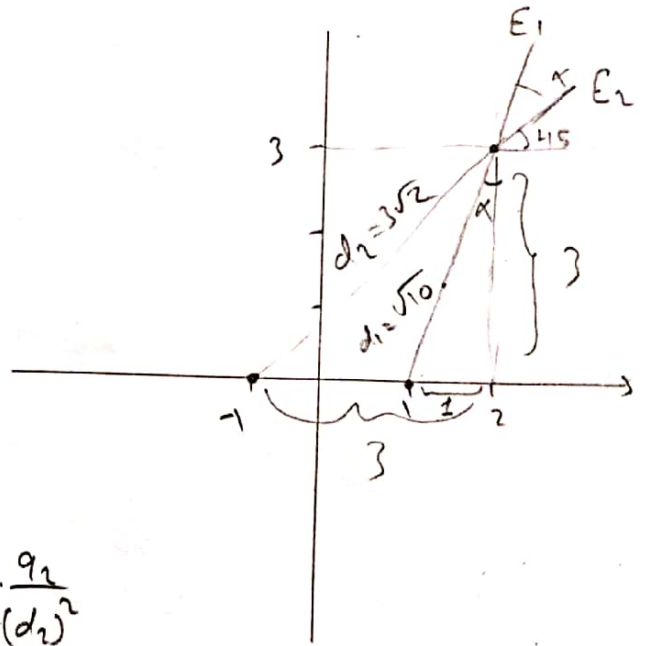


$$1) \vec{E} = \vec{E}_1 + \vec{E}_2$$

$$\vec{E}_x = \vec{E}_{1x} + \vec{E}_{2x} \quad , \quad \vec{E}_y = \vec{E}_{1y} + \vec{E}_{2y}$$

$$\Rightarrow \sin \alpha = \frac{1}{\sqrt{10}} \quad \cos \alpha = \frac{3}{\sqrt{10}}$$



$$E_{1x} = (E_1 \cdot \cos \alpha) \hat{i}$$

$$E_{2x} = (E_2 \cdot \cos 45) \hat{i}$$

$$E_2 = k \cdot \frac{q_2}{(d_2)^2}$$

$$E_{1y} = (E_1 \cdot \sin \alpha) \hat{j}$$

$$E_1 = k \cdot \frac{q_1}{(d_1)^2}$$

$$E_{2y} = (E_2 \cdot \sin 45) \hat{j}$$

$$\Rightarrow \vec{E}_x = \vec{E}_{1x} + \vec{E}_{2x} = (E_1 \cdot \cos \alpha) \hat{i} + (E_2 \cdot \cos 45) \hat{i}$$

$$= \left(k \cdot \frac{q_1}{(d_1)^2} \cdot \frac{3}{\sqrt{10}} \right) \hat{i} + \left(k \cdot \frac{q_2}{(d_2)^2} \cdot \frac{1}{\sqrt{2}} \right) \hat{i} = k \left(\frac{10 \times 10^{-6} \text{ C}}{(\sqrt{10})^2} \cdot \frac{3}{\sqrt{10}} + \frac{20 \times 10^{-6}}{(3\sqrt{2})^2} \cdot \frac{1}{\sqrt{2}} \right) \hat{i}$$

$$\Rightarrow \vec{E}_x = (9 \times 10^3 \text{ N/C}) \hat{i}$$

$$\vec{E}_y = \vec{E}_{1y} + \vec{E}_{2y} = (E_1 \cdot \sin \alpha) \hat{j} + (E_2 \cdot \sin 45) \hat{j}$$

$$= \left(k \cdot \frac{q_1}{(d_1)^2} \cdot \frac{1}{\sqrt{10}} + k \cdot \frac{q_2}{(d_2)^2} \cdot \frac{1}{\sqrt{2}} \right) \hat{j} = k \left(\frac{10 \times 10^{-6}}{(\sqrt{10})^2} \cdot \frac{1}{\sqrt{10}} + \frac{20 \times 10^{-6}}{(3\sqrt{2})^2} \cdot \frac{1}{\sqrt{2}} \right) \hat{j}$$

