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Section: 16

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Ans to the Q: N: 1

(a)

$q_1 = (10, 7)$

$P_1 = (-29, -25)$

$\therefore \vec{r} = (-29 - 10)\hat{i} + (-25 - 7)\hat{j}$

$= (-39\hat{i} - 37\hat{j})\,cm$

$= (-0.39\hat{i} - 0.37\hat{j})\,m$

(b)

$q_1 = 27\ \mu C$

$= 27 \times 10^{-6}\ C$

$|\vec{r}| = \sqrt{(-0.37)^2 + (-0.37)^2}$

$= 0.5376$

$\therefore |\vec{E}| = k \frac{q_1}{|\vec{r}|^2}$

$= 8.987 \times 10^9 \times \frac{27 \times 10^{-6}}{(0.5376)^2}$

$= 839575.9427$

(c)

$P_2 = 47\hat{i} - 21\hat{j}$

$q_1 = 27 \times 10^{-6}\ C$

$\therefore \vec{r}_{P_2 q_1} = (47-10)\hat{i} + (-21-7)\hat{j}$

$= (37\hat{i} - 28\hat{j})\ cm$

$= (0.37\hat{i} - 0.28\hat{j})\ m$

$\therefore |\vec{r}| = 0.464$

$\therefore \vec{F} = k \cdot \frac{q_1}{r^3} \cdot \vec{r}$

$= 8.987 \times 10^9 \times \frac{27 \times 10^{-6}}{0.099} \times \vec{r}$

$= 2451000 \times \vec{r}$

$= 906870\hat{i} - 686280\hat{j}$

(d)

$$\vec{r}_{P_1 q_1} = \hat{P}_1 - \hat{q}_1$$

$$= \left(-0.39\hat{i} - 0.37\hat{j}\right) m$$

~~$\left|\vec{r}_{P_1 q_1}\right| =$~~

~~From b,~~

$\therefore$ ~~$\vec{E}_{ele} = \vec{E}$~~

$$\left|\vec{r}_{P_1 q_1}\right| = 0.5376$$

$$\therefore \vec{E} = k \cdot \frac{q_1}{\left|\vec{r}_{P_1 q_1}\right|^3} \times \vec{r}$$

$$= 156711.2036 \times \vec{r}$$

$$= -60906.3691\hat{i} - 52783.1563\hat{j}$$

$$\vec{r}_{P_1 q_2} = -34\hat{i} - 28\hat{j}$$

$$= -0.34\hat{i} - 0.28\hat{j}$$

$$\therefore |\vec{r}_{P_1 q_2}| = 0.4404$$

$$\therefore \vec{E}_{P_1 q_2} = 8.987 \times 10^9 \times \frac{25 \times 10^{-6}}{(0.4404)^3} \times \vec{r}_{P_1 q_2}$$

$$= -894317.5152\hat{i} - 736596.9225\hat{j}$$

$$\therefore \text{Total } \vec{E}_{P_1} = \vec{E}_{P_1 q_1} + \vec{E}_{P_1 q_2}$$

$$= -1503385.88\hat{i} - 1314329.923\hat{j}$$