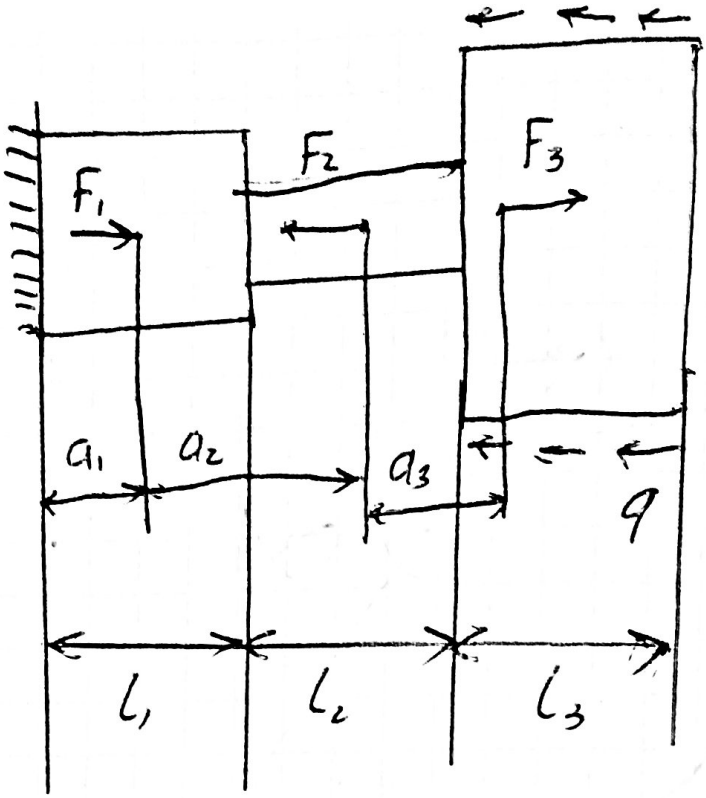


$l_1 = 1\,м$

$l_2 = 1{,}4\,м$

$l_3 = 1{,}1\,м$

$a_4 = 0{,}8\,м$

$a_2 = 2a_3 = 1{,}3\,м$

$F_1 = 40\,кН$

$F_2 = 20\,кН$

$F_3 = 30\,кН$

$q = 40\,кН/м$

$$0 < \text{I} < (l_1 + l_2 + l_3 - a_1 - a_2 - a_3)$$

$$N_z' = -q z_1 \Big|_0^{\,\cdot\,,\,(l_1+l_2+l_3-a_1-a_2-a_3)}$$

$$N_z'(l_1+l_2+l_3-a_1-a_2-a_3) = -q(l_1+l_2+l_3-a_1-a_2-a_3) =$$

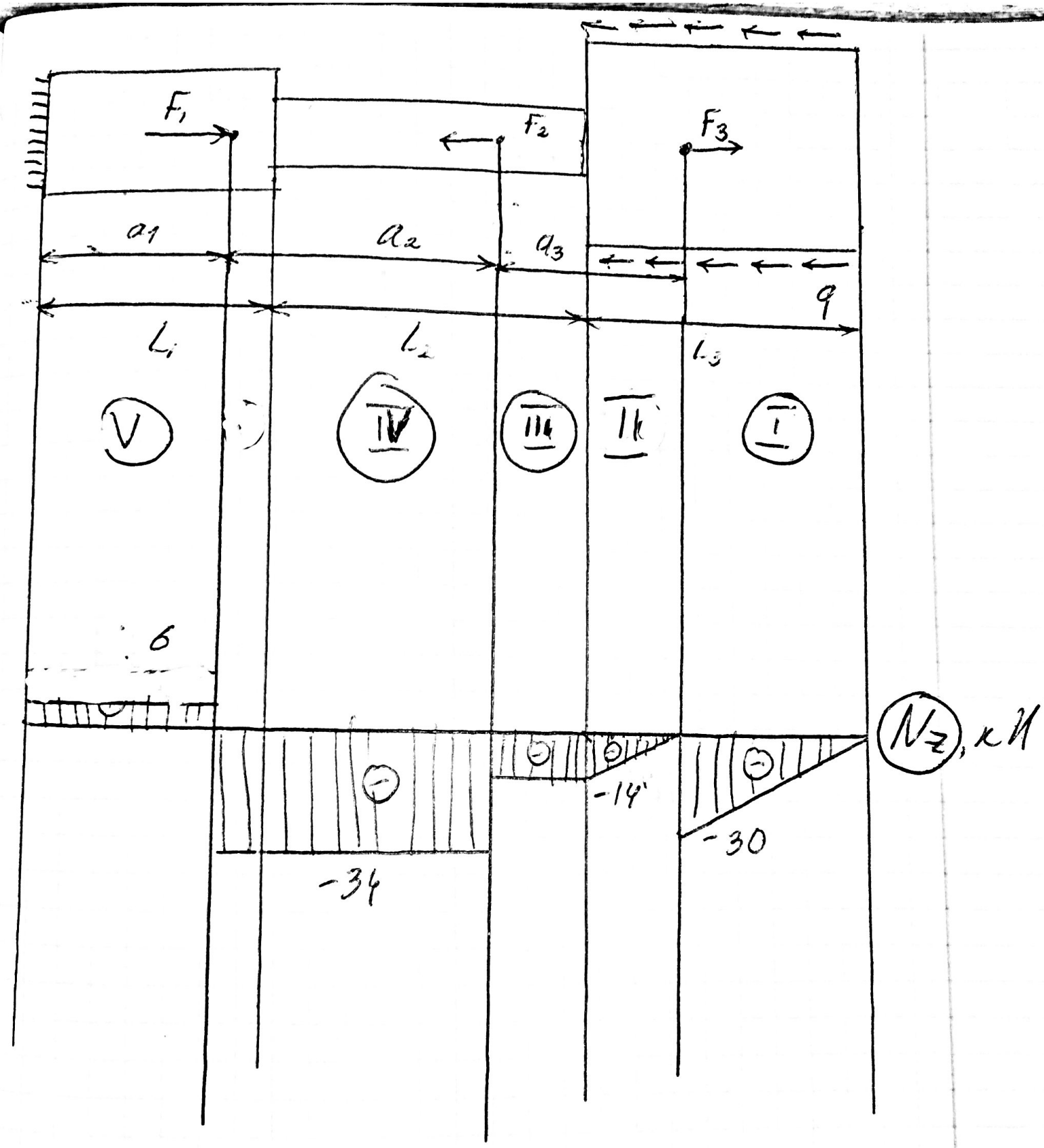
$$= -40\left(1+1{,}4+1{,}1-0{,}8-1{,}3-\frac{1{,}3}{2}\right) = -30\,кН$$

$$(l_1+l_2+l_3-a_1-a_2-a_3) < \text{II} < (l_3 \quad \cdot \quad \cdot)$$

$$N_z'' = -q z_2 + F_3 \Big|_{l_1+l_2+l_3-a_1-a_2-a_3}^{l_3 \quad \cdot \quad \cdot}$$