$$\Rightarrow \vec{E}_y = (11 \times 10^3 \text{ N/C}) \hat{j}$$

$$E = \sqrt{(E_x)^2 + (E_y)^2} = \sqrt{(9 \times 10^3)^2 + (11 \times 10^3)^2} = 14 \times 10^3 \text{ N/C}$$

$$\theta = \tan^{-1} \left(\frac{E_y}{E_x} \right) \Rightarrow \theta \approx 50^\circ$$

$$2) a) \Phi = \frac{q_{i\phi}}{\epsilon_0} \Rightarrow \oint \vec{E} \cdot d\vec{A} = \frac{q_{i\phi}}{\epsilon_0}$$

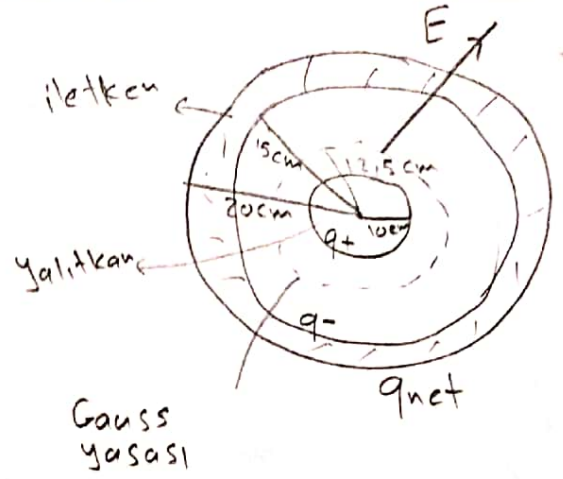
$$\Phi = E \oint dA \quad \Rightarrow \Phi = E(4\pi r^2)$$

Gauss yüzey alanı

$$\Rightarrow E(4\pi r^2) = \frac{q_{i\phi}}{\epsilon_0} \Rightarrow E = \frac{1}{4\pi\epsilon_0} \cdot \frac{Q}{r^2}$$

$$\Rightarrow Q = \frac{E \cdot r^2}{k} = \frac{(1785 \text{ N/C})(0,125 \text{ m})^2}{9 \times 10^9 \text{ N.m}^2/\text{C}^2}$$

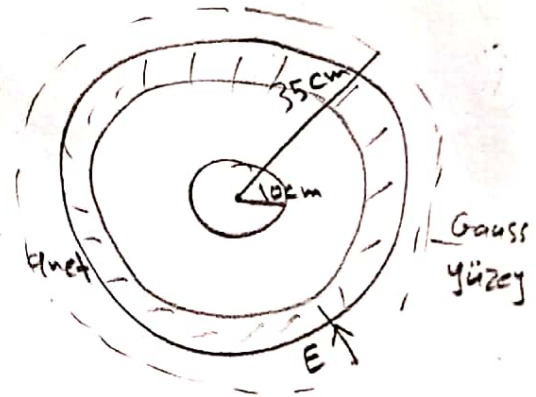
$$\Rightarrow Q = 3 \times 10^{-9} \text{ C}$$



$$b) E = \frac{1}{4\pi\epsilon_0} \cdot \frac{q_{net}}{r^2}$$

$$\Rightarrow q_{net} = \frac{E \cdot r^2}{k} = \frac{(132 \text{ N/C})(0,35 \text{ m})^2}{9 \times 10^9 \text{ N.m}^2/\text{C}^2}$$

