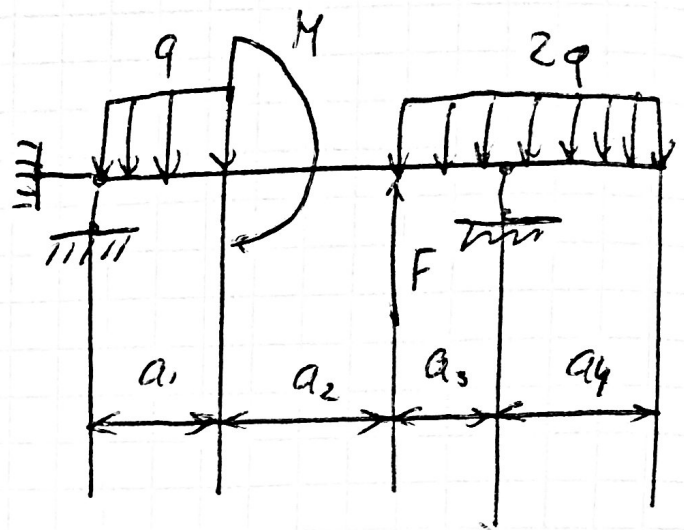


$$\begin{aligned}
 a_1 &= 1,4 \text{ м} & q &= 20 \text{ кН/м} \\
 a_2 &= 1,2 \text{ м} & F &= 20 \text{ кН} \\
 a_3 &= 0,5 \text{ м} & M &= 35 \text{ кНм} \\
 a_4 &= 2,3 \text{ м}
 \end{aligned}$$