$$N_z''(l_1+l_2+l_3-a_1-a_2-a_3) = -q(l_1+l_2+l_3-a_1-a_2-a_3) +$$

$$+ F_3 = -30 + 30 = 0\,кН$$


F1
F2
F3
a1
a2
a3
q
l1
l2
l3
V
IV
III
II
I
6
-34
-14
-30
Nz, кН

$N_z''(l_3+$ $) = -q($ l_3 $) +$

$+F_3 = -40($ $1{,}1$ $) + 30 = -14\,кН$

$l_3 < (III) < (l_1 + l_2 + l_3 - a_1 - a_2)$

$N_z''' = -q l_3 + F_3 = -14\,кН$

$(l_1 + l_2 + l_3 - a_1 - a_2) < (IV) < (l_2 + l_3 + l_1 - a_1)$

$N_z^{IV} = -q l_3 + F_3 - F_2 = -40 \cdot 1{,}1 + 30 - 20 = -34\,кН$

$(l_2 + l_3 + l_1 - a_1) < (V) < (l_1 + l_2 + l_3)$

$N_z^{V} = -q l_3 + F_3 - F_2 + F_1 = -40 \cdot 1{,}1 + 30 - 20 + 40 = 6\,кН$

$a_1 = 0{,}6$ м

$a_2 = 0{,}4$ м

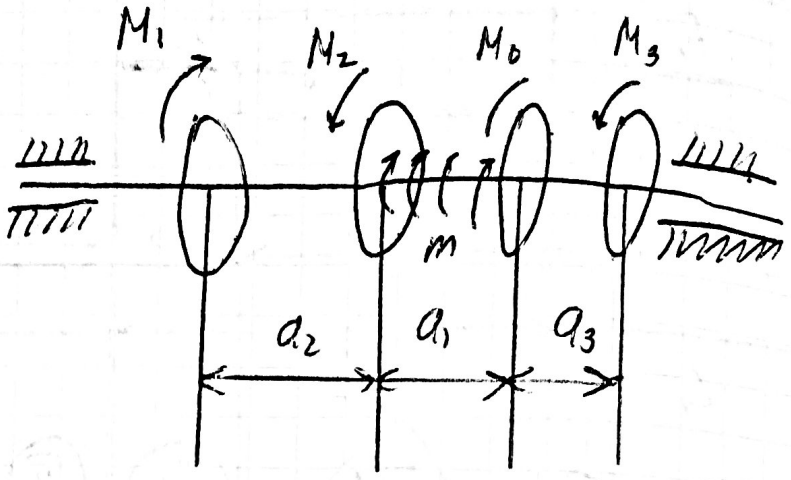
$a_3 = 0{,}2$ м

$M_1 = 2{,}2$ кНм

$M_2 = 2{,}8$ кНм

$M_3 = 3{,}0$ кНм

$m = 10{,}0$ кНм/м



Нахождение M_0

$\sum M_z = 0$ – условие равновесия

$M_1 - M_2 + m a_1 + M_0 - M_3 = 0$

$M_0 = M_3 + M_2 - M_1 - m a_1 = 3 + 2{,}8 - 2{,}2 - 10 \cdot 0{,}6 =$

$= -2{,}4$ кНм

Построение эпюр (M_z)

