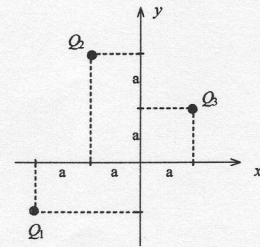
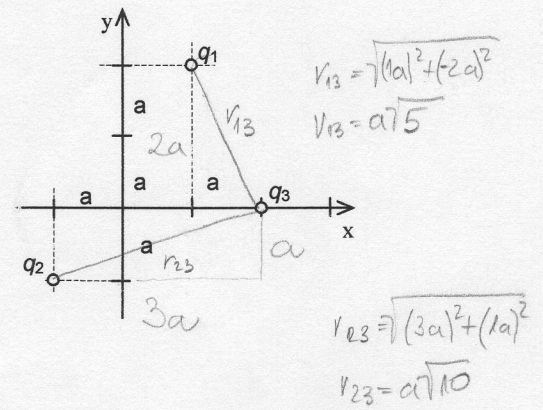


1. Izračunajte silo na točkasto elektrino  $Q_3 = -8 \cdot 10^{-6}$  As, ki se nahaja v elektrostatičnem polju elektrin  $Q_1 = 4 \cdot 10^{-6}$  As in  $Q_2 = -3 \cdot 10^{-6}$  As.

$a = 4$  cm.

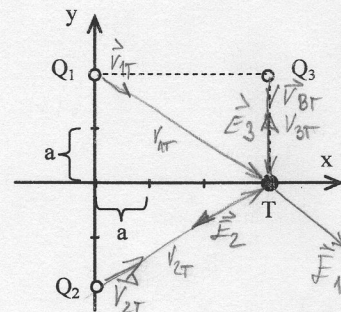


2. Izračunajte silo na meter preme elektrine  $q_3$ , ki se nahaja v elektrostatičnem polju dveh premih elektrin.  $q_1 = 5 \cdot 10^{-6}$  As/m in  $q_2 = -3 \cdot 10^{-6}$  As/m, ( $q_3 = 2 \cdot 10^{-6}$  As/m in  $a = 15$  cm).



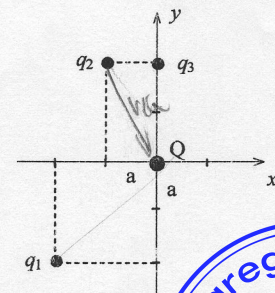
3. V elektrostatičnem polju točkastih nosilcev elektrin se nahaja točka T.

- a) Kolikšna je električna poljska jakost (po velikosti in smeri) v točki T ( $Q_1 = 3 \cdot 10^{-6}$  As,  $Q_2 = -3 \cdot 10^{-6}$  As,  $Q_3 = -2,8 \cdot 10^{-6}$  As,  $a = 10$  cm)
- b) Kolikšen mora biti naboj  $Q_3$ , da bo električna poljska jakost v točki T enaka nič ( $Q_1$  in  $Q_2$  ostaneta nespremenjena)
- c) Kolikšna je sila na naboj  $Q = 6 \cdot 10^{-6}$  As, ki ga postavimo v točko T



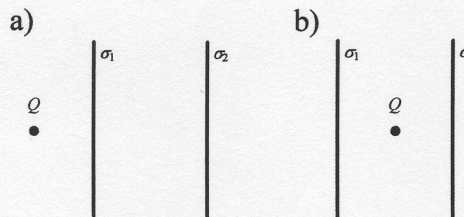
4. V elektrostatičnem polju premih elektrin  $q_1$ ,  $q_2$  in  $q_3$  določite elektrino  $q_2$  tako, da bo sila na točkasto elektrino Q enaka nič.

$q_1 = 4 \cdot 10^{-6}$  As/m,  $q_3 = 6 \cdot 10^{-6}$  As/m,  
 $a = 10$  cm.

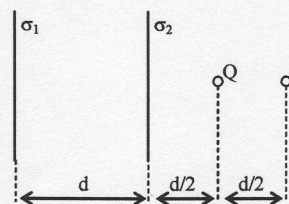


5. Izračunajte silo na točkasto elektrino  $Q = 8 \cdot 10^{-6}$  As, ki se nahaja v elektrostatičnem polju ravninskih elektrin  $\sigma_1 = 7 \cdot 10^{-6}$  As/m<sup>2</sup> in  $\sigma_2 = -5 \cdot 10^{-6}$  As/m<sup>2</sup>, za naslednja primera.

