

1. Obliczenie stopnia statycznej niewyznaczalności.

$$n_s = r + s - 3t = 4 + 2 - 3 \cdot 2 = 0$$

2. Obliczenie reakcji :

$$\sum M_C = 0$$

$$-2ql \cdot 3l + R_B \cdot 2l - 2ql^2 = 0$$

$$R_B = 4ql$$

$$\sum P_y = 0$$

$$-2ql + R_B + R_C = 0$$

$$R_C = -2ql$$

$$\sum P_x^L = 0$$

$$2\sqrt{3}ql - H_C = 0$$

$$H_C = 2\sqrt{3}ql$$

$$\sum P_x^P = 0$$

$$H_C - H_D = 0$$

$$H_D = 2\sqrt{3}ql$$

$$\sum M_E = 0$$

$$-R_C \cdot 3l - 2ql \cdot 2l \cdot 2l + R_D \cdot l = 0$$

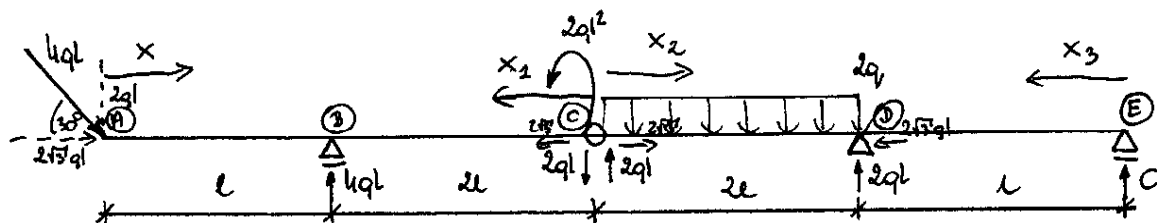
$$R_D = 2ql$$

$$\sum P_y = 0$$

$$-R_C - 4ql + R_D + R_E = 0$$

$$R_E = 0$$

3. Równanie sił wewnętrznych w poszczególnych przedziałach.



$$AB \quad 0 \leq x \leq l$$

$$T(x) = -2ql$$

$$M(x) = -2ql \cdot x$$

$$N(x) = -2\sqrt{3}ql$$

$$CB \quad 0 \leq x_1 \leq 2l$$

$$T(x_1) = 2ql$$

$$M(x_1) = 2ql^2 - 2ql \cdot x_1$$

$$N(x_1) = -2\sqrt{3}ql$$

$$CD \quad 0 \leq x_2 \leq 2l$$

$$T(x_2) = 2ql - 2q \cdot x_2$$

$$M(x_2) = 2ql \cdot x_2 - 2q \cdot x_2 \cdot \frac{x_2}{2}$$

$$N(x_2) = -2\sqrt{3}ql$$

Nyżsaczenie ekstremum :