$0 < z_1 < a_2$

$M_z' = M_1 = 2{,}2$ кНм

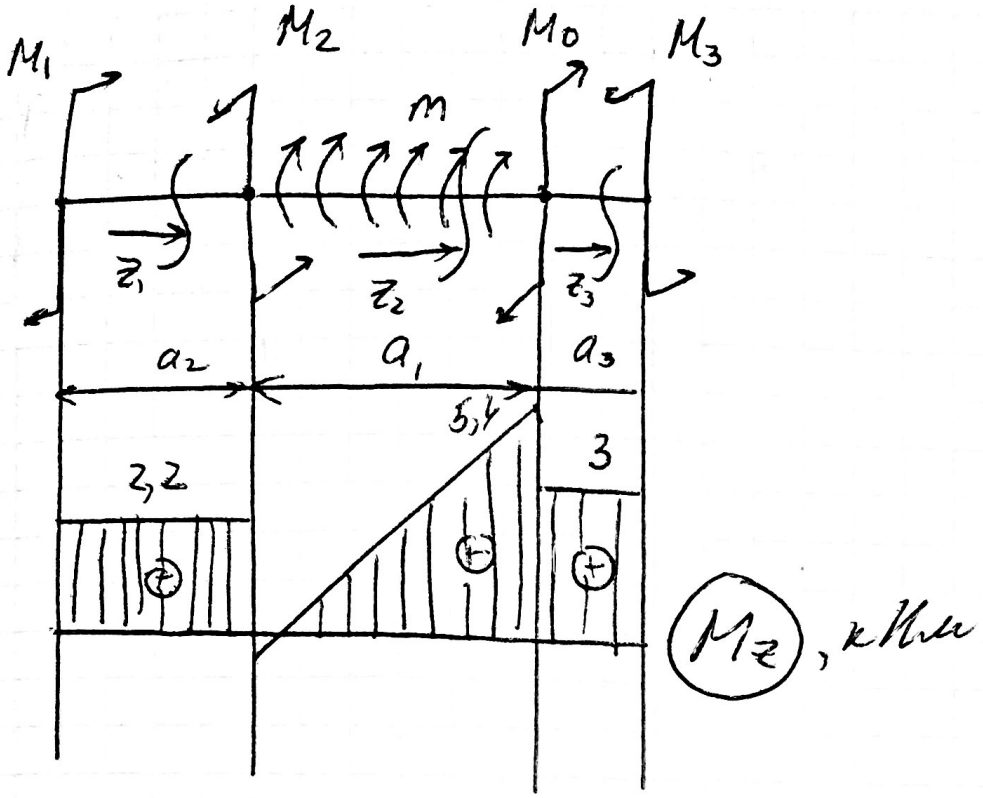
$a_2 < z_2 < (a_1 + a_2)$

$M_z'' = M_1 - M_2 + m(z_2 - a_2)\Big|_{a_2}^{a_1 + a_2}$

$M_z''(a_2) = M_1 - M_2 = 2{,}2 - 2{,}8 = -0{,}6$ кНм

$M_z''(a_1 + a_2) = M_1 - M_2 + m a_1 = 2{,}2 - 2{,}8 + 10 \cdot 0{,}6 =$

$= 5{,}4$ кНм



$(a_2 + a_1) < z_3 < (a_1 + a_2 + a_3)$

$M_z^m = M_1 - M_2 + m a_1 + M_0 = 2,2 - 2,8 + 10 \cdot 0,6 +$

$+ (-2,4) = 3$ кНм

$a_1 = 1{,}4$ м

$a_2 = 1{,}2$ м

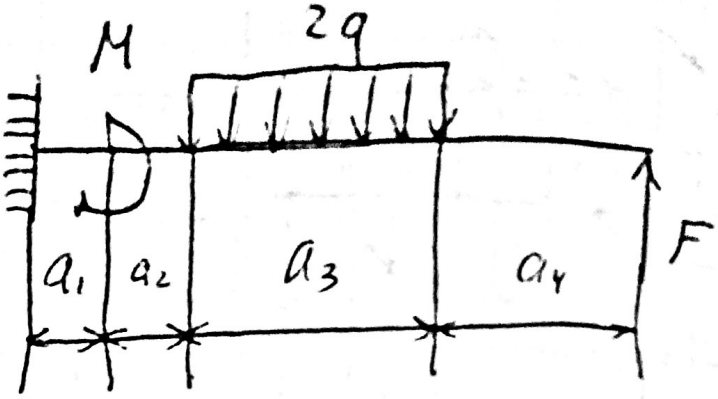
$a_3 = 0{,}5$ м

$a_4 = 2{,}3$ м

$q = 20$ кН/м

$F = 20$ кН

$M = 35$ кНм



Построение эпюр ВСФ

$0 < z_1 < a_4$

$Q_y' = -F = -20$ кН

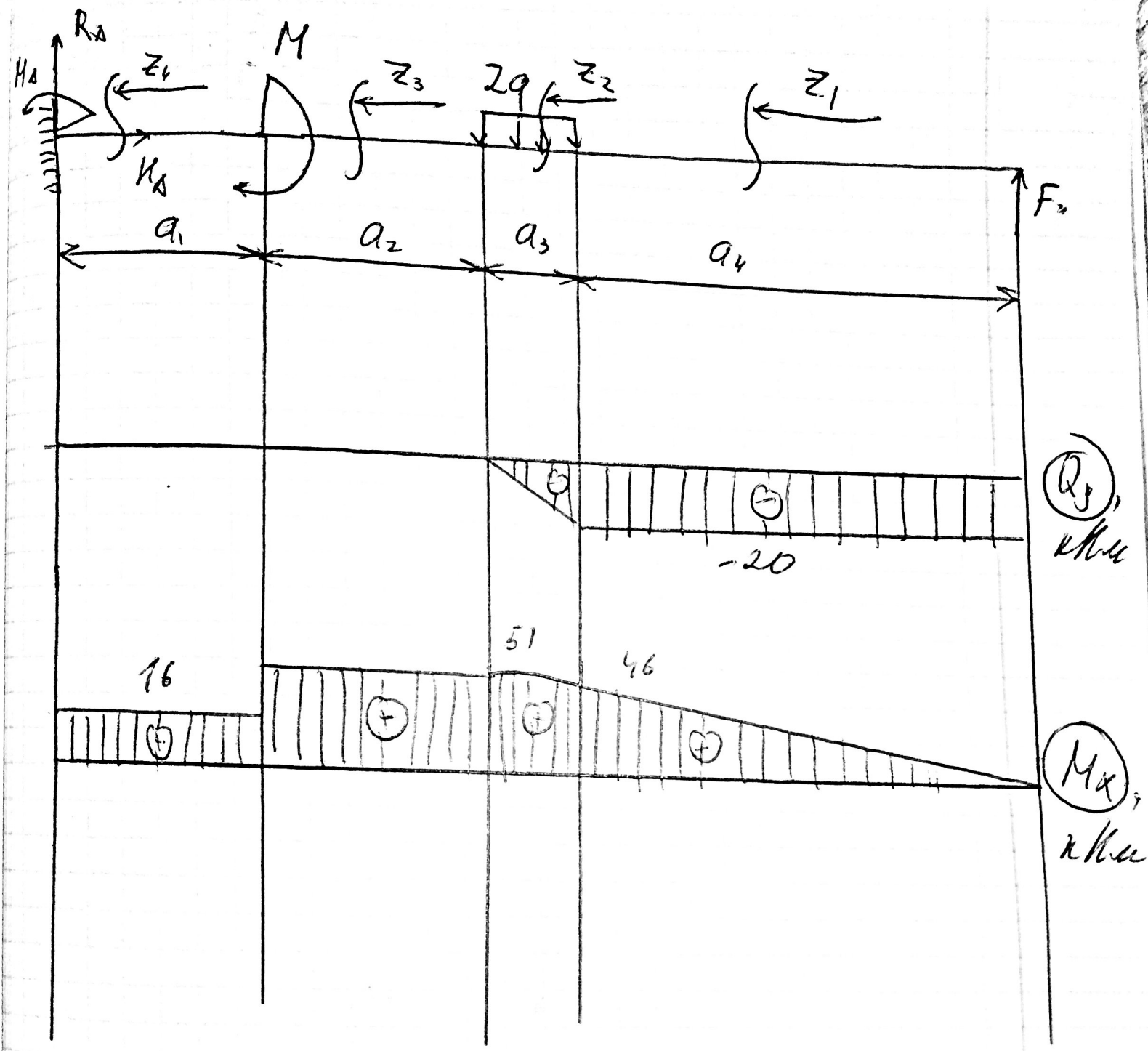
$M_x' = F_4 z_1 \Big|_{0 \to 0}^{a_4 \to F a_4 = 20 \cdot 2{,}3 = 46}$ кНм

$a_4 < z_2 < (a_3 + a_4)$

$Q_y'' = -F + 2q(z_2 - a_4) \Big|_{a_4 \to -F = -20 \text{ кН}}^{a_3 + a_4 \to -F + 2qa_3 = -20 + 2 \cdot 20 \cdot 0{,}5 = 0 \text{ кН}}$

$M_x'' = +Fz_2 - 2q\frac{(z_2 - a_4)^2}{2} \Big|_{a_4 = +Fa_4 = 46 \text{ кНм}}^{a_3 + a_4}$

$M_x''(a_3 + a_4) = F(a_3 + a_4) - qa_3^2 = 20(0{,}5 + 2{,}3) - 20 \cdot 0{,}5^2 = 51$ кНм


R_A
M
H_A
z_4
z_3
$2q$
z_2
z_1
M_A
F_z
a_1
a_2
a_3
a_4
Q_y, кН
-20
51
46
16
M_x, кН

$(a_3 + a_4) < z_3 < (a_2 + a_3 + a_4)$

$Q_y^{III} = -F + 2qa_3 = 0$ кН

$M_x^{III} = Fz_3 - 2qa_3\left(z_3 - a_4 - \frac{a_3}{2}\right)\Big|_{a_3+a_4}^{a_3+a_4+a_2}$

$M_x^{III}(a_3 + a_4) = F(a_3 + a_4) - 2qa_3\left(\frac{a_3}{2}\right) =$

$= 20(0,5 + 2,3) - 2 \cdot 20 \cdot 0,5\,\frac{0,5}{2} = 51$ кНм

$M_x^{III}(a_3 + a_4 + a_2) = F(a_3 + a_4) - 2qa_3\left(\frac{a_3}{2} + a_2\right) =$

$= 20(0,5 + 2,3) - 2 \cdot 20 \cdot 0,5\left(\frac{0,5}{2} + 1,2\right) =$

$= 27$ кНм

$(a_2 + a_3 + a_4) < z_4 < (a_2 + a_3 + a_4 + a_1)$

$Q_y^{IV} = -F + 2qa_3 = 0$ кН

$M_x^{IV} = Fz_4 - 2qa_3\left(z_4 - a_4 - \frac{a_3}{2}\right) - M\Big|_{a_2+a_3+a_4}^{a_2+a_3+a_4+a_1}$