- a) naboj  $Q$  leži levo od ravnine  $\sigma_1$   
b) naboj  $Q$  leži med ravninama  $\sigma_1$  in  $\sigma_2$



6. Izračunajte silo na točkasto elektrino  $Q = 4 \cdot 10^{-6}$  As, ki se nahaja v elektrostatičnem polju ravninskih elektrin  $\sigma_1 = -2 \cdot 10^{-6}$  As/m<sup>2</sup> in  $\sigma_2 = 1 \cdot 10^{-6}$  As/m<sup>2</sup> ter preme elektrine  $q = -3 \cdot 10^{-6}$  As/m.  
 $d = 3,5$  cm



## REŠITVE

1.  $\vec{F}_{Q3} = (\vec{i}_x \cdot 12,62 - \vec{i}_y \cdot 19,73) \text{ N}$

2.  $\vec{F}_{q3} = \vec{i}_x \cdot 0,024 - \vec{i}_y \cdot 0,55 \text{ N/m}$

3. a)  $\vec{E} = \vec{i}_y \cdot 400 \frac{\text{kV}}{\text{m}}$   
b)  $Q_3 = 1 \cdot 10^{-6} \text{ As}$   
c)  $\vec{F}_Q = \vec{i}_y \cdot 2,4 \text{ N}$

4.  $q_2 = -5 \cdot 10^{-6} \text{ As/m}$

5. a)  $\vec{F} = -\vec{i}_x \cdot 0,9 \text{ N}$   
b)  $\vec{F} = \vec{i}_x \cdot 5,4 \text{ N}$

6.  $\vec{F} = \vec{i}_x \cdot 12,1 \text{ N}$

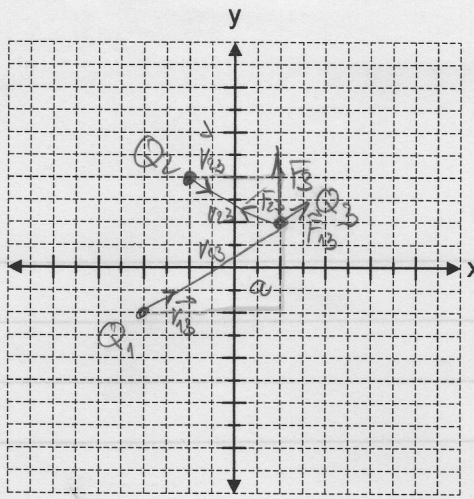
D.N. 1/1

$$Q_3 = -8 \cdot 10^{-6} \text{ As}$$

$$Q_1 = 4 \cdot 10^{-6} \text{ As}$$

$$Q_2 = -3 \cdot 10^{-6} \text{ As}$$

$$a = 4 \text{ cm}$$



$$V_{13} = \sqrt{(3a)^2 + (2a)^2}$$

$$V_{13} = a\sqrt{13}$$

A. KOLEČNIK SKL. A

$$\vec{F}_3 = ?$$

$$\vec{F}_3 = \vec{F}_{13} + \vec{F}_{23}$$

$$\vec{V}_{13} = \frac{\vec{r}_{13}}{V_{13}} = \frac{3a\vec{i}_x + 2a\vec{i}_y}{a\sqrt{13}}$$

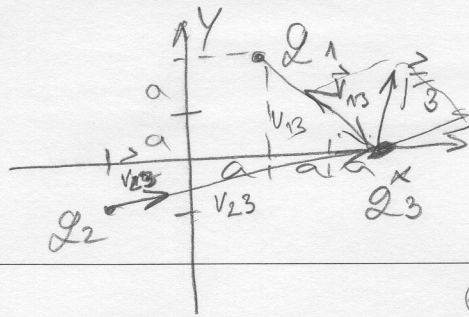
$$\vec{F}_{13} = \frac{Q_1 Q_3}{4\pi\epsilon_0 V_{13}^2} \vec{V}_{13} = \frac{4 \cdot 10^{-6} \text{ As} \cdot (-8 \cdot 10^{-6} \text{ As})}{4\pi \cdot 8,85 \cdot 10^{-12} (4 \cdot 10^{-2} \sqrt{13})^2} \left( \frac{3}{\sqrt{13}} \vec{i}_x + \frac{2}{\sqrt{13}} \vec{i}_y \right)$$