Определение опорных реакций

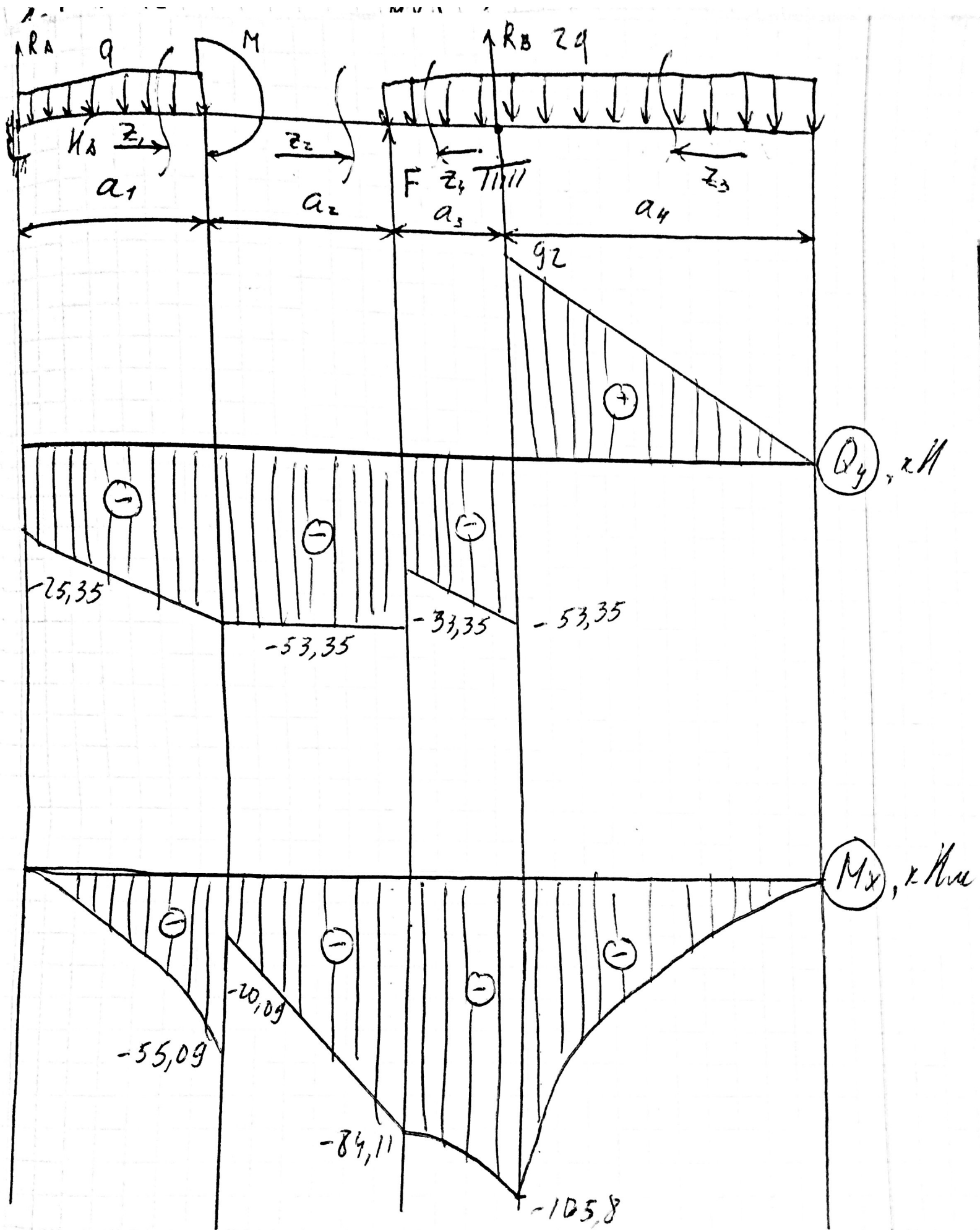
$$\frac{\sum x_i = 0}{H_A = 0}$$

$$\frac{\sum y_i = 0}{R_A - qa_1 + F - 2q(a_3 + a_4) + R_B = 0}$$

$$\frac{\sum m_A = 0}{q \frac{a_1^2}{2} + M - F(a_1 + a_2) + 2q(a_3 + a_4) \left(a_1 + a_2 + \frac{a_3 + a_4}{2} \right) - R_B(a_1 + a_2 + a_3) = 0}$$

$$R_B = \frac{q \frac{a_1^2}{2} + M - F(a_1 + a_2) + 2q(a_3 + a_4) \left(a_1 + a_2 + \frac{a_3 + a_4}{2} \right)}{a_1 + a_2 + a_3}$$

$$\begin{aligned}
 R_B &= \frac{20 \frac{1,4^2}{2} + 35 - 20(1,4 + 1,2) + 2 \cdot 20(0,5 + 2,3) \left(1,4 + 1,2 + \frac{0,5 + 2,3}{2} \right)}{1,4 + 1,2 + 0,5} \\
 &= \frac{20 \frac{1,96}{2} + 35 - 20(2,6) + 2 \cdot 20(2,8) \left(2,6 + \frac{2,8}{2} \right)}{3,1}
 \end{aligned}$$



$$= 145,35 \text{ кН}$$

$$R_A = qa_1 - F + 2q(a_3 + a_4) - R_B = 20 \cdot 1,4 -$$

$$- 20 + 2 \cdot 20(0,5 + 2,3) = 145,35 = -25,35 \text{ кН}$$

Полное значение усилий Q_y , M_x

$$0 < z_1 < a_1$$

$$Q_y' = R_A - qz_1 \left| \begin{array}{l} a_1 \rightarrow R_A - qa_1 = -25,35 - 20 \cdot 1,4 = -53,35 \text{ кН} \\ 0 \rightarrow R_A = -25,35 \text{ кН} \end{array} \right.$$

$$M_x' = R_A z_1 - q \frac{z_1^2}{2} \Big|_0^{a_1}$$

$$M_x'(0) = 0$$

$$M_x'(a_1) = R_A a_1 - q \frac{a_1^2}{2} = -25,35 \cdot 1,4 - 20 \frac{1,4^2}{2} = -55,09 \text{ кНм}$$

$$a_1 < z_2 < (a_1 + a_2)$$

$$Q_y'' = R_A - qa_1 = -53,35 \text{ кН}$$

$$M_x'' = R_A z_2 - qa_1(z_2 - \frac{a_1}{2}) - M \Big|_{a_1}^{a_1 + a_2}$$

$$M_x''(a_1) = R_A a_1 - qa_1 \frac{a_1}{2} = M = -55,09 + 35 = -20,09 \text{ кНм}$$

$$M_x''(a_1 + a_2) = R_A(a_1 + a_2) - qa_1(a_2 + \frac{a_1}{2}) - M =$$

$$= -25,35(1,4 + 1,2) - 20 \cdot 1,4(1,2 + \frac{1,4}{2}) + 35 = -84,11 \text{ кНм}$$

$$0 < z_3 < a_4$$

$$Q_y^{III} = 2q z_3 \left| \begin{array}{l} a_4 \rightarrow 2q a_4 = 2 \cdot 20 \cdot 2,3 = 92 \text{ kN} \\ 0 \rightarrow 0 \end{array} \right.$$

$$M_x^{III} = -2q \frac{z_3^2}{2} \left| \begin{array}{l} a_4 \rightarrow -q a_4^2 = -20 \cdot 2,3^2 = -105,8 \text{ kNm} \\ 0 \rightarrow 0 \end{array} \right.$$

$$a_4 < z_4 < (a_3 + a_4)$$

$$Q_y^{IV} = 2q a_4 - R_B + 2q (z_4 - a_4) \left| \begin{array}{l} a_3 + a_4 \\ a_4 \end{array} \right.$$

$$Q_y^{IV}(a_4) = 2q a_4 - R_B = 2 \cdot 20 \cdot 2,3 - 145,35 = -53,35 \text{ kN}$$

$$Q_y^{IV}(a_3 + a_4) = 2q a_4 - R_B + 2q a_3 = -53,35 + 2 \cdot 20 \cdot 0,5 = -33,35 \text{ kN}$$

$$M_x^{IV} = -2q \frac{z_4^2}{2} + R_B (z_4 - a_4) \left| \begin{array}{l} a_3 + a_4 \\ a_4 \end{array} \right.$$

$$M_x^{IV}(a_4) = -q a_4^2 = -105,8 \text{ kNm}$$

$$M_x^{IV}(a_4 + a_3) = -q (a_4 + a_3)^2 + R_B a_3 = -20 (2,3 + 0,5)^2 + 145,35 \cdot 0,5 = -84,1 \text{ kNm}$$