$M_x^{IV}(a_2 + a_3 + a_4) = F(a_2 + a_3 + a_4) - 2qa_3\left(a_2 + \frac{a_3}{2}\right) -$

$- M = 20(1,2 + 0,5 + 2,3) - 2 \cdot 20 \cdot 0,5\left(1,2 + \frac{0,5}{2}\right) = 35 =$

$= 46$ кНм

$M_x^{IV}(a_2 + a_3 + a_4 + a_1) = F(a_2 + a_3 + a_4 + a_1) -$

$- 2qa_3\left(a_2 + \frac{a_3}{2} + a_1\right) - M = 20(1,2 + 0,5 +$

$+ 2,3 + 1,4) - 2 \cdot 20 \cdot 0,5\left(1,2 + \frac{0,5}{2} + 1,4\right) -$

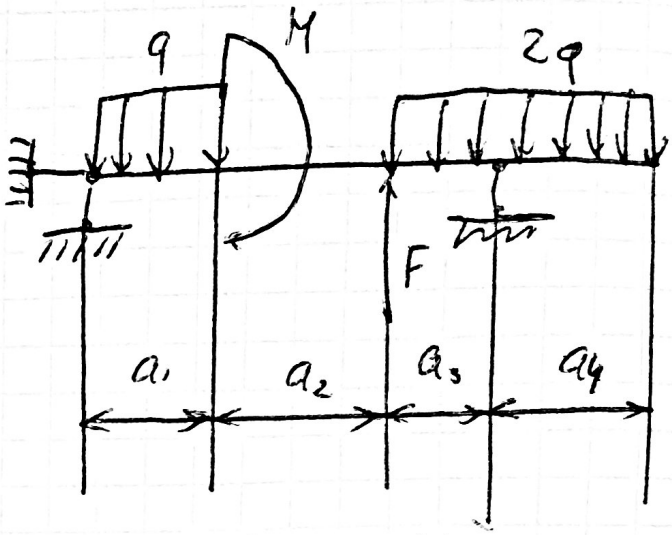
$- 35 = 60$ кНм

$a_1 = 1{,}4$ м $q = 20$ кН/м

$a_2 = 1{,}2$ м $F = 20$ кН

$a_3 = 0{,}5$ м $M = 35$ кНм

$a_4 = 2{,}3$ м



Определение опорных реакций

$$\sum x_i = 0$$

$$H_A = 0$$

$$\sum y_i = 0$$

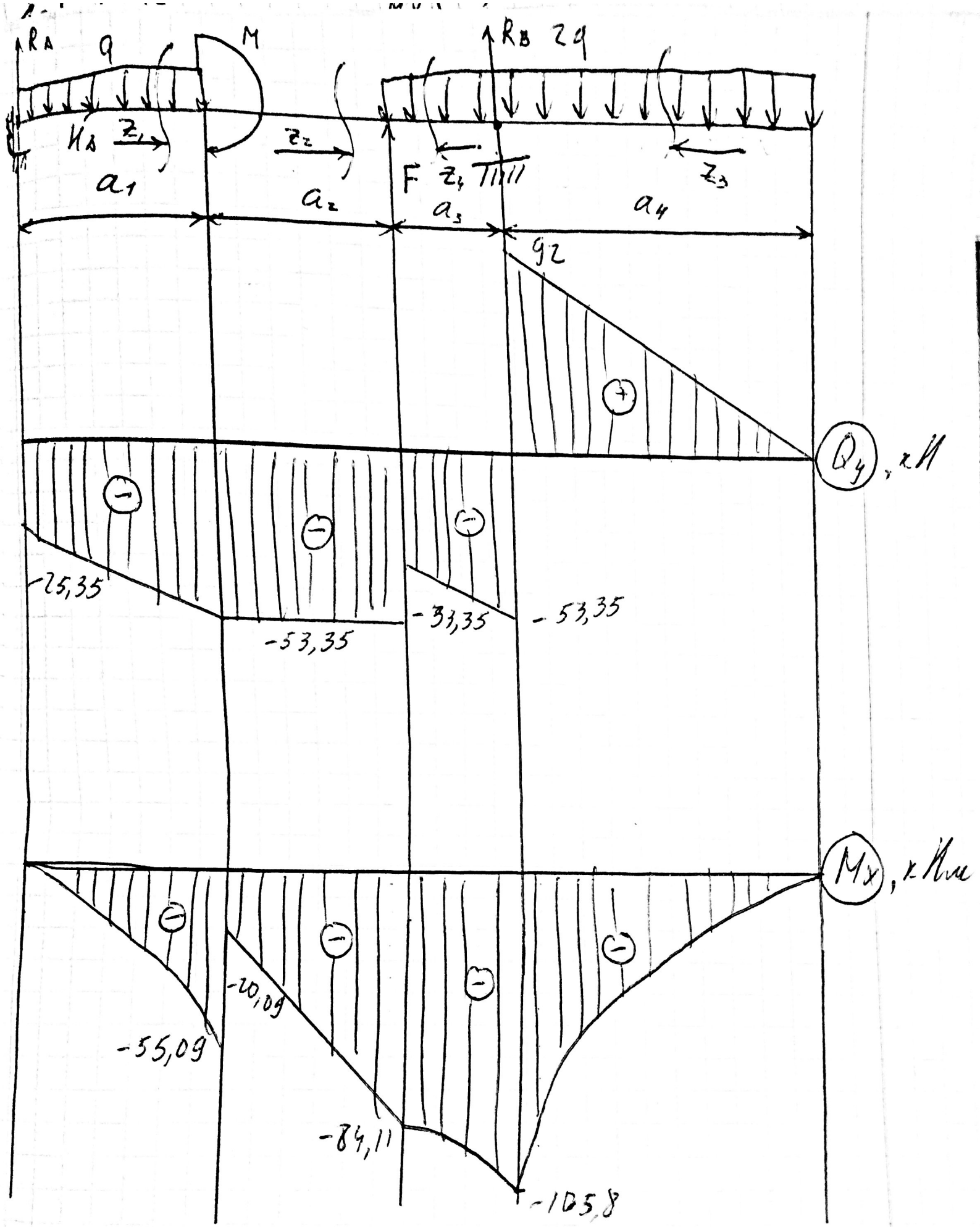
$$R_A - qa_1 + F - 2q(a_3 + a_4) + R_B = 0$$

$$\sum m_A = 0$$

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

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

$$= \frac{\left(20\frac{1{,}4^2}{2} + 35 - 20(1{,}4 + 1{,}2) + 2 \cdot 20(0{,}5 + 2{,}3)\left(1{,}4 + 1{,}2 + \frac{0{,}5 + 2{,}3}{2}\right)\right)}{1{,}4 + 1{,}2 + 0{,}5} =$$


RA
q
M
RB
2q
HA
z1
z2
F
z4
z3
a1
a2
a3
a4
q2
+
Qy, кН
-25,35
-53,35
-33,35
-53,35
Mx, кНм
-55,09
-20,09
-84,11
-105,8