$$\vec{F}_{13} = -13,83 \left( \frac{3}{\sqrt{13}} \vec{i}_x + \frac{2}{\sqrt{13}} \vec{i}_y \right)$$

$$\vec{F}_{23} = \frac{Q_2 Q_3}{4\pi\epsilon_0 V_{23}^2} \vec{V}_{23} = \frac{3 \cdot 10^{-6} (-8 \cdot 10^{-6})}{4\pi \cdot 8,85 \cdot 10^{-12} (4 \cdot 10^{-2} \sqrt{5})^2} \left( \frac{2}{\sqrt{5}} \vec{i}_x + \frac{1}{\sqrt{5}} \vec{i}_y \right)$$

$$\vec{F}_{23} = 26,98 \cdot \left( \frac{2}{\sqrt{5}} \vec{i}_x + \frac{1}{\sqrt{5}} \vec{i}_y \right)$$

$$\vec{F}_3 = \vec{F}_{13} + \vec{F}_{23} = (12,62 \vec{i}_x + 19,74 \vec{i}_y) \text{ N}$$



D.N. 1./2

$$q_3 = 2 \cdot 10^{-6} \text{ As/m}$$

$$q_2 = -3 \cdot 10^{-6} \text{ As/m}$$

$$q_1 = 5 \cdot 10^{-6} \text{ As/m}$$

$$a = 15 \text{ cm} = 15 \cdot 10^{-2} \text{ m}$$

$$Q = q \cdot l$$

$$A = 2TR \epsilon_0$$

$q$  - električna nabojna gostota dolžinski valja

$Q$  - skupna nabojna količina valja dolžine  $l$  (može  $Q = \infty$ )

$$\vec{V}_3 = q \cdot \sqrt{5}$$

$$V_3 = q \sqrt{10}$$

$$\vec{F}_3 = ?$$

$$\vec{F}_3 = \frac{Q}{\epsilon_0} = \frac{q}{2TR \epsilon_0} =$$

$$\vec{F}_{23} = \frac{q_2 \cdot q_3}{2TR \epsilon_0} \Rightarrow \vec{F}_{23} = \frac{-3 \cdot 10^{-6} \cdot 2 \cdot 10^{-6}}{2\pi \cdot 8,85 \cdot 10^{-12} \cdot (15 \cdot 10^{-2})^2 \cdot \sqrt{10}} \cdot \left( \frac{3}{\sqrt{10}} \vec{i}_x + \frac{1}{\sqrt{10}} \vec{i}_y \right)$$

$$\vec{F}_{23} = -0,23 \left( \frac{3}{\sqrt{10}} \vec{i}_x + \frac{1}{\sqrt{10}} \vec{i}_y \right) \text{ N} \quad (-0,22 \vec{i}_x - 0,072 \vec{i}_y)$$

$$\vec{F}_{13} = \frac{5 \cdot 10^{-6} \cdot 2 \cdot 10^{-6}}{2\pi \cdot 8,85 \cdot 10^{-12} \cdot (15 \cdot 10^{-2})^2 \cdot \sqrt{5}} \cdot \left( \frac{1}{\sqrt{5}} \vec{i}_x - \frac{2}{\sqrt{5}} \vec{i}_y \right)$$

$$\vec{F}_{13} = 0,54 \cdot \left( \frac{1}{\sqrt{5}} \vec{i}_x - \frac{2}{\sqrt{5}} \vec{i}_y \right) \quad (0,24 \vec{i}_x - 0,47 \vec{i}_y)$$