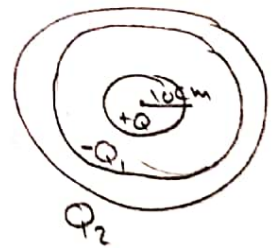
$$\Rightarrow q_{net} = -1,7 \times 10^{-9} \text{ C}$$



$$c) Q = -Q_1 \quad ; \quad Q_1 = -3 \times 10^{-9} \text{ C}$$

$$q_{net} = Q_1 + Q_2 \Rightarrow -1,7 \times 10^{-9} = -3 \times 10^{-9} + Q_2$$

$$\Rightarrow Q_2 = 1,3 \times 10^{-9} \text{ C}$$



$$d) \sigma_{dis} = \frac{q_{net}}{A} = \frac{-1,7 \times 10^{-9} \text{ C}}{4\pi(0,2 \text{ m})^2}$$

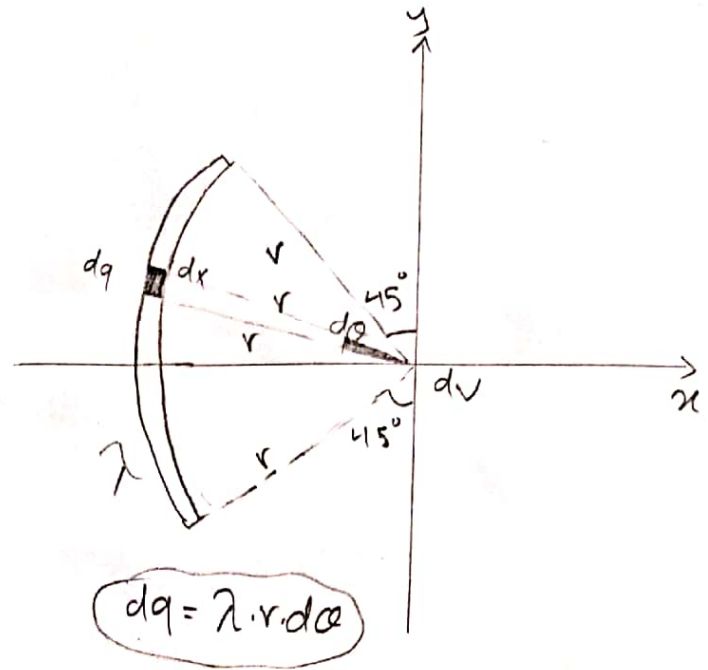
$$\sigma_{dis} = -3,4 \text{ C/m}^2$$

$$3) a) \int dV = \int k \cdot \frac{dq}{r}$$

$$\Rightarrow V = \int k \frac{\lambda \cdot r \cdot d\theta}{r}$$

$$\Rightarrow V = k \lambda \int_0^{\pi/2} d\theta = k \lambda [\theta]_0^{\pi/2}$$

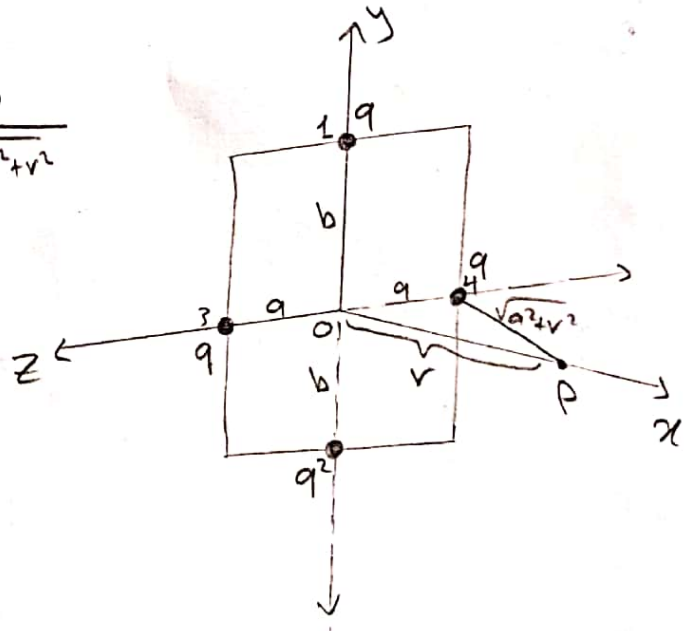
$$\Rightarrow V = \frac{k \lambda \pi}{2}$$