$= 145,35$ кН

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

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

Построение эпюр Q_y, M_x

$0 < z_1 < a_1$

$Q_y' = R_A - q z_1 \Big|_0^{a_1} \begin{matrix} a_1 \to R_A - q a_1 = -25,35 - 20 \cdot 1,4 = -53,35 \text{ кН} \\ 0 \to R_A = -25,35 \text{ кН} \end{matrix}$

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

$M_x'(0) = 0$

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

$= -55,09$ кНм

$a_1 < z_2 < (a_1 + a_2)$

$Q_y'' = R_A - q a_1 = -53,35$ кН

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

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

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

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

$0 < z_3 < a_4$

$$Q_y^{III} = 2qz_3 \Big|_{0}^{a_4} \quad a_4 \to 2qa_4 = 2 \cdot 20 \cdot 2{,}3 = 92\ кН$$

$$M_x^{III} = -2q\frac{z_3^2}{2} \Big|_{0}^{a_4} \quad a_4 \to -qa_4^2 = -20 \cdot 2{,}3^2 = -105{,}8\ кНм$$

$a_4 < z_4 < (a_3 + a_4)$

$$Q_y^{IV} = 2qa_4 - R_B + 2q(z_4 - a_4) \Big|_{a_4}^{a_3+a_4}$$

$$Q_y^{IV}(a_4) = 2qa_4 - R_B = 2 \cdot 20 \cdot 2{,}3 - 145{,}35 =$$

$$= -53{,}35\ кН$$

$$Q_y^{IV}(a_3 + a_4) = 2qa_4 - R_B + 2qa_3 = -53{,}35 +$$

$$+ 2 \cdot 20 \cdot 0{,}5 = -33{,}35\ кН$$

$$M_x^{IV} = -2q\frac{z_4^2}{2} + R_B(z_4 - a_4) \Big|_{a_4}^{a_3+a_4}$$

$$M_x^{IV}(a_4) = -qa_4^2 = -105{,}8\ кНм$$

$$M_x^{IV}(a_4 + a_3) = -q(a_4 + a_3)^2 + R_B a_3 = -20(2{,}3 + 0{,}5)^2 +$$

$$+ 145{,}35 \cdot 0{,}5 = -84{,}1\ кНм$$

$l_1 = 1\,м$

$l_2 = 1{,}4\,м$

$l_3 = 1{,}1\,м$

$a_4 = 0{,}8\,м$

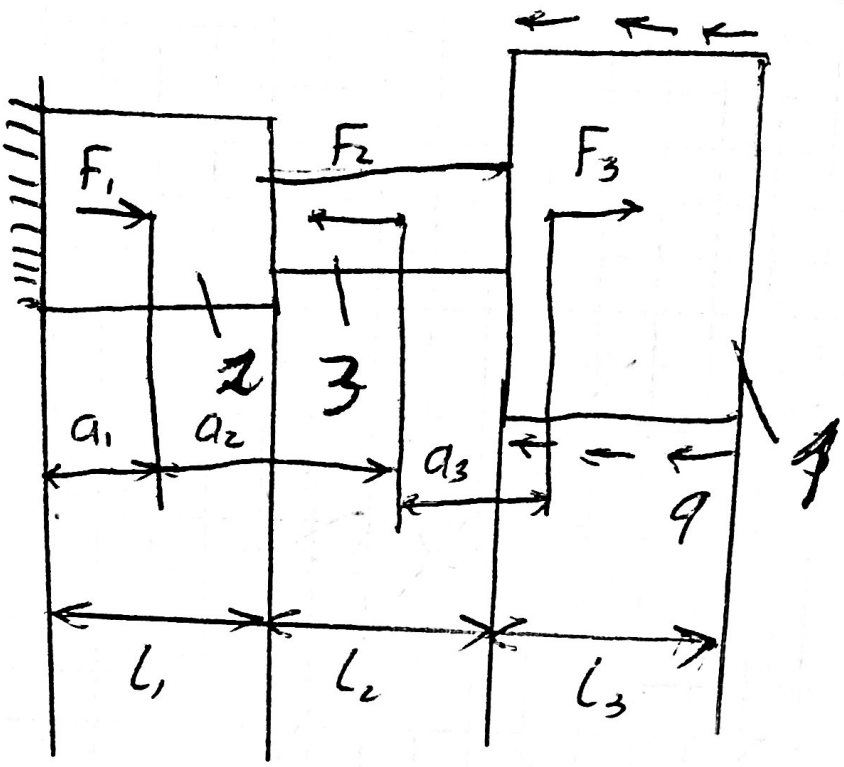
$a_2 = 2a_3 = 1{,}3\,м$

$F_1 = 40\,кН$

$F_2 = 20\,кН$

$F_3 = 30\,кН$

$q = 40\,кН/м$



$\sigma_т = 850\,МПа$

$n_т = 1{,}3$; сталь 45 ✗

$0 < I < (l_1 + l_2 + l_3 - a_1 - a_2 - a_3)$

$N_z' = -q z_1 \Big|_0^{(l_1+l_2+l_3-a_1-a_2-a_3)}$

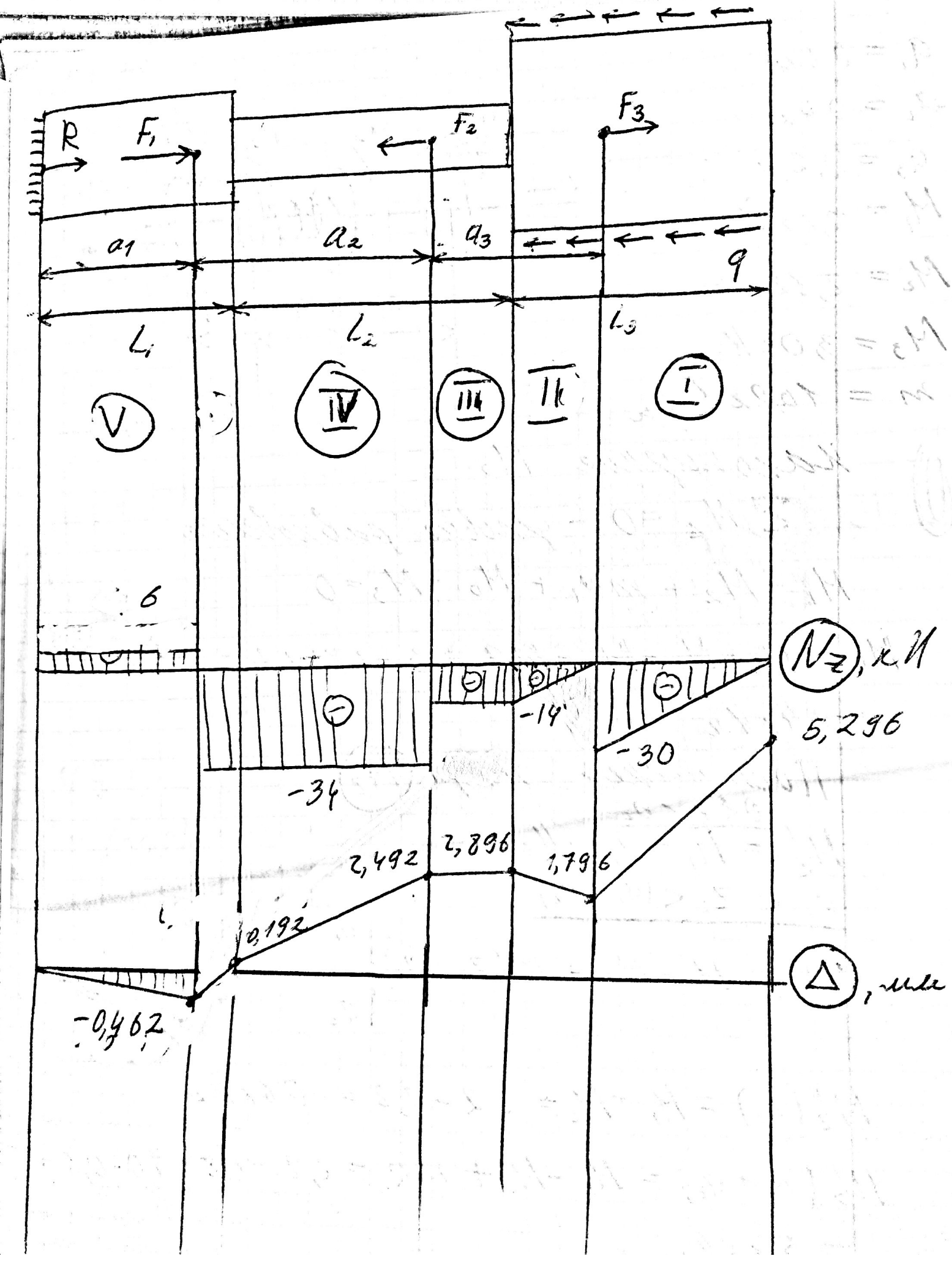
$N_z'(l_1+l_2+l_3-a_1-a_2-a_3) = -q(l_1+l_2+l_3-a_1-a_2-a_3) =$

