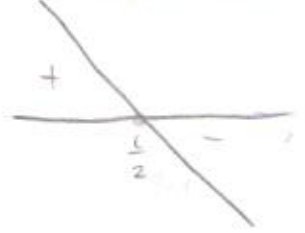


$\frac{dMg}{dx}$ zmienia znak
 z "+" na "-"
 w punkcie $x = \frac{l}{2}$ więc
 jest to maksimum

$$\frac{dMg}{dx} = R_{Ay} - q \cdot x$$



$$R_{Ay} - q \cdot x = 0$$

$$q \cdot x = R_{Ay}$$

$$q \cdot x = \frac{q \cdot l}{2} \quad | : q$$

$$x = \frac{l}{2} \quad \text{w punkcie } \frac{l}{2} \text{ maksimum}$$

Teraz obliczamy wartość maksimum

$$Mg = R_{Ay} \cdot \frac{l}{2} - q \cdot \frac{l}{2} \cdot \frac{l}{2} \cdot \frac{1}{2} =$$

$$= \frac{q \cdot l}{2} \cdot \frac{l}{2} - \frac{q \cdot l^2}{8} = \frac{q \cdot l^2}{4} - \frac{q \cdot l^2}{8} = \frac{q \cdot l^2}{8}$$

$$Mg_{\max} = \frac{q \cdot l^2}{8}$$

$$\sum F_{ix} = 0 \quad R_{Ax} = 0$$

$$\sum F_{iy} = 0 \quad R_{Ay} - q \cdot l + R_B = 0 \rightarrow R_{Ay} = q \cdot l - R_B = q \cdot l - \frac{q \cdot l}{2} = \frac{q \cdot l}{2}$$

$$\sum M_{iA} = 0 \quad q \cdot l \cdot \frac{l}{2} - R_B \cdot l = 0 \rightarrow R_B \cdot l = q \cdot l \cdot \frac{l}{2} \quad | : l$$

$$R_B = \frac{q \cdot l}{2}$$

$$R_B = \frac{q \cdot l}{2}$$

$$R_{Ay} = \frac{q \cdot l}{2}$$

$$0 < x < l$$

$$T = R_{Ay} - q \cdot x$$

$$Mg = R_{Ay} \cdot x - q \cdot x \cdot \frac{x}{2} = \frac{q \cdot l}{2} \cdot x - \frac{q \cdot x^2}{2}$$

$$\text{dla } x = 0$$

$$\text{dla } x = l$$

$$Mg = 0$$

$$Mg = \frac{q \cdot l}{2} \cdot l - q \cdot l \cdot \frac{l}{2} = 0$$

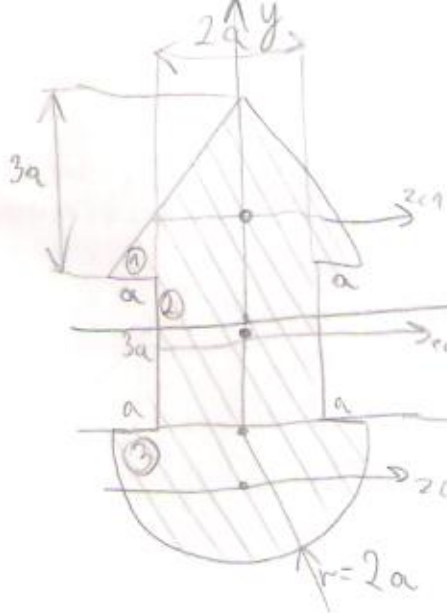
$$\text{dla } x = 0$$

$$\text{dla } x = l$$

$$T = \frac{q \cdot l}{2}$$

$$T = \frac{q \cdot l}{2} - q \cdot l = -\frac{q \cdot l}{2}$$

$$\sigma = \frac{Mg_{\max}}{J_z} \cdot y_{\max} \leq k \cdot q$$



$$A_1 = 2a \cdot 3a = 6a^2 \quad y_{c1} = 4a \quad z_{c1} = 0$$

$$A_2 = 2a \cdot 3a = 6a^2 \quad y_{c2} = 1.5a \quad z_{c2} = 0$$

$$A_3 = \frac{\pi r^2}{2} = \frac{\pi (2a)^2}{2} = 2\pi a^2 \quad y_{c3} = -\frac{8a}{3\pi} \quad z_{c3} = 0$$

