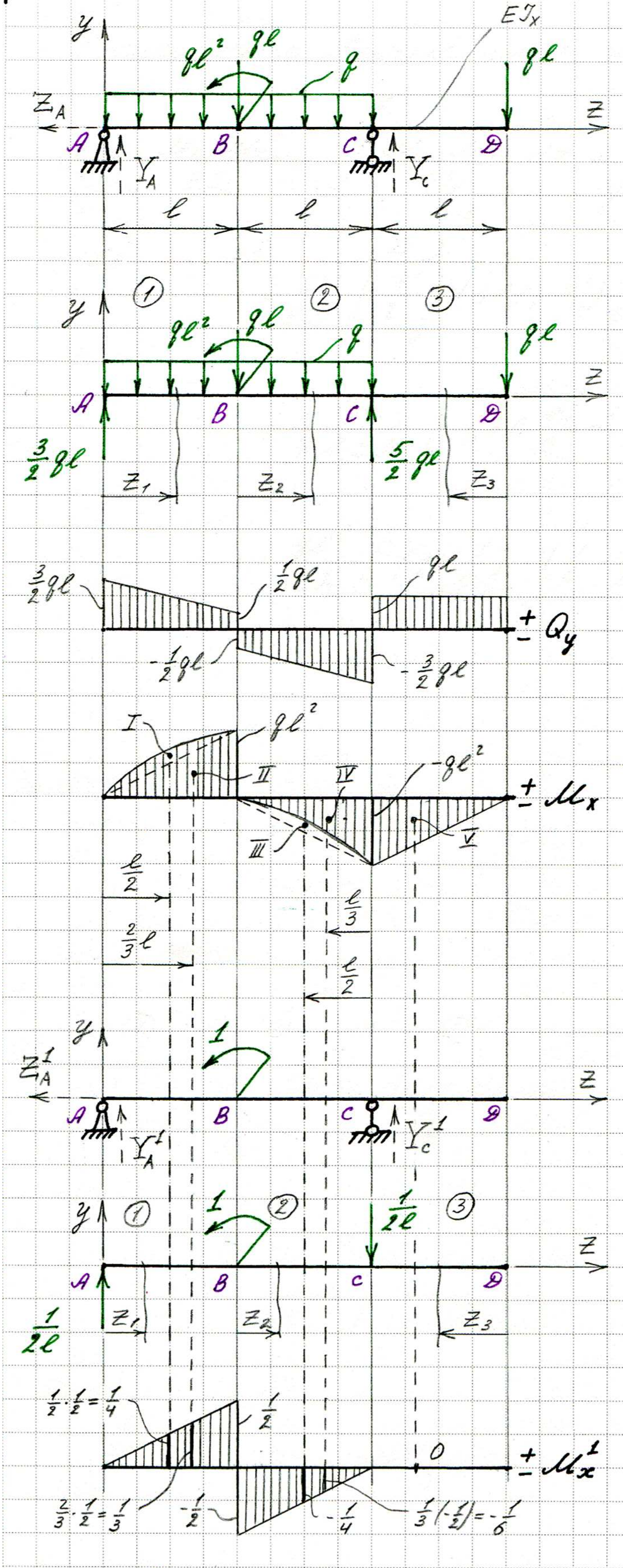
$\Theta_B = ?$ – угол поворота сечения B



$Z_A = 0$

$Y_A = \frac{3}{2} ql$

$Y_C = \frac{5}{2} ql$

$$\left.\begin{aligned} Q_{y_1} &= \frac{q}{2}(3l - 2z_1) \\ Q_{y_2} &= -\frac{q}{2}(l + 2z_2) \\ Q_{y_3} &= ql \\ \mathcal{M}_{x_1} &= \frac{q}{2}(3l z_1 - z_1^2) \\ \mathcal{M}_{x_2} &= -\frac{q}{2}(l \cdot z_2 + z_2^2) \\ \mathcal{M}_{x_3} &= -ql z_3 \end{aligned}\right\} \text{РОЗУ}$$

$Z_A^1 = 0$

$Y_A^1 = \frac{1}{2l}$

$Y_C^1 = -\frac{1}{2l}$

$$\left.\begin{aligned} \mathcal{M}_{x_1}^1 &= \frac{z_1}{2l} \\ \mathcal{M}_{x_2}^1 &= \frac{z_2 - l}{2l} \\ \mathcal{M}_{x_3}^1 &= 0 \end{aligned}\right\} \text{РОЗУ}$$

Способ Верещагина:

$$\Theta_B = \frac{\mathcal{M}_x \cdot \mathcal{M}_x^1}{EJ_x} = \frac{1}{EJ_x} \cdot \Big[\overset{I}{\left(\frac{ql^3}{12}\right)\frac{1}{4}} + \overset{II}{\left(\frac{1}{2} l\, ql^2\right)\frac{1}{3}} + \overset{III}{\left(\frac{ql^3}{12}\right)\left(-\frac{1}{4}\right)} + \overset{IV}{\left(-\frac{1}{2} l\, ql^2\right)\cdot\left(-\frac{1}{6}\right)} + \overset{V}{\left(-\frac{1}{2} l\, ql^2\right)\cdot 0} \Big] =$$

$$= \frac{ql^3}{EJ_x} \cdot \left[\frac{1}{48} + \frac{1}{6} - \frac{1}{48} + \frac{1}{12} \right] = \frac{ql^3}{4EJ_x}$$

Классическое вычисление интеграла Мора:

$$\theta_B = \frac{M_x \cdot M_x^1}{EJ_x} = \int_0^l \frac{M_{x1} \cdot M_{x1}^1}{EJ_x} dz_1 + \int_0^l \frac{M_{x2} \cdot M_{x2}^1}{EJ_x} dz_2 + \int_0^l \frac{M_{x3} \cdot \overset{0}{\cancel{M_{x3}^1}}}{EJ_x} dz_3 =$$

$$= \frac{1}{EJ_x} \cdot \left[\frac{q}{2} \cdot \int_0^l (3lz_1 - z_1^2) \frac{z_1}{2l} dz_1 - \frac{q}{2} \int_0^l (lz_2 + z_2^2) \frac{z_2 - l}{2l} dz_2 \right] =$$

$$= \frac{q}{4 \cdot l \cdot EJ_x} \cdot \left[\left(3l \frac{z_1^3}{3} - \frac{z_1^4}{4} \right) \Big|_0^l - \left(l \frac{z_2^3}{3} + \frac{z_2^4}{4} - l^2 \frac{z_2^2}{2} - l \frac{z_2^3}{3} \right) \Big|_0^l \right] =$$

$$= \frac{ql^3}{4EJ_x} \cdot \left[\left(1 - \frac{1}{4} \right) - \left(\frac{1}{4} - \frac{1}{2} \right) \right] = \frac{ql^3}{4EJ_x}$$