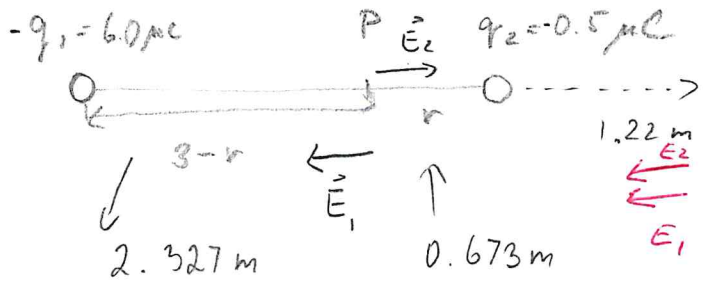
$$E = \frac{k|q|}{r^2}$$

PHYSICS 12 **ELECTRIC FIELD – practice**

1. Consider two negative charges placed in vacuum and separated by 3.0m. Charge 1 is-6.0 μC strong while charge 2 is only-0.5 μC . Find point P where the net electric field is zero.



$$\|\vec{E}_1\| = \|\vec{E}_2\|$$

$$\frac{k|q_1|}{(3-r)^2} = \frac{k|q_2|}{r^2}$$

$$\frac{r^2}{3-r^2} = \frac{|q_2|}{|q_1|}$$

$$\left(\frac{r}{3-r}\right)^2 = \frac{0.5}{6}$$

$$\frac{r}{3-r} = \sqrt{\frac{0.5}{6}}$$

$$\frac{r}{3-r} = 0.289$$

$$r = \pm 0.289(3-r)$$

$$r = \pm 0.866 \mp 0.289r$$

$$1.286r = 0.866$$

$$r_1 = 0.673\ m$$

$$r_2 = \frac{-.866}{.711}$$

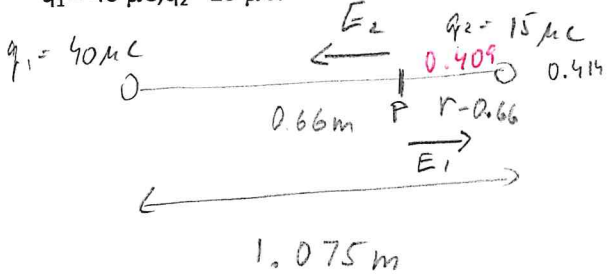
$$r_2 = -1.22m$$

∴ Point P is 2.33m away from q_1

P is 0.673m away from q_2

2. How far from each other are q_1 and q_2 placed if the net electric field is zero 0.66m away from q_1?

$q_1 = 40\ \mu C, q_2 = 15\ \mu C$.



$$E_1 = E_2$$

$$\frac{kq_1}{0.66^2} = \frac{kq_2}{(r-0.66)^2}$$

$$\frac{(r-0.66)^2}{0.66^2} = \frac{15}{40}$$

$$\left(\frac{r-0.66}{0.66}\right)^2 = 0.375$$

$$\frac{r-0.66}{0.66} = \pm\sqrt{0.375}$$

$$\frac{r-0.66}{0.66} = \pm 0.612$$

$$r - 0.66 = \pm 0.4082$$

$$r_1 = 1.075\ m$$

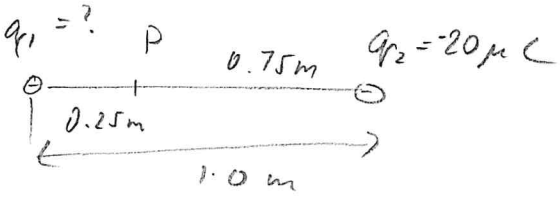
$$r_2 = 0.2518m$$

∴ q_1 and q_2 are 1.075m apart

$E_1 = 8.24 \times 10^5\ N/C$

$E_2 = 8.1 \times 10^5\ N/C$

3. What is the charge on q_1 if the two negative charges are placed 1.0 m fr0m each other, the net electric field is zero 0.25 m from q_1 and $q_2 = -20\mu C$?



$q_1 < q_2$

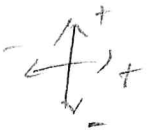
$$E_1 = E_2$$

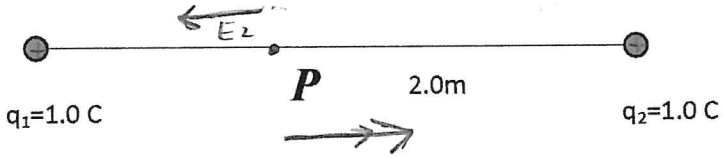
$$\frac{k|q_1|}{0.25^2} = \frac{k|-20\times10^{-6}|}{0.75^2}$$

$$q_1 = \frac{|-20\times10^{-6}|\,(0.25)^2}{(0.75)^2}$$

$$q_1 = 2.2\times10^{-6}\ C$$

4. What is the net electric field at point P if the charges are separated by 3.0m?





$$\Sigma\vec{E} = \vec{E_1} + \vec{E_2}$$

$$= 9\times10^9 - 2.25\times10^9$$

$$= 6.75\times10^9\ N/C\ [Right]$$

$$E_1 = \frac{k|1|}{1^2}$$

$$\vec{E_1} = 9\times10^9\ N/C\ (Right)$$

$$E_2 = \frac{k|1|}{2^2}$$

$$= 2.25\times10^9\ N/C\ [Left]$$