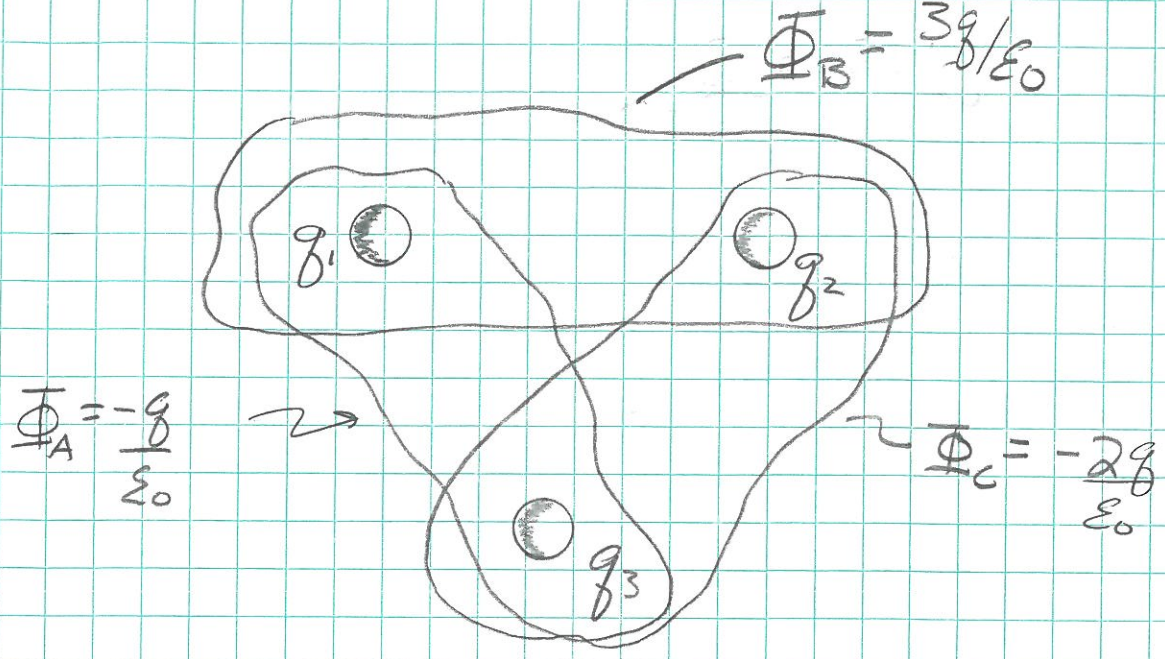


Gauss' Law: $\Phi_E = \oint \vec{E} \cdot d\vec{A} = \frac{Q_{in}}{\varepsilon_0}$

So:

$$\Phi_A = \frac{-q}{\varepsilon_0} = \frac{q_1 + q_3}{\varepsilon_0} \qquad (1)$$

$$\Phi_B = \frac{3q}{\varepsilon_0} = \frac{q_1 + q_2}{\varepsilon_0} \qquad (2)$$

$$\Phi_C = \frac{-2q}{\varepsilon_0} = \frac{q_2 + q_3}{\varepsilon_0} \qquad (3)$$

Subtract: equ'n (1) − equ'n (2)

$$-q - 3q = (q_1 + q_3) - (q_1 + q_2) = q_3 - q_2$$

So:

$$-4q = q_3 - q_2 \qquad (4)$$

Add equ'n (3) + equ'n (4)

$$-4q - 2q = (q_2 + q_3) + (q_3 - q_2)$$

So:

$$-6q = 2q_3 \Rightarrow q_3 = -3q$$

Subst into equ'n (4):

$$q_2 = q_3 + 4q = q$$

Subst. into equ'n (2):

$$q_1 = 3q - q_2 = 2q$$