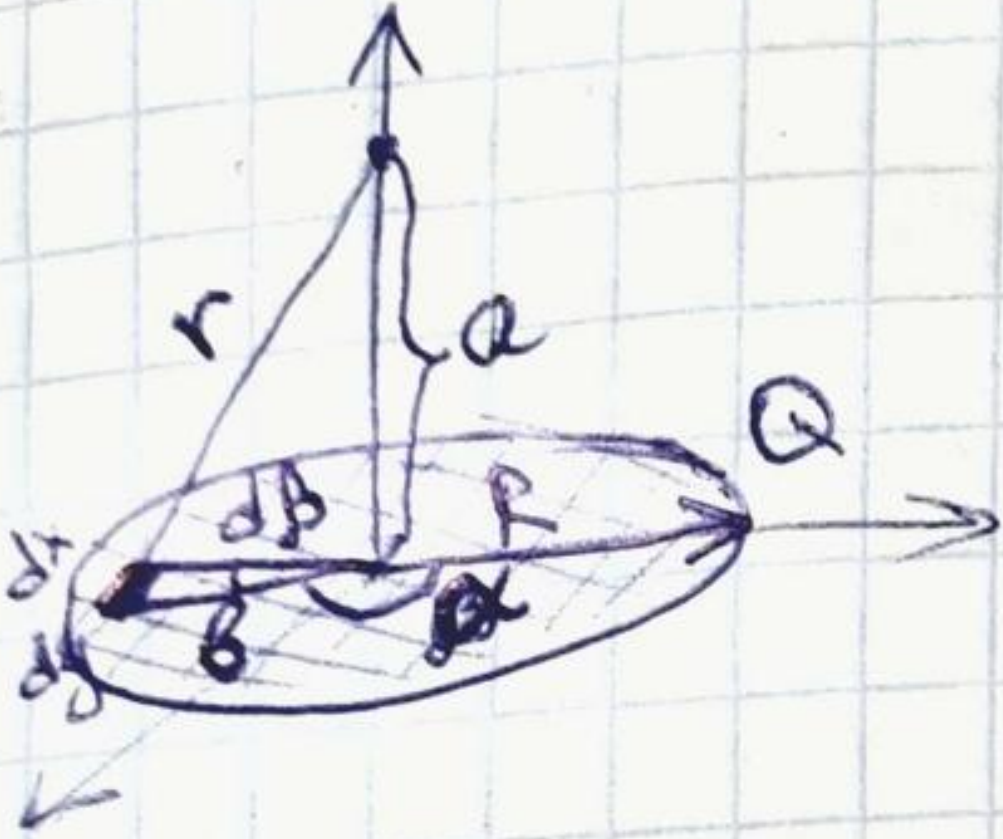


Cvičení 3-4

A8 N6

$a = 20 \text{ cm} = 0,2 \text{ m}$ $R = 0,1 \text{ m}$ $Q = 1 \mu\text{C}$ $\varphi = ?$

