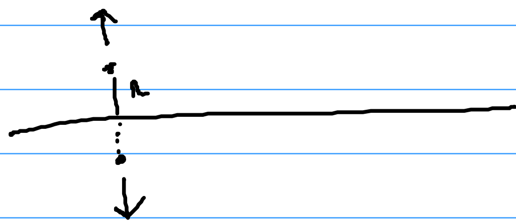
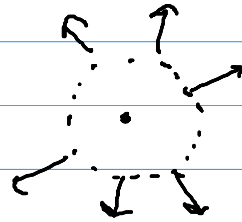
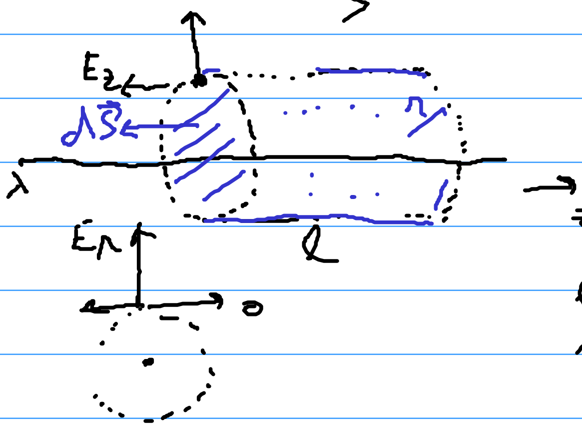




$\sim \frac{1}{r}$

GAUSS: $\oint_S \vec{E}\cdot d\vec{S} = \frac{Q_{in}}{\varepsilon_0}$



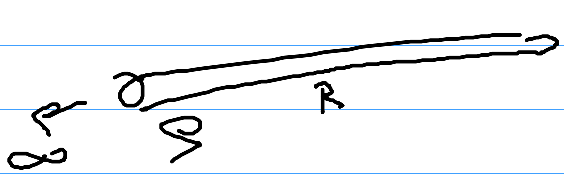
$\vec{E} = \vec{E}(r) = E(r)\,\hat{r}$

$E_z = 0$

$$\oint_S \vec{E}\cdot d\vec{S} = \underbrace{0+0}_{\text{podstavy}} + 2\pi r\cdot l\cdot E(r) = \frac{\lambda\cdot l}{\varepsilon_0}$$

$$E(r) = \frac{\lambda}{2\pi r\varepsilon_0}$$

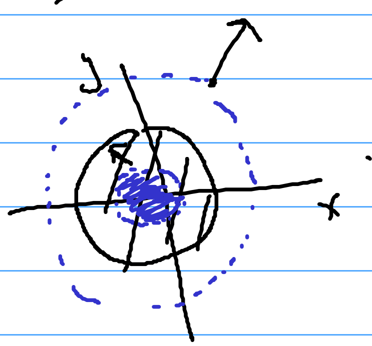
HOMOG. NABL. VÁLEC



$\vec{E} = ?$ Gaussem

$r < R$

$r > R$

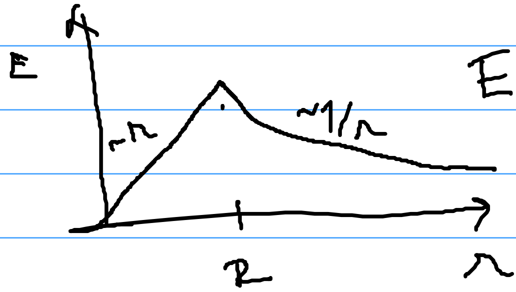


$r > R$: $\oint \vec{E}\cdot d\vec{S} = 2\pi r\cdot l\cdot E(r)$

$= \pi R^2\cdot l\rho/\varepsilon_0$

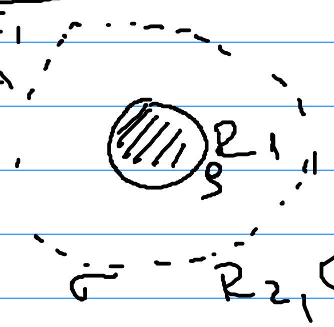
$$E = \frac{\rho R^2}{2\varepsilon_0 r}$$

