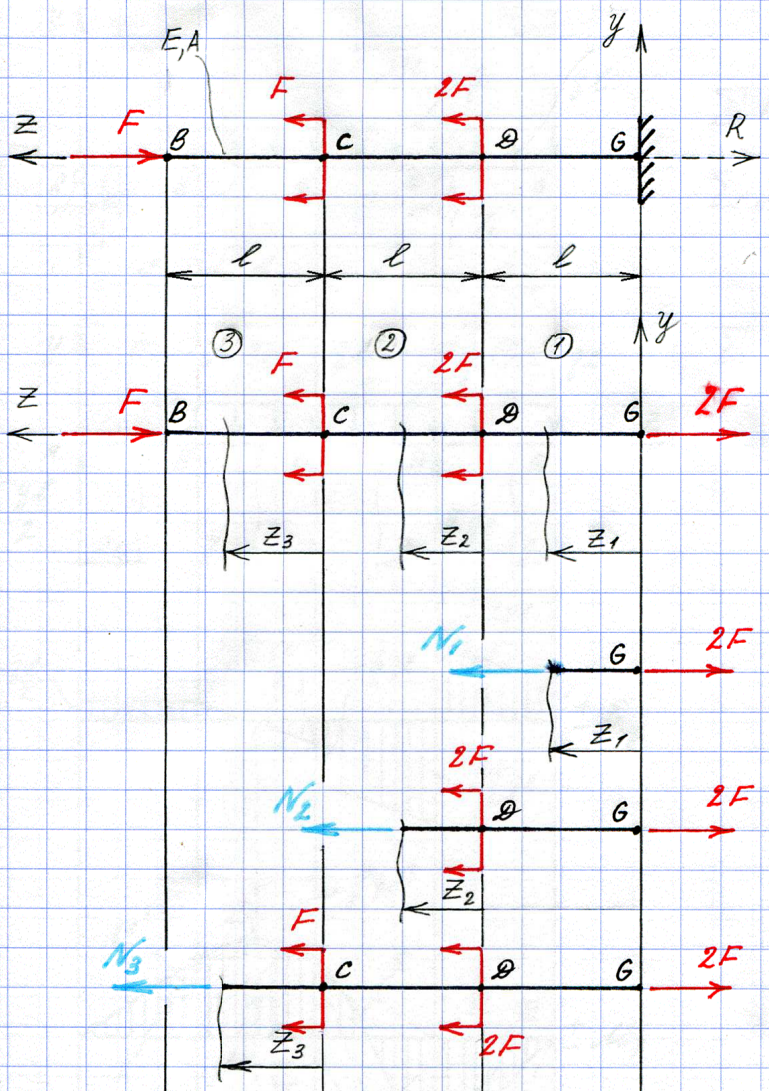

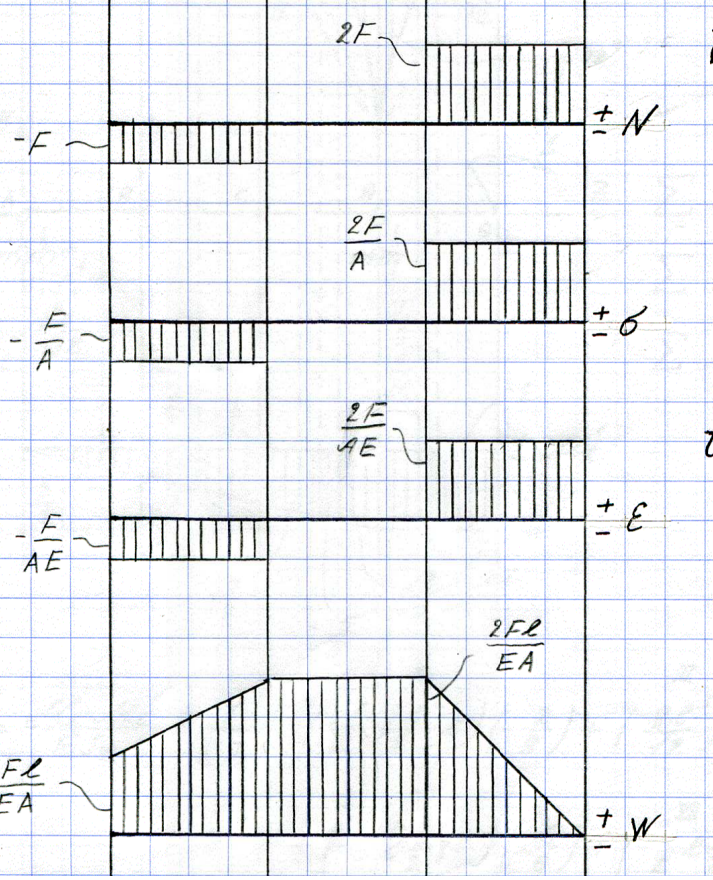

$W = ?, \quad U = ?$

$$\sum F_z = 0 = -F + F + 2F - R \Rightarrow R = 2F$$

$$\sum F_{z_1} = 0 = N_1 - 2F \Rightarrow N_1 = 2F$$

$$\sum F_{z_2} = 0 = N_2 + 2F - 2F \Rightarrow N_2 = 0$$

$$\sum F_{z_3} = 0 = N_3 + F + 2F - 2F \Rightarrow N_3 = -F$$

$$\sigma_1 = \frac{N_1}{A_1} = \frac{2F}{A}; \quad \sigma_2 = \frac{N_2}{A_2} = 0; \quad \sigma_3 = \frac{N_3}{A_3} = -\frac{F}{A}$$

$$\varepsilon_1 = \frac{\sigma_1}{E_1} = \frac{2F}{EA}; \quad \varepsilon_2 = \frac{\sigma_2}{E_2} = 0; \quad \varepsilon_3 = \frac{\sigma_3}{E_3} = -\frac{F}{EA}$$

$$W_1 = \cancel{W_0^{кон}}^{0} + \int_0^{z_1} \varepsilon_1 dz_1 = 0 + \int_0^{z_1} \frac{2F}{EA} dz_1 = \frac{2F \cdot z_1}{EA}$$

$z_1 = 0: \; W_1^{нач} = 0, \quad z_1 = \ell: \; W_1^{кон} = \frac{2F\ell}{EA};$

