Phy220 Unquiz 01

Note: $k=8.99\text{x}10^{9}\frac{Nm^2}{C^2}$

Consider the following charges: 1:(+2μC;2,3),2:(-3μC;1,5)

(a) Find $\vec{E}$ and $|\vec{E}|$ at (7,2) with correct SI units.

(b) If a charge Q=-3μC is located at (7,2), find $\vec{F}$ and $|\vec{F}|$ with correct SI units.

Phy220 Unquiz 01

Note: $k=8.99\text{x}10^{9}\,\frac{\text{N}\text{m}^2}{\text{C}^2}$

Consider the following charges: 1:(+2μC;2,3),2:(-3μC;1,5)

(a) Find $\vec{E}$ and $|\vec{E}|$ at (7,2) with correct SI units.

(b) If a charge Q=-3μC is located at (7,2), find $\vec{F}$ and $|\vec{F}|$ with correct SI units.

Write down what you want to calculate: $\vec{E}=\sum_{i=1}^{i=2} k\,\frac{q_i}{r_{ip}^2}\hat{r}_{ip}$

Identify the following vectors: $\vec{r}_p;\vec{r}_1;\vec{r}_2$

$\vec{r}_p=7\hat{x}+2\hat{y}:\vec{r}_1=2\hat{x}+3\hat{y}:\vec{r}_2=1\hat{x}+5\hat{y}$

Calculate the following vectors: $\vec{r}_{1p}:\vec{r}_{2p}$

$\vec{r}_{1p}=\vec{r}_p-\vec{r}_1=(7-2)\hat{x}+(2-3)\hat{y}=5\hat{x}-1\hat{y}$

$\vec{r}_{2p}=\vec{r}_p-\vec{r}_2=(7-1)\hat{x}+(2-5)\hat{y}=6\hat{x}-3\hat{y}$

Calculate the following: $r_{1p}^2:r_{2p}^2:\hat{r}_{1p}:\hat{r}_{2p}$

$r_{1p}^2=5^2+1^2=26:r_{2p}^2=6^2+3^2=45$

$\hat{r}_{1p}=\frac{\vec{r}_{1p}}{|\vec{r}_{1p}|}=\frac{5\hat{x}-1\hat{y}}{\sqrt{26}}:\hat{r}_{2p}=\frac{\vec{r}_{2p}}{|\vec{r}_{2p}|}=\frac{6\hat{x}-3\hat{y}}{\sqrt{45}}$

Put every thing together:

$\vec{E}=8990\left[2\frac{(5\hat{x}-1\hat{y})}{26\sqrt{26}}-3\frac{(6\hat{x}-3\hat{y})}{45\sqrt{45}}\right]\frac{\text{N}}{\text{C}}$

Find $\vec{F}$ from $\vec{F}=q_p\vec{E}$

$\vec{F}=-3\text{x}10^{-6}\text{x}8990\left[2\frac{(5\hat{x}-1\hat{y})}{26\sqrt{26}}-3\frac{(6\hat{x}-3\hat{y})}{45\sqrt{45}}\right]\text{N}$

numerical answers:

$\vec{E}=\left(1\,\text{x}10^{-6}\text{x}8.990\,\text{x}10^{9}\right)\left[(0.0754\hat{x}-0.0151\hat{y})+(-0.0596\hat{x}+0.0298\hat{y})\right]$

$\Rightarrow\vec{E}=8990\left[0.0158\hat{x}+0.0147\hat{y}\right]=142.9\hat{x}+132.2\hat{y}$

$\vec{F}=\left(-3\text{x}10^{-6}\right)\left[142.9\hat{x}+132.2\hat{y}\right]$

Final answer:

$\vec{E}=[142.9\hat{x}+132.2\hat{y}]\frac{\text{N}}{\text{C}}:\vec{F}=[-4.29\text{x}10^{-4}\hat{x}-3.97\text{x}10^{-4}\hat{y}]\text{N}$