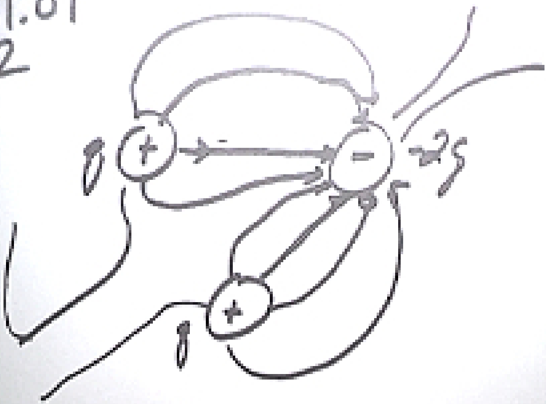
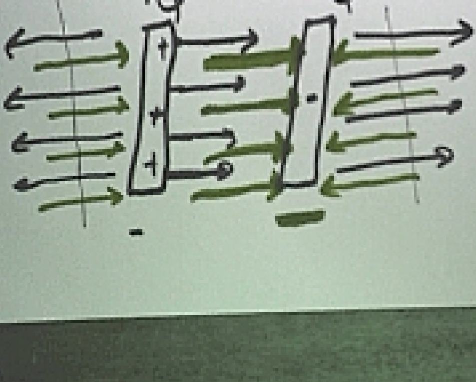
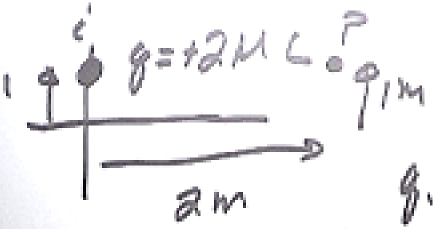
251.01
22







$q_i = q_1 = 2\mu$

$i=1: (+2\mu; 0, 1)$

$P: (2, 1)$

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

$$= k\sum_{i=1}^{n} \frac{q_i(\vec{r}_{ip})}{|\vec{r}_{ip}|^{3}}$$

$\vec{r}_i, \vec{r}_p, \vec{r}_{ip}$

$\vec{r}_i = 0\hat{x} + 1\hat{y}$

2μ $\vec{r}_i = 0\hat{x} + 1\hat{y}$ $\quad \vec{r}_p = 2\hat{x} + 1\hat{y}$

$$\vec{r}_{ip} = \vec{r}_p - \vec{r}_i = (2\hat{x} + 1\hat{y}) - (0\hat{x} + 1\hat{y})$$

$$= 2\hat{x} + 0\hat{y}$$

$$|\vec{r}_{ip}| = \sqrt{2^2 + 0^2} = 2$$

$$\vec{E}_p = 8990 \cdot 2 \left[\frac{2\hat{x} + 0\hat{y}}{2^3} \right]$$

$$= 2248 \left[2\hat{x} + 0\hat{y} \right]$$

$$\vec{E}_p = 4495\hat{x} + 0\hat{y} \quad \frac{N}{C} \qquad \leftarrow \ominus$$

$q_p = -10\mu$

$$\vec{F}_p = q\vec{E} = -44950\hat{x} + 0\hat{y}$$

2M $\vec{r}_i = 0\hat{x} + 1\hat{y}$ $\quad \vec{r}_p = 2\hat{x} + 1\hat{y}$

$$\vec{r}_{ip} = \vec{r}_p - \vec{r}_i = (2\hat{x} + 1\hat{y}) - (0\hat{x} + 1\hat{y})$$

$$= 2\hat{x} + 0\hat{y}$$

$$|\vec{r}_{ip}| = \sqrt{2^2 + 0^2} = 2$$

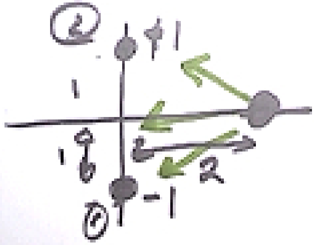
$$\vec{E}_p = 8990 \cdot 2 \left[\frac{2\hat{x} + 0\hat{y}}{2^{3}}\right]$$