$$T(x_2) = 0 \Rightarrow 2ql - 2q \cdot x_2 = 0 \Rightarrow x_2 = l$$

$$M(x_2 = l) = 2ql \cdot l - 2q \cdot l \cdot \frac{l}{2} = ql^2$$

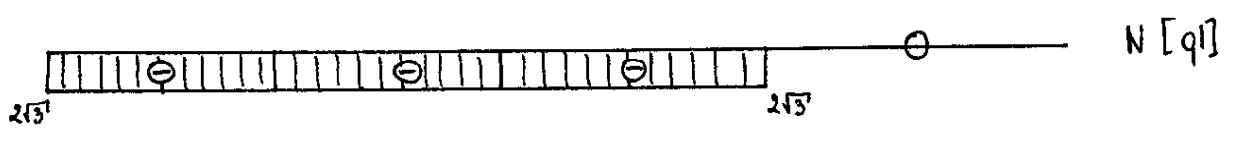
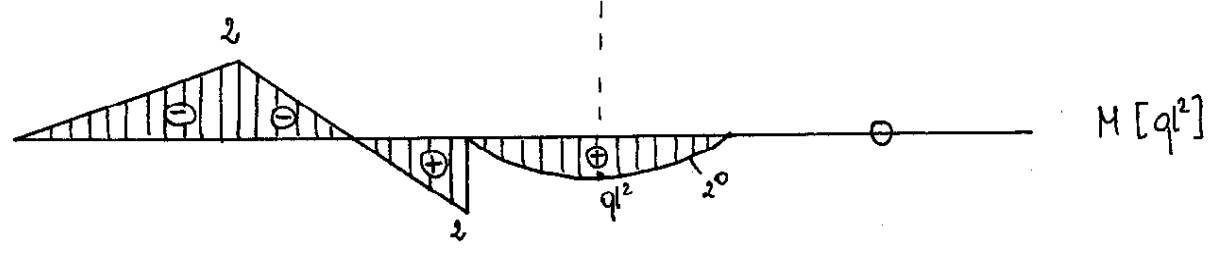
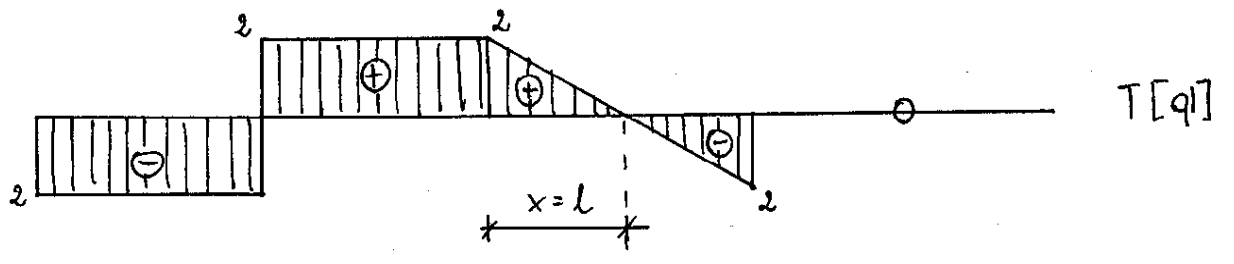
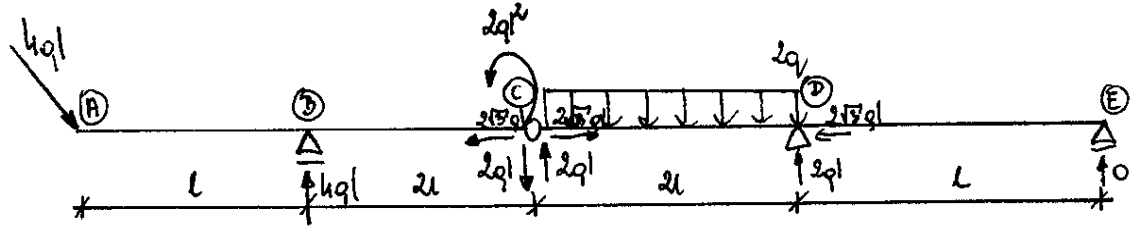
$$ED \quad 0 \leq x_3 \leq l$$