$$\vec{F}_3 = (0,02 \vec{i}_x + 0,542 \vec{i}_y) \text{ N/m}$$



B.N. 1. / 3

$$Q_1 = 3 \cdot 10^{-6} \text{ As}$$

$$F = \frac{Q}{A} = \frac{Q}{4\pi\epsilon_0 R^2} \quad V_{\text{IT}} =$$

$$Q_2 = -3 \cdot 10^{-6} \text{ As}$$

$$Q_3 = -2,8 \cdot 10^{-6} \text{ As}$$

$$a = 10 \text{ cm} = 10 \cdot 10^{-2} \text{ m}$$

$$\vec{E}_{\text{IT}} = \frac{Q_1}{4\pi\epsilon_0 \vec{r}_{\text{IT}}^2} = \frac{3 \cdot 10^{-6} \text{ As}}{4\pi \cdot 8,85 \cdot 10^{-12} \frac{\text{C}^2}{\text{Vm}} \cdot (10 \cdot 10^{-2} \cdot \sqrt{13})^2} \cdot \left( \frac{3}{\sqrt{13}} \vec{i}_x - \frac{2}{\sqrt{13}} \vec{i}_y \right)$$

$$\vec{E}_{\text{IT}} = (172,65 \cdot 10^3 \vec{i}_x - 115,1 \cdot 10^3 \vec{i}_y) \frac{\text{V}}{\text{m}}$$

$$\vec{E}_{\text{IT}} = \frac{Q_2}{4\pi\epsilon_0 \vec{r}_{\text{IT}}^2} = \frac{-3 \cdot 10^{-6}}{4\pi \cdot 8,85 \cdot 10^{-12} \cdot (10 \cdot 10^{-2} \cdot \sqrt{13})^2} \cdot \left( \frac{3}{\sqrt{13}} \vec{i}_x + \frac{2}{\sqrt{13}} \vec{i}_y \right)$$

$$\vec{E}_{\text{IT}} = (-172,65 \cdot 10^3 \vec{i}_x - 115,1 \cdot 10^3 \vec{i}_y) \frac{\text{V}}{\text{m}}$$

$$\vec{E}_{\text{IT}} = \frac{Q_3}{4\pi\epsilon_0 \vec{r}_{\text{IT}}^2} = \frac{-2,8 \cdot 10^{-6}}{4\pi \cdot 8,85 \cdot 10^{-12} \cdot (10 \cdot 10^{-2} \cdot \sqrt{4})^2} \cdot \left( \frac{0}{\sqrt{4}} \vec{i}_x - \frac{2}{\sqrt{4}} \vec{i}_y \right)$$

$$\vec{E}_{\text{IT}} = (0 \vec{i}_x + 629,43 \vec{i}_y) \frac{\text{V}}{\text{m}}$$

$$\vec{E}_{\text{T}} = \vec{i}_y 399,23 \cdot 10^3 \frac{\text{V}}{\text{m}}$$

$$\vec{E}_{\text{T}} = 0 \Rightarrow \vec{E}_{\text{T}} = \vec{E}_1 + \vec{E}_2 - \vec{E}_3 = 0$$

$$+\vec{E}_3 = \vec{E}_1 + \vec{E}_2 = +230,2 \cdot 10^3 \frac{\text{V}}{\text{m}} \vec{i}_y \quad 0 \vec{i}_x$$

$$Q_3 = +230,200 \cdot 4\pi \cdot 8,85 \cdot 10^{-12} \cdot (10 \cdot 10^{-2} \cdot \sqrt{4})^2$$

$$Q_3 = +1,024 \cdot 10^{-6} \text{ As}$$



c)  $Q_T = 6 \cdot 10^{-6} \text{ As}$

$$\vec{F} = \vec{E} \cdot Q$$

$$\vec{F}_1 + \vec{F}_2 + \vec{F}_3$$

$$\frac{V}{m} \cdot \frac{A_0}{m} = \frac{VA_0}{m^2}$$

$$\vec{F}_T = 1399,2310 \cdot 6 \cdot 10^{-6} \text{ As}$$

$$\vec{F}_T = 2,4 \text{ N}$$

D.N. 1/4

$$Q_1 = 4 \cdot 10^{-6} \text{ As/m}$$

$$Q_3 = 6 \cdot 10^{-6} \text{ As/m}$$

$$a = 10 \text{ cm} = 10 \cdot 10^{-2} \text{ m}$$

$$\vec{F}_0 = \emptyset$$

$$254326,64$$

$$\frac{1}{\sqrt{2}}$$

$$\vec{E}_1 = \frac{Q_1}{2\pi \epsilon_0 r_0} \cdot \left( \frac{2}{\sqrt{2}} \hat{i} + \frac{2}{\sqrt{2}} \hat{j} \right)$$