$$b) V = k \frac{q}{d}$$

$$i) V_P = k \cdot \frac{q}{\sqrt{a^2 + r^2}} + k \frac{q}{\sqrt{b^2 + r^2}} + k \frac{q}{\sqrt{a^2 + r^2}} + k \frac{q}{\sqrt{b^2 + r^2}}$$

$$V_P = \frac{2kq}{\sqrt{a^2 + r^2}} + \frac{2kq}{\sqrt{b^2 + r^2}}$$



$$ii) W_{uyg} = \Delta U = \Delta V \cdot q_{aktiflen}$$

P'deki potansiyel

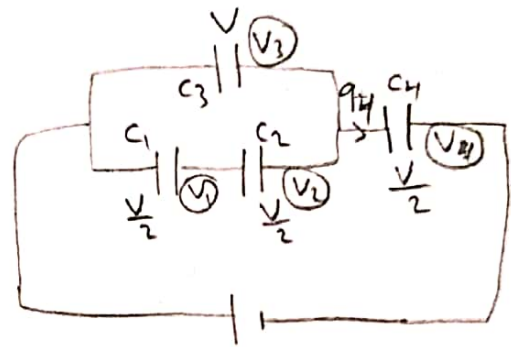
$$\Rightarrow W_{uyg} = q \left(2kq \left(\frac{1}{\sqrt{a^2 + r^2}} + \frac{1}{\sqrt{b^2 + r^2}} \right) \right)$$

$$4) a) \frac{1}{C_{1-2}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{C_1 + C_2}{C_1 \cdot C_2} \Rightarrow C_{1-2} = \frac{15 \times 10}{15 + 10} = 6 \mu F$$

$$C_{1-2} + C_3 = 6 \mu F + 6 \mu F = 12 \mu F$$

$$\frac{1}{C_{1-2-3-4}} = \frac{1}{C_{1-2-3}} + \frac{1}{C_4} = \frac{C_{1-2-3} + C_4}{C_{1-2-3} \cdot C_4} \Rightarrow C_{eq} = \frac{12 \cdot 12}{12 + 12} \Rightarrow C_{eq} = 6 \mu F$$

b) Paralel bağlı: $V = V_1 = V_2 = \dots$ $q = q_1 + q_2 = \dots$
 Seri bağlı: $V = V_1 + V_2 = \dots$ $q = q_1 = q_2 = \dots$



$$\Rightarrow V = 30 \text{ V}$$

$$q_4 = C_{eq} \cdot V = 6 \mu F \times 30 = 18 \times 10^{-5} \text{ C}$$

$$V_1 + V_2 = V_3 \Rightarrow \frac{q_1}{C_1} + \frac{q_2}{C_2} = \frac{q_3}{C_3} \Rightarrow \frac{10q_1 + 15q_2}{150} = \frac{q_2}{6} \Rightarrow q_1 = q_2$$

$$q_1 + q_2 = q_4 \Rightarrow 2q_1 = q_4 \Rightarrow q_1 = q_2 = 9 \times 10^{-5} \text{ C}$$

$$q_3 = 9 \times 10^{-5} \text{ C}$$

$$c) V = \frac{q}{C}$$

$$V_1 = \frac{q_1}{C_1} = \frac{90 \mu C}{15 \mu F} = 6 \text{ V}$$

$$V_3 = \frac{q_3}{C_3} = \frac{90 \mu C}{6 \mu C} = 15 \text{ V}$$

$$V_2 = \frac{q_2}{C_2} = \frac{90 \mu C}{10 \mu F} = 9 \text{ V}$$

$$V_4 = \frac{q_4}{C_4} = \frac{180 \mu C}{12 \mu C} = 15 \text{ V}$$