$$\bar{y}_c = \frac{\sum A_i \cdot y_i}{\sum A_i} = \frac{6a^2 \cdot 4a + 6a^2 \cdot 1.5a + 2\pi a^2 \cdot (-\frac{8a}{3\pi})}{6a^2 + 6a^2 + 2\pi a^2}$$

$$\bar{y}_c = \frac{24a^3 + 9a^3 - \frac{16}{3}a^3}{(12 + 2\pi)a^2} = \frac{(24 + 9 - \frac{16}{3})a^3}{(12 + 2\pi)a^2} = 1.52a$$

$$\bar{I}_{z_{c1}} = \frac{b \cdot h^3}{36} = \frac{4a \cdot (3a)^3}{36} = \frac{108}{36} a^4 = 3a^4$$

$$\bar{I}_{z_c}^{(1)} = \bar{I}_{z_{c1}} + d_1^2 \cdot A \quad d_1 = 4a - 1.52a = 2.48a$$

$$\bar{I}_{z_c}^{(1)} = 3a^4 + (2.48a)^2 \cdot 6a^2 = 3a^4 + 37a^4 = 40a^4$$

$$\bar{I}_{z_{c2}} = \frac{b \cdot h^3}{12} = \frac{2a \cdot (3a)^3}{12} = \frac{54a^4}{12} = 4.5a^4$$

$$\bar{I}_{z_c}^{(2)} = \bar{I}_{z_{c2}} + d_2^2 \cdot A = 4.5a^4 + (0.02a)^2 \cdot 6a^2 = 4.5024a^4$$

$$\bar{I}_{z_{c3}} = \frac{\pi d^4}{128} = \frac{\pi (4a)^4}{128} = \frac{256\pi}{128} a^4 = 6.3a^4$$

$$\bar{I}_{z_c}^{(3)} = \bar{I}_{z_{c3}} + d_3^2 \cdot A = 6.3a^4 + (2.37a)^2 \cdot 2\pi a^2 = 47.6a^4$$

$$\bar{I}_{z_c} = \bar{I}_{z_c}^{(1)} + \bar{I}_{z_c}^{(2)} + \bar{I}_{z_c}^{(3)} = 40a^4 + 4.5024a^4 + 47.6a^4 = 86.1a^4$$

$$\bar{I}_{z_c} = 86.1a^4$$

$$\bar{I}_{y_c} = \bar{I}_{y_c}^{(1)} + \bar{I}_{y_c}^{(2)} + \bar{I}_{y_c}^{(3)}$$

$$\bar{I}_{y_c} = 2 \cdot \frac{b \cdot h^3}{12} + \frac{b \cdot h^3}{12} + \frac{\pi d^4}{64}$$

$$\bar{I}_{y_c} = 2 \cdot \frac{3a \cdot (2a)^3}{12} + \frac{3a \cdot (2a)^3}{12} + \frac{\pi \cdot (4a)^4}{64}$$

$$\bar{I}_{y_c} = \left(\frac{6 \cdot 8}{12} + \frac{3 \cdot 8}{12} + \frac{256\pi}{128} \right) a^4$$

$$\bar{I}_{y_c} = (4 + 2 + 6.3)a^4$$

$$\bar{I}_{y_c} = 12.3a^4$$

$$\bar{I}_0 = \bar{I}_{z_c} + \bar{I}_{y_c} = 86.1a^4 + 12.3a^4$$

$$\bar{I}_0 = 98.4a^4$$