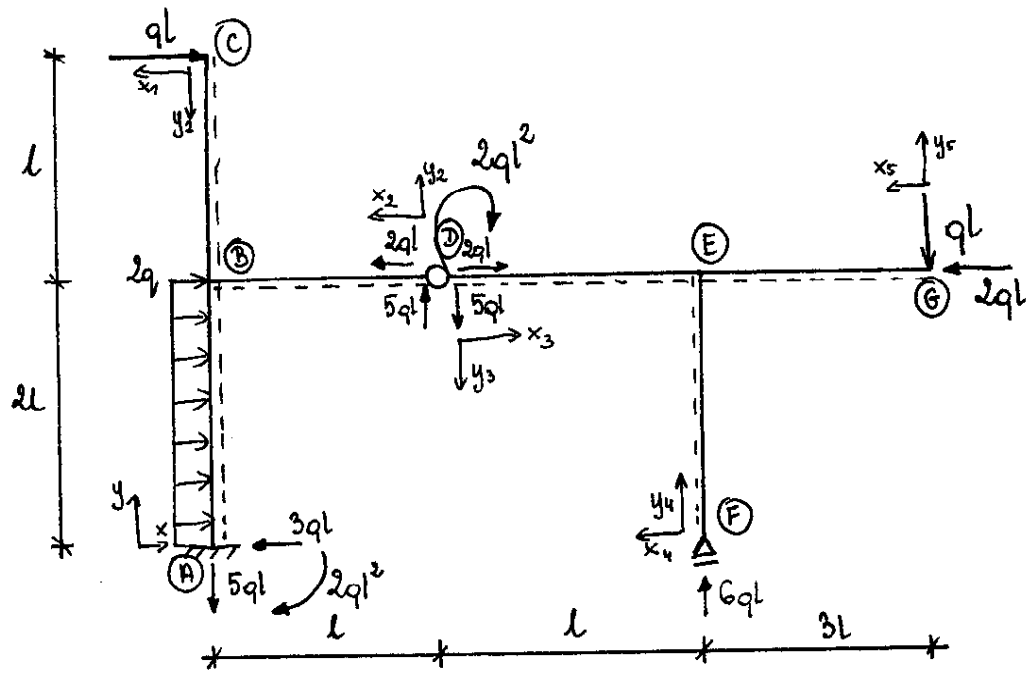
$$T(x_3) = 0$$

$$M(x_3) = 0$$

$$N(x_3) = 0$$

4. Wykresy sił wewnętrznych.





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$$n_s = n + s - 3t = 4 + 2 - 3 \cdot 2 = 0$$

2. Obliczenie reakcji :

$$\sum M_D^p = 0$$

$$2ql^2 - R_F \cdot l + ql \cdot 4l = 0$$

$$R_F = 6ql$$

$$\sum P_y = 0$$

$$-R_D + R_F - ql = 0$$

$$R_D = 5ql$$

$$\sum P_x = 0$$

$$H_D - 2ql = 0$$

$$H_D = 2ql$$

$$\sum P_y = 0$$

$$-R_A + 5ql = 0$$

$$R_A = 5ql$$

$$\sum P_x = 0$$

$$4ql + ql - 2ql - H_A = 0$$

$$H_A = 3ql$$

$$\sum M_A = 0$$

$$M_A + 4ql \cdot l + ql \cdot 3l - 5ql \cdot l - 2ql \cdot 2l = 0$$

$$M_A = 2ql^2$$

3. Równanie sił wewnętrznych w poszczególnych przedziałach.

AB $x=0$
 $0 \leq y \leq 2l$

$$T(x,y) = 3ql - 2q \cdot y$$

$$M(x,y) = 2ql^2 + 3ql \cdot y - 2q \cdot y \cdot \frac{y}{2}$$

$$N(x,y) = 5ql$$

Obliczenie ekstremum :

$$T(x,y) = 0 \Rightarrow 3ql - 2qy = 0 \Rightarrow y = \frac{3}{2}l$$

$$M(x = \frac{3}{2}l) = 2ql^2 + 3ql \cdot \frac{3}{2}l - 2q \cdot \frac{3}{2}l \cdot \frac{\frac{3}{2}l}{2} = \frac{17}{4}ql^2 = 4 \frac{1}{4}ql^2$$