$= -40\left(1+1{,}4+1{,}1-0{,}8-1{,}3-\frac{1{,}3}{2}\right) = -30\,кН$

$(l_1+l_2+l_3-a_1-a_2-a_3) < II < (l_3$ [illegible] $)$

$N_z'' = -q z_2 + F_3 \Big|_{l_1+l_2+l_3-a_1-a_2-a_3}^{l_3}$ [illegible]

$N_z''(l_1+l_2+l_3-a_1-a_2-a_3) = -q(l_1+l_2+l_3-a_1-a_2-a_3) +$


R
F1
F2
F3
a1
a2
a3
q
l1
l2
l3
V
IV
III
II
I
6
-34
-14
-30
5,296
2,492
2,896
1,796
0,192
-0,462
Nz, кН
Δ, мм

Определение напряжения

$$0 < \text{I} < (l_1 + l_2 + l_3 - a_1 - a_2 - a_3)$$

$$\sigma'_z = \frac{N'_z}{A_1} = \frac{-q z_1}{A_1}\Bigg|_{0 \to 0}^{l_1 + l_2 + l_3 - a_1 - a_2 - a_3}$$

$$\sigma'_z(l_1 + l_2 + l_3 - a_1 - a_2 - a_3) = \frac{-q(l_1 + l_2 + l_3 - a_1 - a_2 - a_3)}{A_1}$$

$$= \frac{-40\left(1 + 1{,}4 + 1{,}1 - 0{,}8 - 1{,}3 - \frac{1{,}3}{2}\right)}{A_1} \cdot 10^3 = \frac{-30000}{A_1}$$

$$(l_1 + l_2 + l_3 - a_1 - a_2 - a_3) < \text{II} < l_3$$

$$\sigma''_z = \frac{N''_z}{A_1} = \frac{-q z_2 + F_3}{A_1}\Bigg|_{l_3 + l_1 + l_2 - a_1 - a_2 - a_3}^{l_3}$$

$$\sigma''_z(l_3 + l_1 + l_2 - a_1 - a_2 - a_3) = -\frac{q(l_3 + l_1 + l_2 - a_1 - a_2 - a_3)}{A_1} +$$

$$+ \frac{F_3}{A_3} = \left(\frac{-40\left(1{,}1 + 1 + 1{,}4 - 0{,}8 - 1{,}3 - \frac{1{,}3}{2}\right)}{A_1} + \frac{30}{A_3}\right) \cdot 10^3 =$$

$$= 0$$

$$\sigma''_z(l_3) = \frac{-q l_3 + F_3}{A_1} = \frac{-40 \cdot 1{,}1 + 30}{A_1} \cdot 10^3 = \frac{-14000}{A_1}$$

$$l_3 < \text{III} < (l_1 + l_2 - a_1 - a_2)$$

$$\sigma_z^{III} = \frac{N_z^{III}}{A_3} = \frac{-ql_3 + F_3}{A_3} = \frac{-40 \cdot 1{,}1 + 30}{A_3} \cdot 10^3 =$$

$$= \frac{-14000}{A_3}$$

$$(l_1 + l_2 - a_1 - a_2) < \text{IV} < l_2 + l_3$$

$$\sigma_z^{IV} = \frac{-ql_3 + F_3 - F_2}{A_3} = \frac{-40 \cdot 1{,}1 + 30 - 20}{A_3} \cdot 10^3 =$$

$$= \frac{-34000}{A_3}$$

$$l_2 + l_3 < \text{IV} < l_1 + l_2 + l_3 - a_1$$

$$\sigma_z^{IV} = \frac{-ql_3 + F_3 - F_2}{A_2} = \frac{-34000}{A_2}$$

$$(l_1 + l_2 + l_3 - a_1) < \text{V} < l_1 + l_2 + l_3$$

$$\sigma_z^{V} = \frac{-ql_3 + F_3 - F_2 + F_1}{A_2} = \frac{-40 \cdot 1{,}1 + 30 - 20 + 40}{A_2} 10^3 =$$

$$= \frac{14000}{A_3}$$

Определение площади сечения А

$$\sigma_{max} \le [\sigma]$$

$$\sigma_{max} \le \frac{\sigma_T}{n_T}$$

1-ый участок

$$\frac{30000}{A_1} \le \frac{\sigma_T}{n_T}$$

$$A_1 \ge \frac{30000\, n_T}{\sigma_T} = \frac{30000 \cdot 1{,}3}{850 \cdot 10^6} = 46 \cdot 10^{-6}\ м^2$$

2-ой участок

$$\frac{34000}{A_2} \le \frac{\sigma_T}{n_T}$$

$$A_2 \ge \frac{34000 n_T}{\sigma_T} = \frac{34000 \cdot 1{,}3}{850 \cdot 10^6} = 52 \cdot 10^{-6}\ м^2$$

