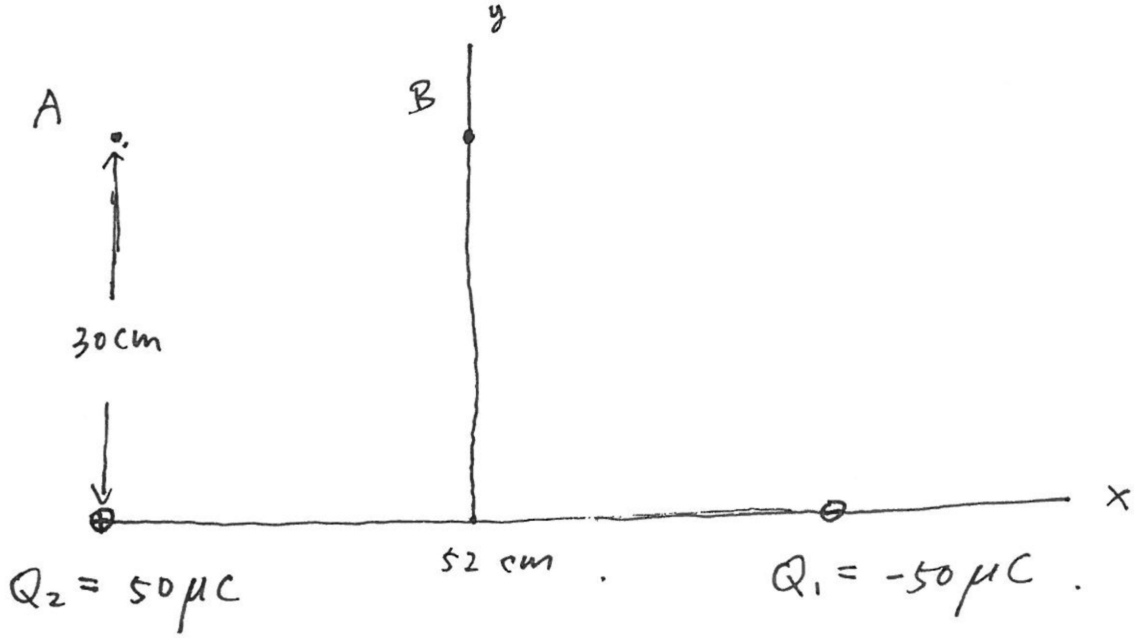
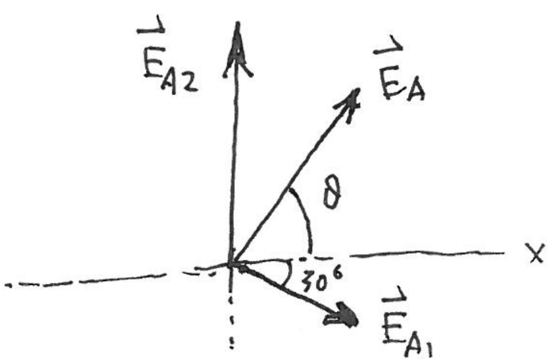
e.g. 16-9. Given Q_1 and Q_2. find $\vec{E}$ at A and B.



a)

at A: Field due to a charge Q: $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$ (magnitude).



$$E_{A1} = \frac{1}{4\pi\varepsilon_0}\cdot\frac{50\times10^{-6}}{(0.6)^2} = 1.25\times10^6\ N/C.$$

$$E_{A2} = 5.0\times10^6\ N/C.$$

(Note: $E_{A2} = 4E_{A1}$. $\because r_{A1} = 2r_{A2}$)

Use components to find $\vec{E}_A = \vec{E}_{A1} + \vec{E}_{A2}$

$$E_{Ax} = E_{A1}\cdot\cos 30° = 1.1\times10^6\ N/C$$

$$E_{Ay} = E_{A1y} + E_{A2} = -E_{A1}\sin 30° + E_{A2} = 4.4\times10^6\ N/C.$$

$$E_A = \sqrt{E_{Ax}^2 + E_{Ay}^2} = 4.5\ N/C.$$

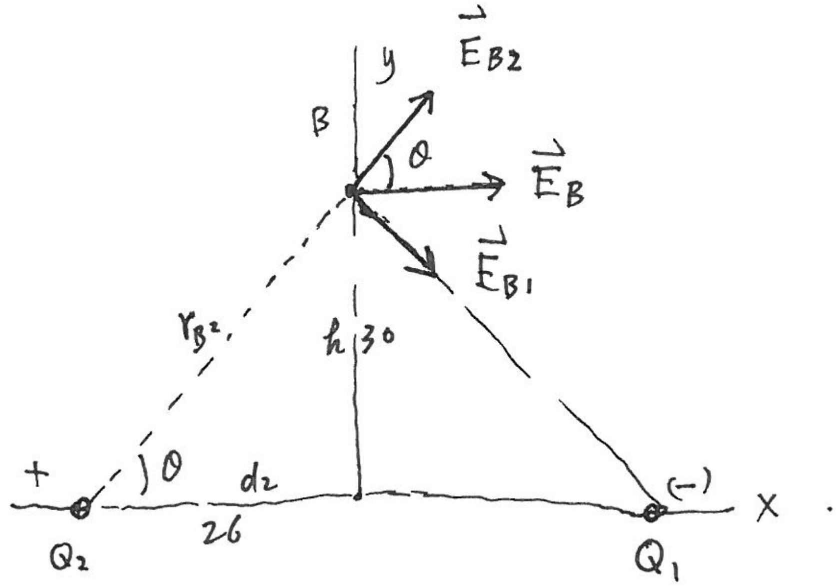
$$\theta = \tan^{-1}\frac{E_{Ay}}{E_{Ax}} = 76°$$

b). at B.

$E_{B2} = E_{B1}$

$\because$ same $|Q|$, same r.

(But $\vec{E}_{B2} \neq \vec{E}_{B1}$!)



By symmetry: $E_{B2y} = - E_{B1y}$. $\quad E_{B2x} = E_{B1x}$

$\vec{E}_B = \vec{E}_{B1} + \vec{E}_{B2}$, $\quad E_{By} = 0$.

$$E_{Bx} = E_{B1x} + E_{B2x}$$

$$= 2E_{B1x} = 2E_{B2x}.$$

$$E_{B2} = \frac{1}{4\pi\varepsilon_0} \frac{Q_2}{r_{B2}^2} \qquad r_{B2} = \sqrt{26^2 + 30^2} = 40\text{ cm} = 0.40\text{ m}$$

$$E_{B2x} = \frac{1}{4\pi\varepsilon_0} \frac{Q_2}{r_{B2}^2} \cos\theta = \frac{1}{4\pi\varepsilon_0} \frac{Q_2}{r_{B2}^2} \cdot \frac{d_2}{r_{B2}} = 1.8 \times 10^6\ N/C$$

$$E_B = 2E_{B2x} = 3.6 \times 10^6\ N/C.$$

Direction of $\vec{E}_B$: $+x$ direction

i.e. $\vec{E}_B = 3.6 \times 10^6\ \hat{x}\ (N/C)$.