$$= 2248 \left[2\hat{x} + 0\hat{y}\right]$$

$$\vec{E}_p = 4495\hat{x} + 0\hat{y} \quad \frac{N}{C}$$

$q_p = -10\,\mu$

$$\vec{F}_p = q\vec{E} = -44950\hat{x} + 0\hat{y}$$



$q_1: (-5\mu, 0, -1)$ $\quad P: (2, 0)$

$q_2: (-5\mu, 0, +1)$

$\vec{r}_p = 2\hat{x} + 0\hat{y}$

$\vec{r}_{1p} = \vec{r}_p - \vec{r}_1$

$\vec{E}$ @ P.

$\vec{r}_{1p}$

r_{2p}

$\vec{r}_1 = 0\hat{x} - 1\hat{y}$ $\quad |\vec{r}_1| = \sqrt{0^2 + (-1)^2} = 1$

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

$|\vec{r}_{1p}| = \sqrt{2^2 + 1^2} = \sqrt{5}$

$\vec{r}_{1p} = (2\hat{x} + 0\hat{y}) - (0\hat{x} - 1\hat{y})$
$= 2\hat{x} + 1\hat{y}$

$(-5)[\vec{E}_1] + (-5)[\vec{E}_2]$

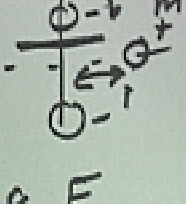
$$(-5)[\hat{E}_1] + (-5)[\hat{E}_2]$$

$$\vec{E}_p = 5\mu k\left[-\frac{(2\hat{x}+1\hat{y})}{\sqrt{5}^3} + -\frac{(2\hat{x}-1\hat{y})}{\sqrt{5}^3}\right]$$

$$\vec{r}_{2p} = \vec{r}_p - \vec{r}_2 = (2\hat{x}+0\hat{y}) - (0\hat{x}+1\hat{y})$$

$$= 2\hat{x} - 1\hat{y} \;;\; |\vec{r}_{2p}| = \sqrt{5}$$

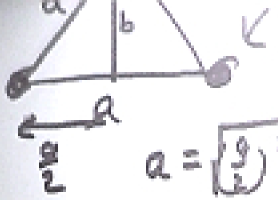
$$\vec{E}_p = \frac{5\mu k}{\sqrt{5}^3}\left[-4\hat{x}+0\hat{y}\right]$$



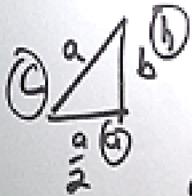
$F \sim -x$

$F = -kx$

$F = q_p E$



$$a = \sqrt{\left(\frac{a}{2}\right)^2 + b^2}$$

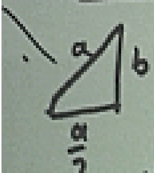


$$a^2 = \frac{a^2}{4} + b^2$$

$$a^2 = \frac{4a^2}{4a^2}$$

$$\frac{4a^2}{4} - \frac{a^2}{4} = \frac{3}{4}a^2$$

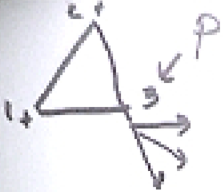
$$b = \sqrt{\frac{3}{4}}\,a = \frac{\sqrt{3}}{2}a$$



$$a^2 = \left(\frac{a}{2}\right)^2 + b^2$$

$$\frac{4a^2}{4} = \frac{a^2}{4} + b^2$$

$$\frac{3a^2}{4} = b^2 \Rightarrow b = a\sqrt{\frac{3}{4}}$$



$$\vec{r}_1 = -\frac{a}{2}\hat{x} + 0\hat{y}$$

$\frac{\sqrt{3}}{2}$

$$\vec{r}_2 = 0\hat{x} + a\sqrt{\frac{3}{4}}\hat{y}$$

$$\vec{r}_p = \vec{r}_3 = \vec{r}_p = \frac{a}{2}\hat{x} + 0\hat{y}$$

$\vec{E}_p$

1

2

$$\vec{r}_{1p} = \vec{r}_p - \vec{r}_1$$

$$= \left(\frac{a}{2}\hat{x} + 0\hat{y}\right) - \left(-\frac{a}{2}\hat{x} + 0\hat{y}\right)$$