$r < R$: $\oint \vec{E} \cdot d\vec{S} = 2\pi r l E(r) = \rho \pi l r^2 / \varepsilon_0$



$$E(r) = \frac{\rho r}{2\varepsilon_0}$$

$\to \partial V$ GAUSS



$E = ?$ $r < R_1$

$R_1 < r < R_2$

$R_2 < r$

$\varphi = ?$

VALEC $\to$ $\varphi = ?$

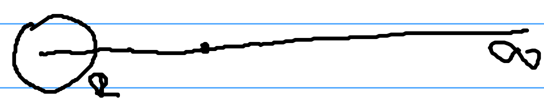
$\vec{E} = -\nabla \varphi$

$$\varphi(\vec{A}) = \int_{\infty}^{\vec{A}} \vec{E} \cdot d\vec{l}$$

$r < R$ $\quad E = \dfrac{\rho r}{2\varepsilon_0}$

$r > R$ $\quad E = \dfrac{\rho R^2}{2\varepsilon_0 r}$

$$\varphi(r > R) = \int_{\infty}^{r} \frac{\rho R^2}{2\varepsilon_0 r'} dr' =$$



$$= \frac{\rho R^2}{2\varepsilon_0} \int^{r} \frac{dr'}{r'}$$

$$= \frac{\rho R^2}{2\varepsilon_0} \left[\ln(r) - \ln(\infty) \right]$$

$\downarrow$

PROBLEM

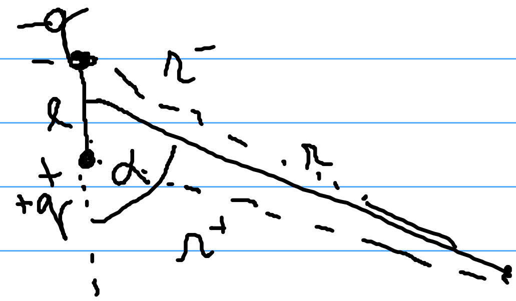
$$\varphi(r < R) = \varphi(R) + \int_{R}^{r} \frac{\rho r'}{2\varepsilon_0} dr' =$$

$$= \varphi(R) + \frac{\rho}{2\varepsilon_0} \frac{1}{2} \left(r^2 - R^2 \right)$$

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$$

DIPÓL 3x JINAK

bodový náb. $\varphi = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$

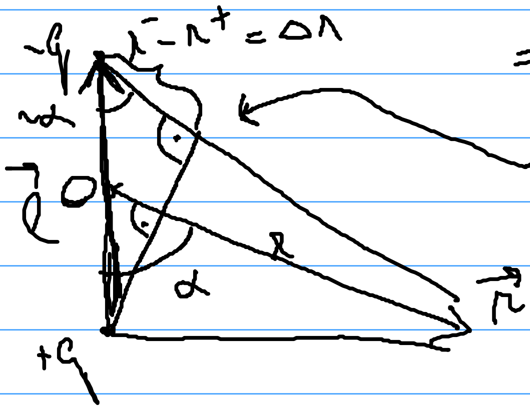


Dipól: $\varphi = \varphi^+ + \varphi^- = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r^+} + \frac{-q}{r^-}\right)$

$\varphi = ?$

$$= \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{r^+} - \frac{1}{r^-}\right) =$$

$$= \frac{q}{4\pi\varepsilon_0}\frac{r^- - r^+}{r^+ r^-}$$



$r \gg l$

$$r^- - r^+ = l \cdot \cos\alpha$$

$$r^+ r^- = r^+(r^+ + \Delta r) \doteq r^2$$

$$\left(r - \frac{\Delta}{2}\right)\left(r + \frac{\Delta}{2}\right) \doteq r^2$$

$$\vec{p} = q \cdot \vec{l}$$

$$\varphi = \frac{q}{4\pi\varepsilon_0}\frac{l \cdot \cos\alpha}{r^2}$$

$$\boxed{\varphi = \frac{\vec{p} \cdot \vec{r}}{4\pi\varepsilon_0 r^3}}$$

$$\vec{p} \cdot \vec{r} = pr \cdot \cos\alpha$$

$$q l r \cos\alpha$$

$$\nabla \frac{\vec{p} \cdot \vec{r}}{r^3} = \text{viz } 1.\text{ cv.}$$