$$W_2 = W_1^{кон} + \int_0^{z_2} \varepsilon_2 dz_2 = \frac{2F\ell}{EA} + 0 = \frac{2F\ell}{EA}$$

$$W_3 = W_2^{кон} + \int_0^{z_3} \varepsilon_3 dz_3 = \frac{2F\ell}{EA} + \int_0^{z_3} \left(-\frac{F}{EA}\right) dz_3 = \frac{F}{EA}(2\ell - z_3)$$

$z_3 = 0: \; W_3^{нач} = \frac{2F\ell}{EA}; \quad z_3 = \ell: \; W_3^{кон} = \frac{F\ell}{EA}.$

$$W = \frac{1}{2} F_B \cdot W_B + \frac{1}{2} F_C \cdot W_C + \frac{1}{2} F_D \cdot W_D =$$

$$= \frac{1}{2}(-F)\frac{F\ell}{EA} + \frac{1}{2} F \frac{2F\ell}{EA} + \frac{1}{2} 2F \frac{2F\ell}{EA} =$$

$$= \frac{5}{2} \cdot \frac{F^2\ell}{EA} \; [Н \cdot м] = [Дж]$$

$$U = \sum \int_0^{\ell_i} \frac{N_i^2 dz_i}{2 E_i A_i} =$$

$$= \int_0^{\ell} \frac{(2F)^2 dz_1}{2EA} + 0 + \int_0^{\ell} \frac{(-F)^2 dz_3}{2EA} =$$

$$= \frac{4F^2\ell}{2EA} + \frac{F^2\ell}{2EA} = \frac{5}{2} \cdot \frac{F^2\ell}{EA} \; [Дж]$$

$$W = U$$