$$= \frac{4 \cdot 10^{-6}}{2\pi \cdot 8,85 \cdot 10^{-12} \cdot (10 \cdot 10^{-2})} \cdot \left( \frac{2}{\sqrt{2}} \hat{i} + \frac{2}{\sqrt{2}} \hat{j} \right)$$

$$(254326,64)$$

$$Q = \emptyset$$

$$Q_2 = ?$$

$$\vec{E}_1 = (\hat{i} \cdot 179,84 \cdot 10^3 + \hat{j} \cdot 179,84 \cdot 10^3) \frac{V}{m}$$

$$539508,28$$

$$F = Q \cdot \vec{E}$$

$$\vec{E}_3 = \left( \frac{6 \cdot 10^{-6}}{2\pi \cdot 8,85 \cdot 10^{-12} \cdot (10 \cdot 10^{-2})} \right) (\hat{i} - \hat{j})$$

$$\vec{E}_3 = (\hat{i} \cdot 10 - \hat{j} \cdot 539,51 \cdot 10^3) \frac{V}{m}$$

$$-\vec{E}_2 = \vec{E}_3 + \vec{E}_1$$

$$-\vec{E}_2 = (\hat{i} \cdot 179,84 \cdot 10^3 + \hat{j} \cdot 359,67 \cdot 10^3) \frac{V}{m}$$

$$\vec{E}_2 = (-\hat{i} \cdot 179,84 \cdot 10^3 + \hat{j} \cdot 359,67 \cdot 10^3) \frac{V}{m}$$

da ucinete

$$\vec{E}_2 = Q$$

$$\vec{E}_2 = \frac{Q_2}{2\pi \epsilon_0 r_0} = \left( \frac{Q_2}{2\pi \cdot 8,85 \cdot 10^{-12} \cdot 10 \cdot 10^{-2}} \right) \cdot \left( \frac{1}{\sqrt{2}} \hat{i} - \frac{2}{\sqrt{2}} \hat{j} \right)$$

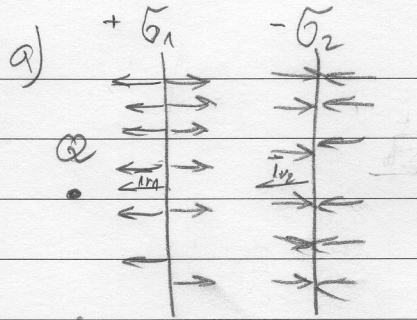
$$359,67 \cdot 10^3$$

$$\frac{Q_2}{2\pi \epsilon_0 r_0} = -179,84 \cdot 10^3 \quad Q_2 = -5,0 \cdot 10^{-6} \text{ As/m}$$



$$\vec{G} = \frac{Q}{A} \quad Q = \vec{G} \cdot A$$

D.N. 1./5



$$\epsilon_0 = 8,85 \cdot 10^{-12} \frac{As}{Vm}$$

$$Q = 8 \cdot 10^{-6} As$$

$$G_1 = 7 \cdot 10^{-6} As/m^2$$

$$G_2 = -5 \cdot 10^{-6} As/m^2$$

$A = \infty$  izpusti

$$\vec{F}_Q = ?$$

$$F = \frac{Q}{2\epsilon_0} = \frac{G_1 A}{2\epsilon_0} = \frac{G}{2\epsilon_0}$$

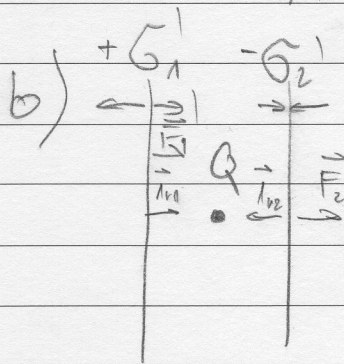
$$\vec{E}_{1Q} = \frac{G_1}{2\epsilon_0} = \frac{7 \cdot 10^{-6}}{2 \cdot 8,85 \cdot 10^{-12}} \frac{As}{Vm} = +395,48 \cdot 10^3 \frac{V}{m}$$

$$\vec{E}_{2Q} = \frac{-5 \cdot 10^{-6}}{2 \cdot 8,85 \cdot 10^{-12}} \frac{As}{Vm} = +282,49 \cdot 10^3 \frac{V}{m}$$

