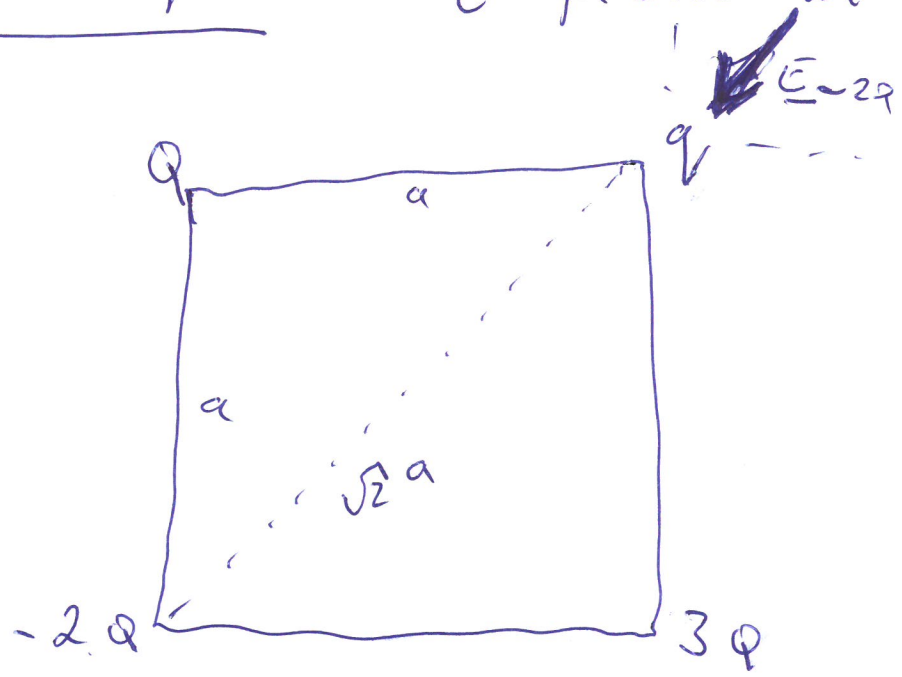
EM1 Lect-1

Example 1 E-field at q?



$$\underline{E}_q = \frac{Q}{4\pi\varepsilon_0 a^2}\,\underline{i}$$

$$\underline{E}_{3q} = \frac{3q}{4\pi\varepsilon_0 a^2}\,\underline{j}$$

$$|\underline{E}_{-2q}| = \frac{-2q}{4\pi\varepsilon_0 (2a^2)}$$

$$\underline{E}_{-2q} = -\frac{Q}{4\pi\varepsilon_0 a^2}\left(\frac{1}{\sqrt{2}}\,\underline{i} + \frac{1}{\sqrt{2}}\,\underline{j}\right)$$

$$\underline{E}_Q = \frac{Q}{4\pi\varepsilon_0 a^2}\left(\left[1-\frac{1}{\sqrt{2}}\right]\underline{i} + \left[3-\frac{1}{\sqrt{2}}\right]\underline{j}\right)$$

$$= \frac{Q}{4\pi\varepsilon_0 a^2}\left(0.29\,\underline{i} + 2.29\,\underline{j}\right)$$

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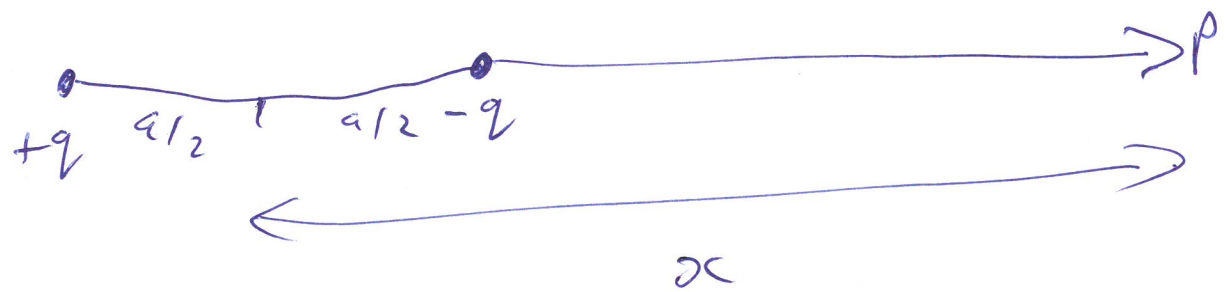
Example 2 - Electric dipole.



$$E_p = \frac{q}{4\pi\varepsilon_0}\left(\frac{1}{(x+\frac{a}{2})^2} - \frac{1}{(x-\frac{a}{2})^2}\right)$$

$$= \frac{q}{4\pi\varepsilon_0}\left(\frac{-2ax}{\left(x^2-\frac{a^2}{4}\right)^2}\right)$$

$$= \frac{-qax}{2\pi\varepsilon_0}\,\frac{1}{\left(x^2-\frac{a^2}{4}\right)^2}$$

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what if $x \gg a$?

$$E_p = \frac{-qax}{2\pi\varepsilon_0}\,\frac{1}{x^4\left(1-\frac{a^2}{4x^2}\right)^2}$$

$\frac{a^2}{4x^2} \ll 1$ so $E_p \approx \frac{-qa}{2\pi\varepsilon_0 x^3}$