3-ий участок

$$A_3 \ge \frac{34000 n_T}{\sigma_T} = 52 \cdot 10^{-6}\ м^2$$

Построение эпюр напряжений

$$\sum N_i = 0$$

$$R + F_1 - F_2 + F_3 - q l_3 = 0$$

$$R = q l_3 - F_3 + F_2 - F_1 = 40 \cdot 1{,}1 - 30 + 20 - 40 = -6\ кН$$

$0 < (V) < a_1$

$$\Delta_1 = \frac{R}{E A_2} a_1 = \frac{-6 \cdot 10^3 \cdot 0{,}8}{2 \cdot 10^{11} \cdot 52 \cdot 10^{-6}} = -462 \cdot 10^{-6}\ м =$$

$$= -0{,}462\ мм$$

$a_1 < (V) < L_1$

$$\Delta_2 = \frac{R + F_1}{E A_2} (L_1 - a_1) = \frac{-6 \cdot 10^3 + 40 \cdot 10^3}{2 \cdot 10^{11} \cdot 52 \cdot 10^{-6}} (1 - 0{,}8) =$$

$$= 654 \cdot 10^{-6}\ м = 0{,}654\ мм$$

$$\delta_{II} = \Delta_1 + \Delta_2 = -0{,}462 + 0{,}654 = 0{,}192\ мм$$

$L_1 < (IV) < (\quad a_1 + a_2)$

$$\Delta_3 = \frac{R + F_1}{E A_3} (-L_2 + a_1 + a_2) = \frac{-6 \cdot 10^3 + 40 \cdot 10^3}{2 \cdot 10^{11} \cdot 52 \cdot 10^{-6}} (-1{,}4 + 0{,}8 +$$

$$+ 1{,}3) = 0{,}0023\ м = 2{,}3\ мм$$

$$\Delta_{III} = 0{,}192 + 3{,}3 = 3{,}492\ мм$$

$(a_1 + a_2) < (II) < (l_1 + l_2)$

$$\Delta_4 = \frac{R + F_1 - F_2}{E A_3}(l_1 + l_2 - a_1 - a_2) = \frac{(-6 \cdot 10^3 + 40 \cdot 10^3 - 20 \cdot 10^3)}{2 \cdot 10^{11} \cdot 52 \cdot 10^{-6}} \cdot$$

$$\cdot (1 + 1{,}4 - 0{,}8 - 1{,}3) = 404 \cdot 10^{-6}\ м = 0{,}404\ мм$$

$$\Delta_{IV} = \Delta_{III} + \Delta_4 = 2{,}492 + 0{,}404 = 2{,}896\ мм$$

$(l_1 + l_2) < (II) < (a_1 + a_2 + a_3)$

$$\Delta_5 = \int_z \frac{R + F_1 - F_2 - q(z - l_1 - l_2)}{E A_1} dz =$$

$$= \frac{(R + F_1 - F_2)(a_1 + a_2 + a_3) - q\frac{(a_1 + a_2 + a_3 - l_1 + l_2)^2}{2}}{E A_1}$$

$$- \frac{(R + F_1 - F_2)(l_1 + l_2)}{E A_1} = \frac{(6 \cdot 10^3 + 40 \cdot 10^3 - 20 \cdot 10^3) \cdot}{2 \cdot 10^{11} \cdot 46 \cdot 10^{-6}} \cdot$$

$$\cdot (0{,}8 + 1{,}3 + \frac{1{,}3}{2} - 1 - 1{,}4) -$$

$$- \frac{40 \cdot 10^3 (0{,}8 + 1{,}3 + \frac{1{,}3}{2} - 1 - 1{,}4)^2}{2 \cdot 2 \cdot 10^{11} \cdot 46 \cdot 10^{-6}} = -0{,}011\ м =$$

$$= -1{,}1\ мм$$

$$\Delta_V = \Delta_{IV} + \Delta_5 = 2,896 - 1,1 = \underline{1,796 \text{ мм}}$$

$$(a_1 + a_2 + a_3) < (I) < (l_1 + l_2 + l_3)$$

$$\Delta_6 = \int_z \frac{R + F_1 - F_2 + F_3 - q(z_6 - l_1 - l_2)}{E A_1} dz =$$

$$= \frac{(R + F_1 - F_2 + F_3)(l_1 + l_2 + l_3 - a_1 - a_2 - a_3)}{E A_1} -$$

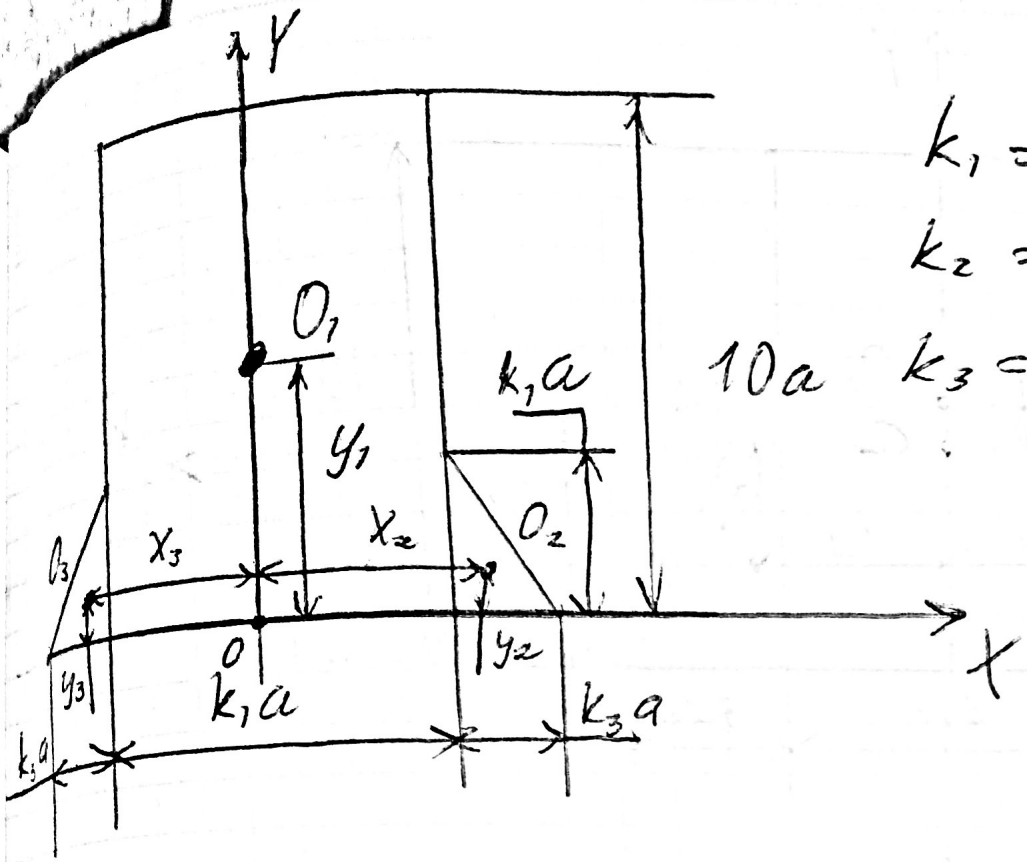
$$- \frac{q\left(l_3 - (a_1 + a_2 + a_3 - l_1 - l_2)\right)^2}{2} =$$

$$= \frac{\left(-6 \cdot 10^3 + 40 \cdot 10^3 - 20 \cdot 10^3 + 30 \cdot 10^3\right)\left(1 + 1,4 + 1,1 - 0,8 - 1,3 - \frac{1,3}{2}\right)}{2 \cdot 10^{11} \cdot 46 \cdot 10^{-6}}$$

$$- \frac{40 \cdot 10^3 \left(1,1 - 0,8 - 1,3 - \frac{1,3}{2} + 1 + 1,4\right)^2}{2 \cdot 2 \cdot 10^{11} \cdot 46 \cdot 10^{-6}} = 0,0035 \text{ м} =$$

