

Phy220 Unquiz 01

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

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

(a) Find $\vec{E}$ and $|\vec{E}|$ at (4,2) with correct SI units.

(b) If a charge $Q=-3\mu\text{C}$ is located at (4,2), find $\vec{F}$ and $|\vec{F}|$ with correct SI units.

$$\vec{E} = \sum_{i=1}^{i=2} k \frac{q_i}{r_{ip}^2} \hat{r}_{ip}$$

$$\vec{r}_{ip} = \vec{r}_p - \vec{r}_i$$

$$\vec{r}_1 = 2\hat{x} + 3\hat{y} : \vec{r}_2 = 1\hat{x} + 3\hat{y} : \vec{r}_p = 4\hat{x} + 2\hat{y}$$

$$\vec{r}_{1p} = (4-2)\hat{x} + (2-3)\hat{y} = 2\hat{x} - 1\hat{y}$$

$$\vec{r}_{2p} = (4-1)\hat{x} + (2-3)\hat{y} = 3\hat{x} - 1\hat{y}$$

$$\vec{E} = k \frac{2\mu}{2^2 + 1^2} \frac{2\hat{x} - 1\hat{y}}{\sqrt{2^2 + 1^2}} + k \frac{-3\mu}{3^2 + 1^2} \frac{3\hat{x} - 1\hat{y}}{\sqrt{3^2 + 1^2}} = k\mu \frac{2}{5\sqrt{5}} (2\hat{x} - 1\hat{y}) - k\mu \frac{3}{10\sqrt{10}} (3\hat{x} - 1\hat{y})$$

$$\vec{E} = k\mu \left[\left(\frac{4}{5\sqrt{5}} - \frac{9}{10\sqrt{10}} \right) \hat{x} + \left(\frac{-2}{5\sqrt{5}} + \frac{3}{10\sqrt{10}} \right) \hat{y} \right] = k\mu [(0.36 - 0.28)\hat{x} + (-0.18 + .09)\hat{y}]$$

$$\vec{E} = k\mu [0.08\hat{x} + (-.09)\hat{y}] = 8990 [0.08\hat{x} - 0.09\hat{y}] = (719.2\hat{x} - 809.1\hat{y}) \frac{N}{C}$$

$$|\vec{E}| = 1082 \frac{N}{C}$$

$$\vec{F} = q\vec{E}$$

$$\vec{F} = -3\mu (719.2\hat{x} - 809.1\hat{y}) = -2157.6\mu\hat{x} + 2427.3\mu\hat{y} = -0.0022\hat{x} + 0.0025\hat{y} N$$

$$\vec{F} = -2.2 \times 10^{-3} \hat{x} + 2.5 \times 10^{-3} \hat{y} N : |\vec{F}| = 0.0033 N = 3.33 \times 10^{-3} N$$