$$\text{CB } \begin{array}{l} x_1 = 0 \\ 0 \leq y_1 \leq l \end{array}$$

$$T(x_1, y_1) = ql$$

$$M(x_1, y_1) = -ql \cdot y_1$$

$$N(x_1, y_1) = 0$$

$$\text{DB } \begin{array}{l} 0 \leq x_2 \leq l \\ y_2 = 0 \end{array}$$

$$T(x_2, y_2) = -5ql$$

$$M(x_2, y_2) = 5ql \cdot x_2$$

$$N(x_2, y_2) = -2ql$$

$$\text{DE } \begin{array}{l} 0 \leq x_3 \leq l \\ y_3 = 0 \end{array}$$

$$T(x_3, y_3) = -5ql$$

$$M(x_3, y_3) = 2ql^2 - 5ql \cdot x_3$$

$$N(x_3, y_3) = -2ql$$

$$\text{FE } \begin{array}{l} x_4 = 0 \\ 0 \leq y_4 \leq 2l \end{array}$$

$$T(x_4, y_4) = 0$$

$$M(x_4, y_4) = 0$$

$$N(x_4, y_4) = -6ql$$

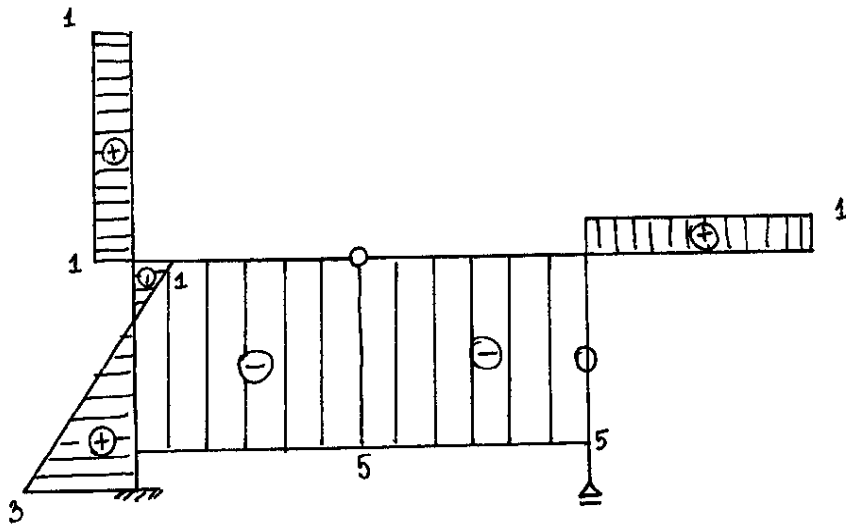
$$\text{GE } \begin{array}{l} 0 \leq x_5 \leq 3l \\ y_5 = 0 \end{array}$$

$$T(x_5, y_5) = ql$$

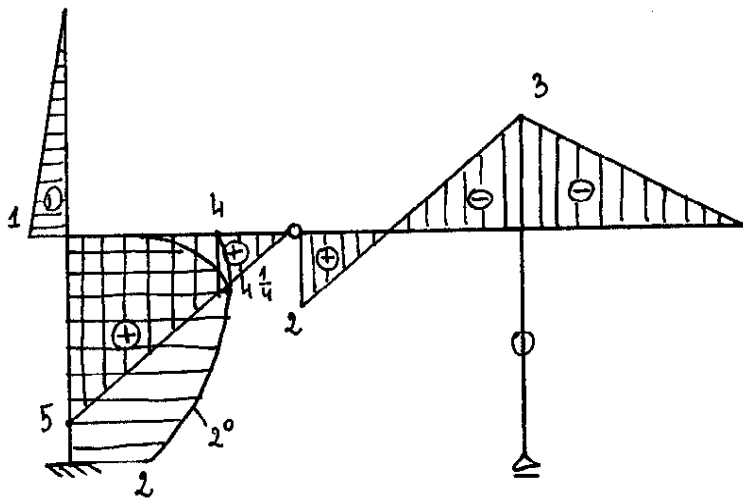
$$M(x_5, y_5) = -ql \cdot x_5$$

$$N(x_5, y_5) = -2ql$$

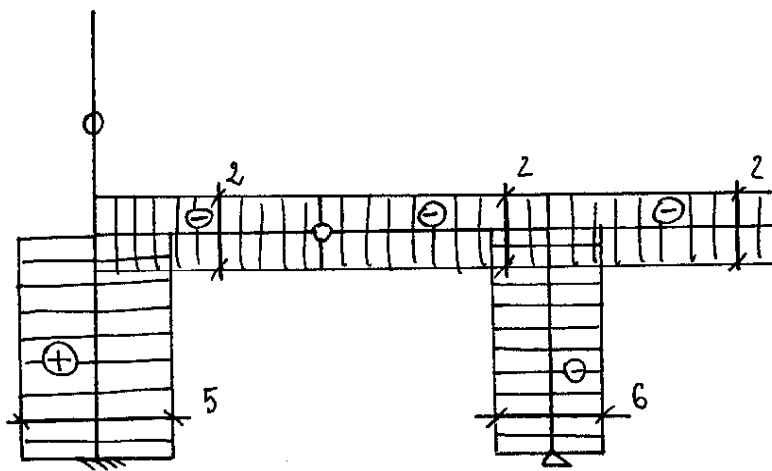
4. Wykresy sił wewnętrznych.



$T[q]$



$M[q^2]$



$N[q]$