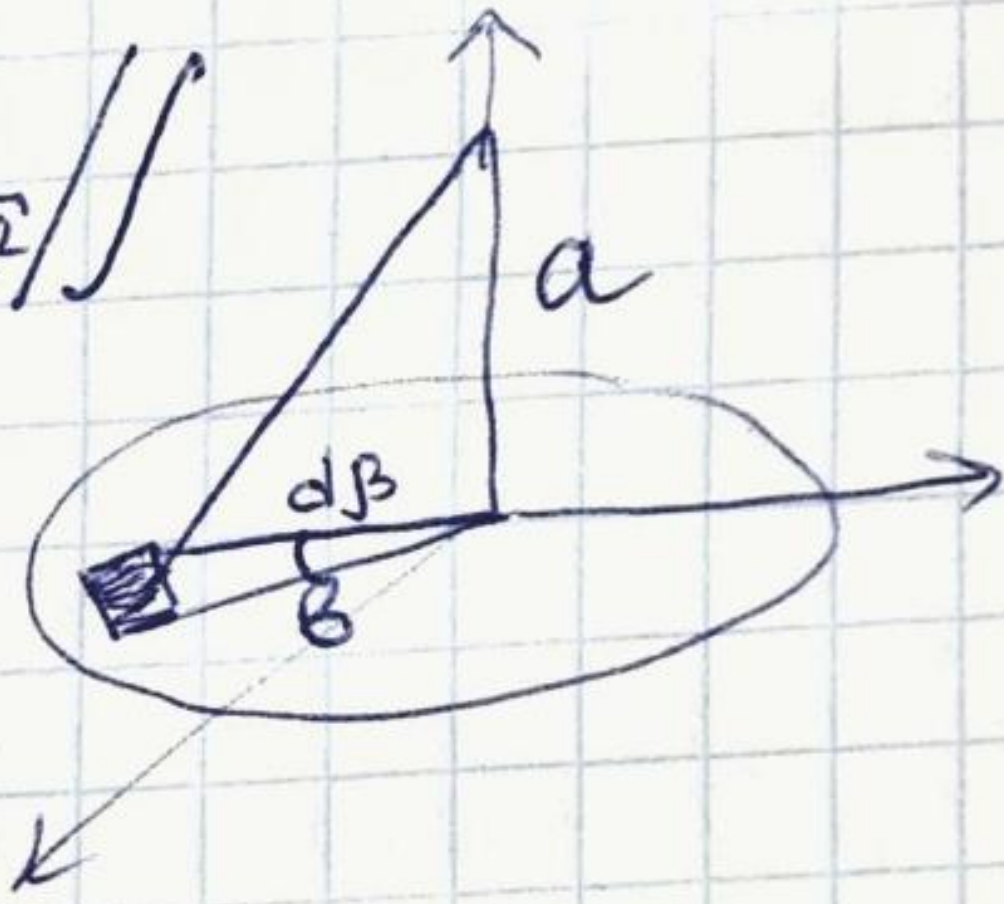


$$\varphi = \frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{r}$$

$Q = \oint dS$
 $dQ = \oint dS = \oint b \, db$

$$d\varphi = \frac{1}{4\pi\epsilon_0} \frac{\oint b \, db \, d\beta}{r} = \frac{\oint b \, db \, d\beta}{4\pi\epsilon_0 \cdot \sqrt{b^2 + a^2}}$$

$$\varphi = \int_0^{2\pi} \int_0^R \frac{\oint b}{4\pi\epsilon_0 \cdot \sqrt{b^2 + a^2}} \, db \, d\beta$$



$b^2 + a^2 = x$, $dx = 2b \, db$, $b=0 \Rightarrow x=a^2$
 $b=R \Rightarrow x=R^2 + a^2$

$$\varphi = \int_{a^2}^{R^2 + a^2} \frac{1 \cdot \oint}{4\pi\epsilon_0} \cdot \frac{1}{2} \cdot \frac{1}{\sqrt{x}} \, dx \, d\beta =$$

$$\int_0^{2\pi} \frac{1}{4\pi\epsilon_0} \left[x^{\frac{1}{2}} \right]_{a^2}^{R^2 + a^2} \, d\beta = \frac{\oint}{4\pi\epsilon_0} \int_0^{2\pi} (\sqrt{R^2 + a^2} - a) \, d\beta =$$

$$\frac{\oint}{4\pi\epsilon_0} (\sqrt{R^2 + a^2} - a) \int_0^{2\pi} d\beta = \frac{\oint}{2} (\sqrt{R^2 + a^2} - a) 2\pi =$$

$$= \frac{\oint}{2\epsilon_0} (\sqrt{R^2 + a^2} - a) \quad \oint = \frac{Q}{S}$$

$$\varphi = \frac{1 \cdot 10^{-6}}{2 \cdot 8,854 \cdot 10^{-12} \cdot \pi \cdot 0,1^2} (\sqrt{0,1^2 + 0,2^2} - 0,2) =$$

$$= \underline{4,24 \cdot 10^4 \text{ V}}$$