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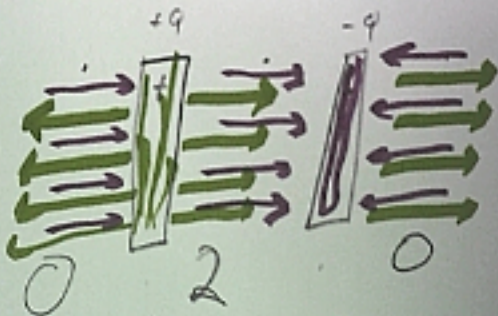
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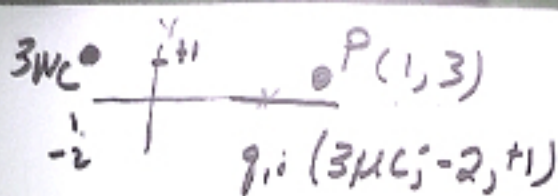
$\ominus \leftarrow$

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$$P: (1, 3)$$

$$\vec{E} = k \sum \frac{q_i \vec{r}_{ip}}{r_{ip}^2} \quad k\mu = 8990$$

$$\vec{r}_1, \vec{r}_p, \vec{r}_{ip} = \vec{r}_p - \vec{r}_1$$

$$\vec{r}_1 = -2\hat{x} + 1\hat{y} \quad \vec{r}_p = 1\hat{x} + 3\hat{y}$$

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

$$\vec{r}_{ip} = 3\hat{x} + 2\hat{y}$$

$$\frac{1}{r_{ip}} \cdot \hat{r}_{ip} = \frac{\vec{r}_{ip}}{r_{ip}^{3/2}}$$

$$= \frac{\vec{r}_{ip}}{r_{ip}^{3/2}}$$

$$13 = |\vec{r}_{ip}|$$

$$[3^2 + 2^2]^{3/2} = [9 + 4]^{3/2}$$

$$= 13^{3/2} = 46.9$$

$$\vec{E} = k \sum \frac{q_i \hat{r}_{ip}}{r_{ip}^2} \rightarrow k \sum \frac{q_i \vec{r}_{ip}}{r_{ip}^{3/2}}$$

$$\vec{E} = 3 \times 8990 \left(\frac{3\hat{x} + 2\hat{y}}{46.9} \right) \text{ N/C}$$

$$= 1725\hat{x} + 1150\hat{y} \text{ N/C}$$

$$E = F/q \Rightarrow E = qE$$



$$-1\mu\epsilon (-1\mu, x=0, y=-1)$$

$$P: (x=0, y=1)$$

$$E_P \quad \vec{r}_1, \vec{r}_P, \vec{r}_{1P}$$

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

~~$$\vec{r}_1 = 0\hat{x} + 1\hat{y} \quad \vec{r}_P = 1\hat{x} + 1\hat{y}$$~~

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

$$\begin{aligned} \vec{r}_{1P} &= \vec{r}_P - \vec{r}_i = (1-0)\hat{x} + (1-(-1))\hat{y} \\ &= 1\hat{x} + 2\hat{y} \end{aligned}$$



$$-1\mu\epsilon (-1\mu; x=0, y=-1)$$

$$P: (x=0, y=1)$$

$$E = -1\mu k \left[\frac{1\hat{x} + 2\hat{y}}{[1^2 + 2^2]^{3/2}} \right]$$

$$= -8990 \left[\frac{1\hat{x} + 2\hat{y}}{5^{3/2}} \right]$$

$$= -8990 \left[\frac{1\hat{x} + 2\hat{y}}{11.2} \right]$$

$$= -803\hat{x} - 1605\hat{y} \frac{N}{C}$$

② $+q = -1\mu C$ $\vec{r}_1: (+1\mu; x=0, -a)$
 ① $-a$ $+q = +1\mu$ $\vec{r}_2: (-1\mu; x=0, +a)$

$P: (x_p, 0)$

$\vec{E}_p: \vec{r}_1, \vec{r}_2, \vec{r}_{1p}, \vec{r}_{2p}$

$\vec{r}_1 = 0\hat{x} - a\hat{y}$ $\vec{r}_2 = 0\hat{x} + a\hat{y}$

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

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

$\vec{r}_{1p} = \vec{r}_p - \vec{r}_1 = (x_p - 0)\hat{x} + (0 + a)\hat{y}$
 $= x_p\hat{x} + a\hat{y}$

