p. 345 # 1-7

1. $q_p = -q_e$ ∴ Force felt by each is equal

2. $r = 1.5\,m$
$q = 3.5\,C$
$\mathcal{E} = ?$

$$\mathcal{E} = \frac{kq}{r^2}$$

$$= \frac{(9.0\times10^9\ Nm^2/C^2)(3.5\,C)}{(1.5\,m)^2}$$

$$= 1.4\times10^{10}\ N/C$$

3. q_1 ——10 cm—— • ——25 cm—— q_2

$q_1 = 4.5\times10^{-6}\,C$
$q_2 = ?$
$\mathcal{E} = 0$

$$\mathcal{E} = \mathcal{E}_1 + \mathcal{E}_2$$
$$0 = \mathcal{E}_1 + \mathcal{E}_2$$
$$\mathcal{E}_2 = -\mathcal{E}_1 = -\frac{kq_1}{r_1^2}$$

$$\frac{kq_2}{r_2^2} = -\frac{kq_1}{r_1^2}$$

$$q_2 = \frac{q_1 r_2^2}{r_1^2}$$

$$= \frac{(4.5\times10^{-6}\,C)(0.25\,m)^2}{(0.10\,m)^2}$$

$$= 2.8\times10^{-5}\,C$$

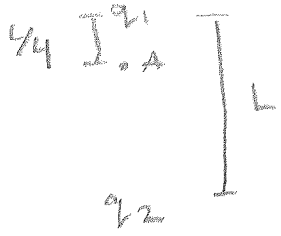
4. $\mathcal{E}$ at origin $= 0$

p. 345 # 1-7.

5. Number of lines & size of charge

6. $q_1 : q_2 = ?$

$\varepsilon_A = 0$.



$$\varepsilon_1 = -\varepsilon_2$$

$$\frac{kq_1}{r_1^2} = -\frac{kq_2}{r_2^2}$$

$$q_1 r_2^2 = -q_2 r_1^2$$

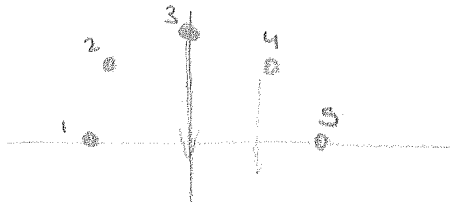
$$\frac{q_1}{q_2} = -\frac{r_1^2}{r_2^2}$$

$$= -\frac{\left(\frac{L}{4}\right)^2}{\left(\frac{3}{4}L\right)^2} = -\frac{L^2}{16} \times \frac{16}{9L^2}$$

$$= -\frac{1}{9}$$

P. 345 #1 - 7.

7. $q = 7.5\,C$
$r = 2.3\,m$



$q_1 = -q_5$ ∴ cancel out

$$\mathcal{E}_3 = \frac{kq_3}{r_3^2} = \frac{(9.0\times10^9\ N m^2/C^2)(7.5C)}{(2.3m)^2}$$

$$= 1.28\times10^{10}\ N/C$$

For q_2 & q_4, the horizontal components cancel out, only use the vertical component.
$\theta = 45°$

$$\therefore \mathcal{E}_{q_2} = \frac{kq_2}{r_2^2}\cos45° = \mathcal{E}_{q_4}$$

$$= \frac{(9.0\times10^9\ N m^2/C^2)(7.5C)}{(2.3m)^2}\sin45°$$

$$= 9.02\times10^9\ N/C$$

$$\therefore \mathcal{E}_T = \mathcal{E}_3 + \mathcal{E}_2 + \mathcal{E}_4$$
$$= 1.28\times10^{10}\ N/C + 2(9.02\times10^9\ N/C)$$
$$= 3.1\times10^{10}\ N/C\ [down]$$