$$= a\hat{x} + 0\hat{y}$$

$$\vec{r}_{2p} = \vec{r}_p - \vec{r}_2 = \left(\frac{a}{2}\hat{x} + 0\hat{y}\right) - \left(0\hat{x} + a\sqrt{\frac{3}{4}}\right.$$

$$\vec{r}_{2p} = \frac{a}{2}\hat{x} - \frac{\sqrt{3}}{2}a\hat{y}$$

$$\vec{E}_p = k\mu\left[\frac{a\hat{x}+0\hat{y}}{a^3} + \frac{a\,\frac{a}{2}\hat{x}-\frac{\sqrt{3}}{2}a\,\hat{y}}{a^3}\right]$$

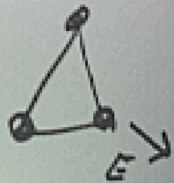
$$|\vec{r}_{1p}| = \sqrt{a^2+0^2} = a$$

$$|\vec{r}_{2p}| = a$$

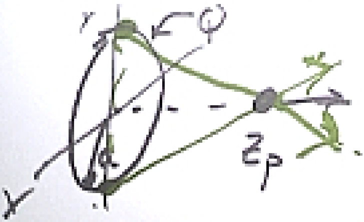
$$= \frac{ka\mu}{a^3}\left[\left(1\hat{x}+0\hat{y}\right)+\left(\frac{1}{2}\hat{x}-\frac{\sqrt{3}}{2}\hat{y}\right)\right]$$

$$= \frac{k\mu}{a^2}\left[\frac{3}{2}\hat{x}-\frac{\sqrt{3}}{2}\hat{y}\right]$$

$$\vec{F}_3 = q_3\,\vec{E}_{\text{at }3}$$



$$F = qE$$



(5)

$$\lambda = \frac{Q}{2\pi a} \qquad \bar{E} = \Sigma E_i$$

$$\bar{r}_{i_+} = 0\hat{x} + a\hat{y} + z_p\hat{z}$$

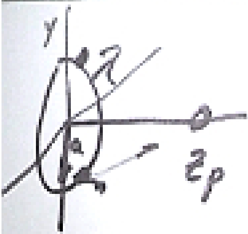
$$\bar{r}_{i_-} = 0\hat{x} - a\hat{y} + z_p\hat{z}$$

$$C = 2\pi a$$

$$|\bar{r}_{i_+}| = |\bar{r}_{i_-}| = \sqrt{a^2 + z_p^2}$$

$$\bar{E}_p = \frac{2\, \frac{dm}{\delta}\, k\,(z_p\hat{z})}{\left(\sqrt{a^2+z_p^2}\right)^3}$$

$$\delta = \frac{2\lambda\pi a\, k}{\left(\sqrt{a^2+z_p^2}\right)^3}\,(z_p\hat{z})$$



$$dq = \lambda \cdot a \cdot d\theta$$

$$\vec{r}_i = 0\hat{x} + a\hat{y} + 0\hat{z}$$

$$\vec{r}_p = 0\hat{x} + 0\hat{y} + z_p\hat{z}$$

$$\vec{r}_{ip} = 0\hat{x} - a\hat{y} + z_p\hat{z}$$

$$\vec{E}_p = k\mu \int_{\theta=0}^{2\pi} \frac{\cancel{-a\hat{y}} + z_p\hat{z}}{[a^2 + z_p^2]^{3/2}} \lambda a \, d\theta$$

$$2\pi$$

$$= \hat{z} \frac{k\mu z_p a 2\pi}{[a^2 + z_p^2]^{3/2}} \cancel{\int_0^{2\pi} d\theta}$$