$= 3,5$ мм

$$\Delta_{V1} = \Delta_V + \Delta_6 = 1,796 + 3,5 = \underline{5,296 \text{ мм}}$$



$k_1 = 6$

$k_2 = 3$

$10a$ $k_3 = 3{,}2$

Определение центра тяжести

$$x_c = \frac{\sum A_i x_i}{\sum A_i} = \frac{A_1 x_1 + A_2 x_2 + A_3 x_3}{A_1 + A_2 + A_3} =$$

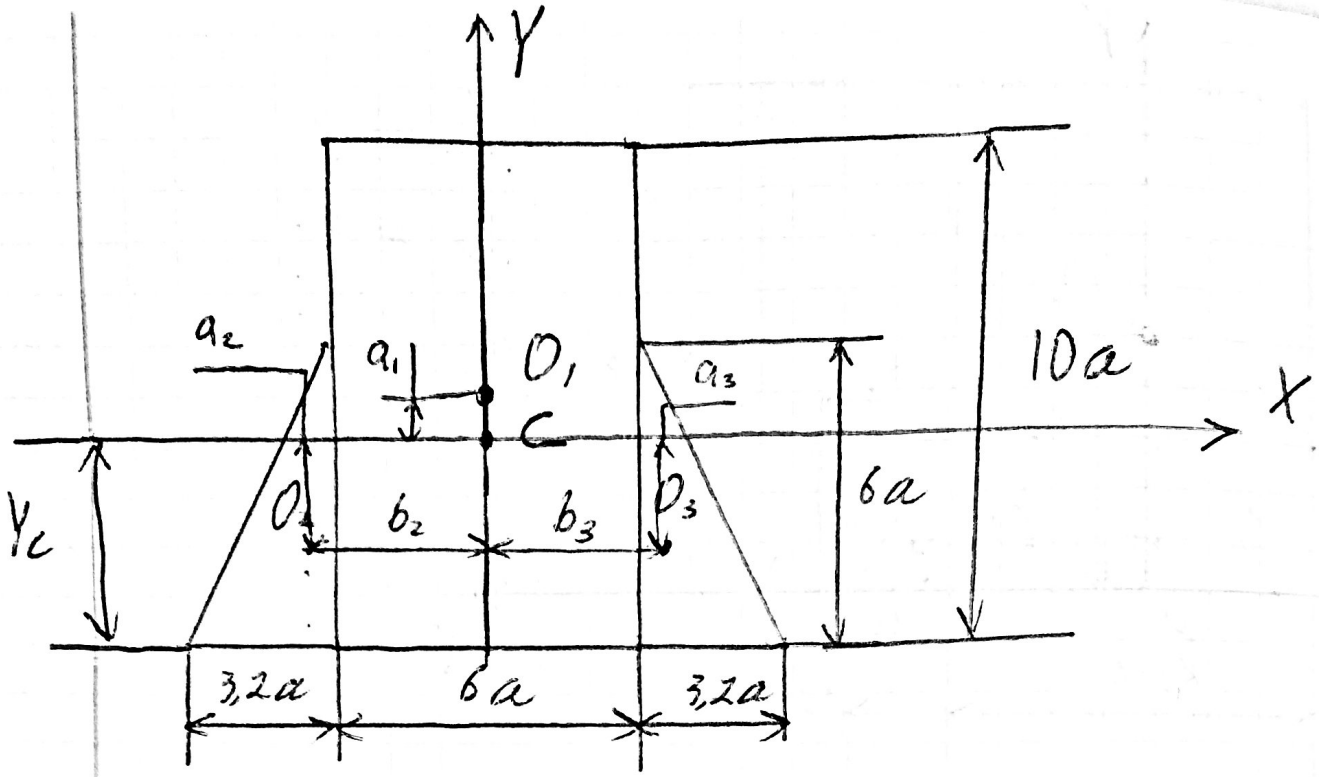
$$= \frac{0 + A_2 x_2 + A_2(-x_2)}{A_1 + 2A_2} = 0$$

$$y_c = \frac{\sum A_i y_i}{\sum A_i} = \frac{A_1 y_1 + A_2 y_2 + A_3 y_3}{A_1 + A_2 + A_3} =$$

$$= \frac{A_1 y_1 + A_2 y_2 + A_2(-y_2)}{A_1 + 2A_2} = \frac{A_1 y_1}{A_1 + 2A_2}$$

$A_1 = 10a \cdot 6a = 60a^2$

$y_1 = 10a/2 = 5a$



$$\Delta_2 = \Delta_3 = \frac{6a \cdot 3,2a}{2} = 9,4a^2$$

$$y_c = \frac{60a^2 \cdot 5a}{60a^2 + 9,4a^2} = 4,32a$$

Определение центральных моментов инерции

$$J_{x_1} = \frac{bh^3}{12} = \frac{6a \cdot (10a)^3}{12} = 500a^4$$

$$J_{y_1} = \frac{hb^3}{12} = \frac{10a \cdot (6a)^3}{12} = 180a^4$$

$$a_1 = \frac{10a}{2} - 4,32a = 1,32a$$

$$a_2 = a_3 = 4,32a - \frac{1}{3} \cdot 6a = 2,32a$$

$$b_2 = b_3 = \frac{6a}{2} + \frac{1}{3} \cdot 3,2a = 4,07a$$

$$J_{x2} = J_{x3} = \frac{bh^3}{36} = \frac{3{,}2a \cdot (6a)^3}{36} = 19{,}2a^4$$

$$J_{y2} = J_{y3} = \frac{hb^3}{36} = \frac{6a \cdot (3{,}2a)^3}{36} = 5{,}46a^4$$

$$J_x = J_x' + J_x'' + J_x''' = (J_{x_1} + a_1^2 A_1) + (J_{x_2} + a_2^2 A_2) +$$

$$+ (J_{x_3} + a_3^2 A_3) = (J_{x_1} + a_1^2 A_1) + 2(J_{x_2} + a_2^2 A_2) =$$

$$(500a^4 + (1{,}32a)^2 \cdot 60a^2) + 2(19{,}2a^4 + (2{,}32a)^2 \cdot 9{,}4a^2) =$$

$$= \underline{744{,}13\ a^4}$$

$$J_y = J_y' + J_y'' + J_y''' = J_{y_1} + (J_{y_2} + b_2^2 A_2) +$$

$$+ (J_{y_3} + b_3^2 A_3) = J_{y_1} + 2(J_{y_2} + b_2^2 A_2) =$$

$$= 180a^4 + 2(5{,}46a + (4{,}07a)^2 \cdot 9{,}4a) = \underline{502{,}34a^4}$$