$$V = \frac{Nm}{As}$$

$$\vec{F} = Q \cdot \vec{E}_m = 8 \cdot 10^{-6} As \cdot 112,99 \cdot 10^3 \frac{V}{m} \cdot \vec{1}_x$$

$$\vec{F} = \vec{1}_x \cdot 0,9 N$$



$$\vec{E}_{2Q} = \vec{E}_{2Q}^1$$

$$\vec{E}_{1Q} = \frac{G_1}{2\epsilon_0} \cdot (-\vec{1}_x) = \frac{7 \cdot 10^{-6} \frac{As}{m^2}}{2 \cdot 8,85 \cdot 10^{-12} \frac{As}{Vm}}$$

$$\frac{\frac{As}{m^2}}{\frac{As}{Vm}} = \frac{Vm}{m^2} = \frac{Nm}{As \cdot m^2} = \frac{N}{As \cdot m}$$

$$\vec{E}_{1Q} = +395,48 \cdot 10^3 \vec{1}_x \frac{V}{m}$$

$$\vec{F}_Q = +677,97 \cdot 10^3 \frac{N}{m} \cdot 8 \cdot 10^{-6} As$$

$$\vec{F}_Q = \vec{1}_x \cdot 5,4 N$$



D.N. 1./6

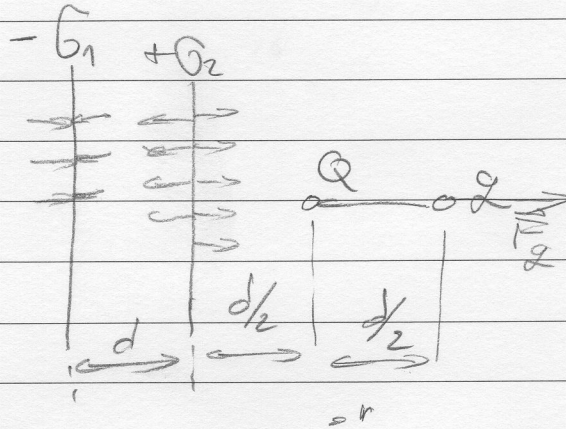
$$Q = 4 \cdot 10^{-6} \text{ As}$$

$$G_1 = -2 \cdot 10^{-6} \frac{\text{As}}{\text{m}^2}$$

$$G_2 = 1 \cdot 10^{-6} \frac{\text{As}}{\text{m}^2}$$

$$g = -3 \cdot 10^{-6} \frac{\text{As}}{\text{m}}$$

$$d = 3,5 \text{ cm} = 3,5 \cdot 10^{-2} \text{ m}$$



$$\vec{F}_Q = ?$$

$$\vec{E}_2 = \frac{Q \cdot \epsilon_0}{2\pi \epsilon_0 \epsilon_r d} = \frac{-3 \cdot 10^{-6} \frac{\text{As}}{\text{m}} \cdot 10^{-6} \text{ As}}{2\pi \cdot 8,85 \cdot 10^{-12} \frac{\text{As}}{\text{Vm}} \cdot 3,5 \cdot 10^{-2} \text{ m}} = +1 \cdot 10^6 \frac{\text{V}}{\text{m}} \cdot \frac{1}{3,082 \cdot 10^4} \frac{\text{V}}{\text{m}}$$

$$\vec{E}_1 = \frac{G}{2\epsilon_0} = \frac{-2 \cdot 10^{-6} \frac{\text{As}}{\text{m}^2}}{2 \cdot 8,85 \cdot 10^{-12} \frac{\text{As}}{\text{Vm}}} = -112,994 \cdot 10^3 \frac{\text{V}}{\text{m}}$$

$$\vec{E}_2 = \frac{1 \cdot 10^{-6}}{2 \cdot 8,85 \cdot 10^{-12}} = 56497 \frac{\text{V}}{\text{m}}$$

$$\vec{F}_Q = \vec{E} \cdot Q = 3026,407 \cdot 10^3 \frac{\text{V}}{\text{m}} \cdot 4 \cdot 10^{-6} \text{ As}$$

$$\vec{F}_Q = 12,1 \text{ N}$$