$\vec{r}_p - \vec{r}_2 = (x_p - 0)\hat{x} + (0 - a)\hat{y}$

$$\vec{r}_{ap} = \vec{r}_p - \vec{r}_a = (x_p - 0)\hat{x} + (0 - a)\hat{y} \\ = x_p\hat{x} - a\hat{y}$$

$$[x_p^2 + (a^2)]^{3/2} \quad [x_p^2 + (-a)^2]^{3/2}$$

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

$$\vec{E}_p = 0\hat{x} + 8990 \frac{2a\hat{y}}{[x_p^2 + a^2]^{3/2}}$$



$$①: (+1\mu; 0; a)$$

$$②: (+1\mu; 0; +a)$$



$$P: (b, 0)$$

$$\vec{E}_P: \vec{r}_1, \vec{r}_2, \vec{r}_P, \vec{r}_{1P}, \vec{r}_{2P}$$

$$\vec{r}_1 = 0\hat{x} - a\hat{y} \quad \vec{r}_2 = a\hat{x} + a\hat{y}$$

$$\vec{r}_P = b\hat{x} + 0\hat{y}$$

$$\vec{r}_{1P} = \vec{r}_P - \vec{r}_1 = b\hat{x} + a\hat{y}$$

$$\vec{r}_{2P} = \vec{r}_P - \vec{r}_2 = b\hat{x} - a\hat{y}$$

$$(r_p^2)^{3/2} = [b^2 + a^2]^{3/2}$$

$$(r_a^2)^{3/2} = [b^2 + a^2]^{3/2}$$

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

$$\vec{E}_p = \frac{2\mu k b}{[b^2 + a^2]^{3/2}} \hat{x}$$

$$\vec{F}_p: -Q \quad \vec{F}_p = -\frac{2\mu k b \cdot Q}{[b^2 + a^2]^{3/2}} \hat{x}$$

$$\vec{F} = -K b \hat{x} \quad \div$$

$$(r_{ip}^2)^{3/2} = [b^2 + a^2]^{3/2}$$

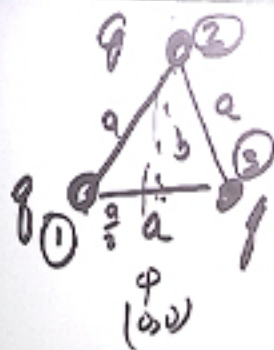
$$(r_{ap}^2)^{3/2} = [b^2 + a^2]^{3/2}$$

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

$$\vec{E}_p = \frac{2\mu k b}{[b^2 + a^2]^{3/2}} \hat{x}$$

$$\vec{F}_p: -Q \quad \vec{F}_p = -\frac{2\mu k b \cdot Q}{[b^2 + a^2]^{3/2}} \hat{x}$$

$$\vec{F}_p = -K b \hat{x} \quad \div$$



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

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

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

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

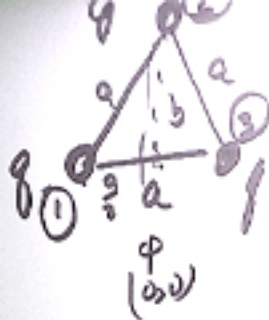
$$q_2 \left(1\mu, 0, \frac{\sqrt{3}}{2}a \right) \quad \vec{E}_3$$

$$q_1 : \left(1\mu, -\frac{a}{2}, 0 \right) \quad \vec{F} = q_3 \vec{E}$$

$$q_3 : \left(1\mu, +\frac{a}{2}, 0 \right) \quad F_3$$

$$\vec{r}_1, \vec{r}_2, \vec{r}_p, \vec{r}_{1p}, \vec{r}_{2p}$$

$$\vec{E}_p, \quad \vec{F}_3 = q_3 \vec{E}_p$$



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

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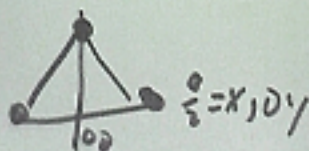
$$q_2: (1\mu, 0, \frac{\sqrt{3}}{2}a) \quad \vec{E}_3$$

$$q_1: (1\mu, -\frac{a}{2}, 0) \quad \vec{F} = q_3 \vec{E}$$

$$q_3: (1\mu, +\frac{a}{2}, 0) \quad F_3$$

$$\vec{r}_1, \vec{r}_2, \vec{r}_p, \vec{r}_{1p}, \vec{r}_{ap}$$

$$\vec{E}_p, \vec{F}_3 = q_3 \vec{E}_p$$



$$\vec{E}_p, \vec{F} = q_3 \vec{E}_p$$



$$\frac{a}{2} = x, 0y$$

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

$$\vec{r}_2 = 0\hat{x} + \frac{\sqrt{3}}{2}a\hat{y}$$

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

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

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

$$\frac{a}{2}\hat{x} - \frac{\sqrt{3}}{2}a\hat{y}$$

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

$$\vec{E} = k\mu a \hat{x} + \frac{a}{2}\hat{x} - \frac{\sqrt{3}}{2}a\hat{y}$$

$$\vec{E}_p, \vec{F}_3 = \gamma_3 \vec{E}_p$$



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

$$\vec{E}_p = \frac{R\mu a}{a^3} \hat{x} + \frac{\frac{a}{2}\hat{x} - \frac{\sqrt{3}}{2}a\hat{y}}{a^3}$$

$$\vec{F}_3 = \gamma_3 \vec{E}_p = \mu \left[\vec{E}_p \right]$$