Phys102 Assignment Cover Sheet

First Name:_____   Last Name:_____   Mark: _____

Student ID:_____   Date: _____

Phys102 Written Assignment #1   *Solution* .

Due Friday Sept 17, 10:30am.

Textbook (Giancoli, SFU edition), page 587, question #38.

(*a*) Determine the electric field $\vec{E}$ at the origin O in Fig. 21–59 due to the two charges at A and B. (*b*) Repeat, but let the charge at B be reversed in sign.

a) $\vec{E} = \vec{E}_A + \vec{E}_B$

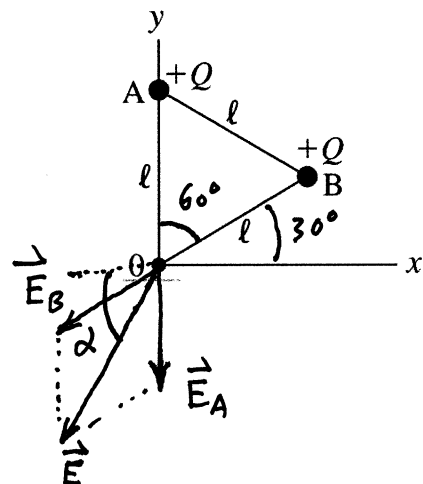$E_A = E_B = \dfrac{Q}{4\pi \varepsilon_0 \ell^2}$

$E_x = - E_B \cos 30° = - \dfrac{Q}{4\pi \varepsilon_0 \ell^2} \dfrac{\sqrt{3}}{2}$

$E_y = - E_A - E_B \sin 30°$

$\quad = - \dfrac{Q}{4\pi \varepsilon_0 \ell^2} - \dfrac{Q}{4\pi \varepsilon_0 \ell^2} \cdot \dfrac{1}{2}$

$\quad = - \dfrac{Q}{4\pi \varepsilon_0 \ell^2} \cdot \dfrac{3}{2}$.

$\therefore \ \vec{E} = - \dfrac{Q}{4\pi \varepsilon_0 \ell^2} \left(\hat{x} \dfrac{\sqrt{3}}{2} + \hat{y} \dfrac{3}{2} \right)$

$E = \sqrt{E_x^2 + E_y^2} = \dfrac{Q}{4\pi \varepsilon_0 \ell^2} \left[\left(\dfrac{\sqrt{3}}{2}\right)^2 + \left(\dfrac{3}{2}\right)^2 \right]^{1/2} = \dfrac{Q\sqrt{3}}{4\pi \varepsilon_0 \ell^2}$

$\alpha = \tan^{-1} \dfrac{|E_y|}{|E_x|} = 60°$

b)

$$\vec{E} = \vec{E}_A + \vec{E}_B$$

$$E_A = E_B = \frac{Q}{4\pi\varepsilon_0 \ell^2}$$

$$E_x = E_B \cos 30° = \frac{Q}{4\pi\varepsilon_0 \ell^2} \cdot \frac{\sqrt{3}}{2}$$

$$E_y = E_B \sin 30° - E_A$$

$$= \frac{Q}{4\pi\varepsilon_0 \ell^2}\left(\frac{1}{2} - 1\right)$$

$$= \frac{-Q}{4\pi\varepsilon_0 \ell^2} \cdot \frac{1}{2}$$

$$\therefore \vec{E} = \frac{Q}{4\pi\varepsilon_0 \ell^2}\left(\hat{x}\frac{\sqrt{3}}{2} - \hat{y}\frac{1}{2}\right)$$

$$E = \sqrt{E_x + E_y} = \frac{Q}{4\pi\varepsilon_0 \ell^2}\left[\left(\frac{\sqrt{3}}{2}\right)^2 + \left(\frac{1}{2}\right)^2\right]^{1/2} = \frac{Q}{4\pi\varepsilon_0 \ell^2}$$

$$\alpha = \tan^{-1}\frac{|E_y|}{|E_x|} = 30°$$