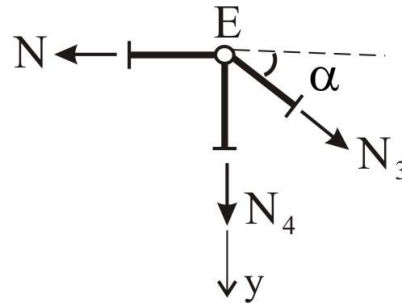
$$0 \leq x \leq 4: \sum M_D^{\text{прав}} = 0: N_3 \cdot f + Y_B \cdot 2 = 0 \rightarrow N_3 = -1.424 \cdot Y_B - \text{левая ветвь линии влияния,}$$

$$0 \leq x \leq 4: \sum M_D^{\text{прав}} = 0: N_3 \cdot f + Y_B \cdot 2 = 0 \rightarrow N_3 = -1.424 \cdot Y_B - \text{левая ветвь линии влияния,}$$

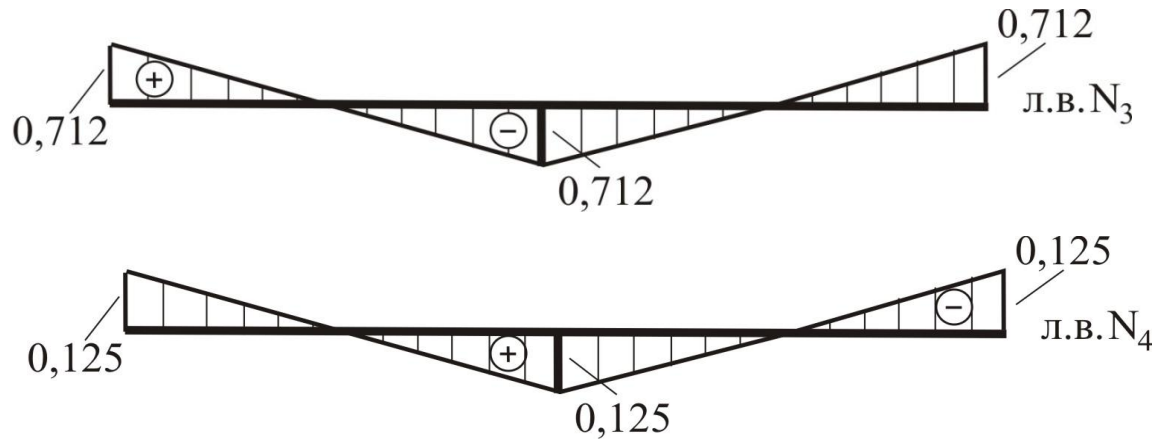


Загружены
е

$$N_3 = 0,712 \cdot (-20 + 10) = -7.12(\text{кН});$$



$$\sum Y = 0: N_4 + N_3 \cdot \sin \alpha = 0 \rightarrow N_4 = -0.351 \cdot N_3,$$



Загружены
е

$$N_4 = 0.125 \cdot (20 - 10) = 1.25(\text{кН});$$