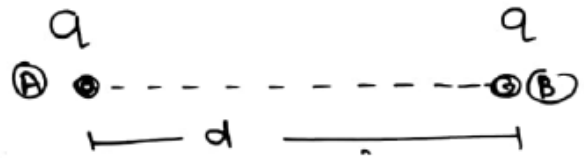
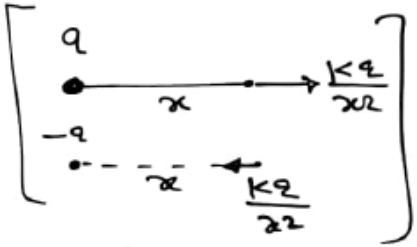
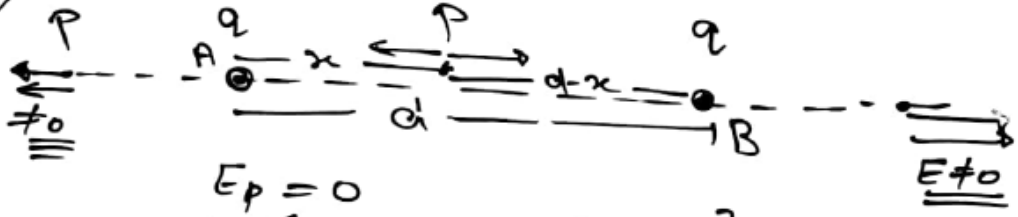
⇒ find position where electric field is zero [due to point charges]

Eg) 



(#)



$E_p = 0$

$$\frac{kq}{x^2} = \frac{kq}{(d-x)^2} \qquad (d-x)^2 = x^2$$

$$d - x = x$$

$$d = 2x$$

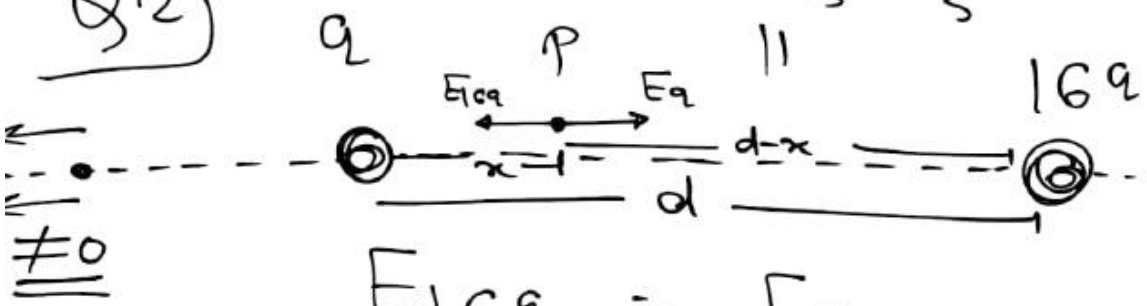
$$x = \frac{d}{2}$$

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

$$F = qE$$

$d - \frac{d}{5} = \frac{4d}{5}$

Q2)



Find Location where Electric field is zero

$E_{16q} = E_q$

$\frac{K(16q)}{(d-x)^2} = \frac{Kq}{x^2}$

$\frac{16}{(d-x)^2} = \frac{1}{x^2}$

$16x^2 = (d-x)^2$

$[4x]^2 = (d-x)^2$

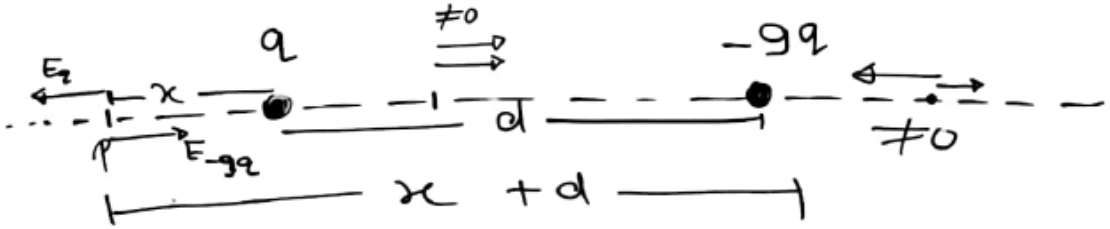
$4x = d - x$

$5x = d$

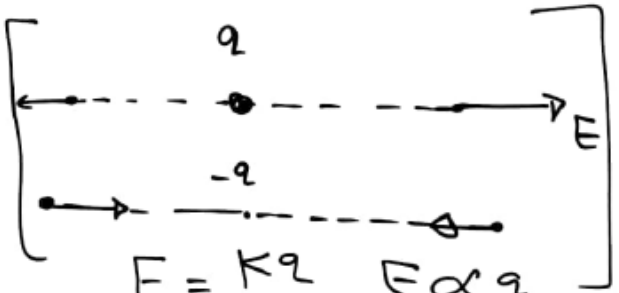
$x = \frac{d}{5}$

at $x = \frac{d}{5}$ from q,

$\frac{4d}{5}$ from 16q



Find location where Electric field is zero.



$E = \frac{Kq}{x^2}$ $E \propto q$ $E \propto \frac{1}{x^2}$

$$E_q = E_{-9q}$$

$$\frac{Kq}{x^2} = \frac{K(9q)}{(x+d)^2}$$

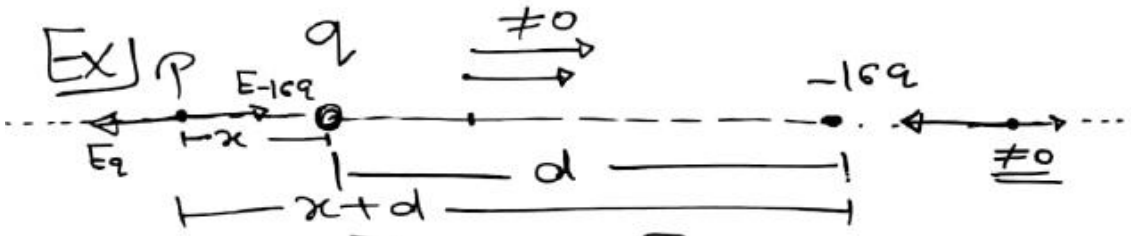
$$(x+d)^2 = 9x^2 \Rightarrow (x+d)^2 = (3x)^2$$

$$x + d = 3x$$

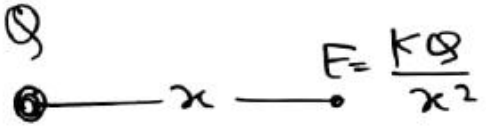
$$d = 2x$$

$x = \frac{d}{2}$, $\frac{d}{2}$ from q, $\frac{3d}{2}$ from (-9q).

Ex) P



Find Location where Electric field is zero.



$$E_q = E_{-16q}$$

$$\frac{Kq}{x^2} = \frac{K(16q)}{(x+d)^2}$$

$$(x+d)^2 = 16x^2$$

$$(x+d)^2 = (4x)^2$$

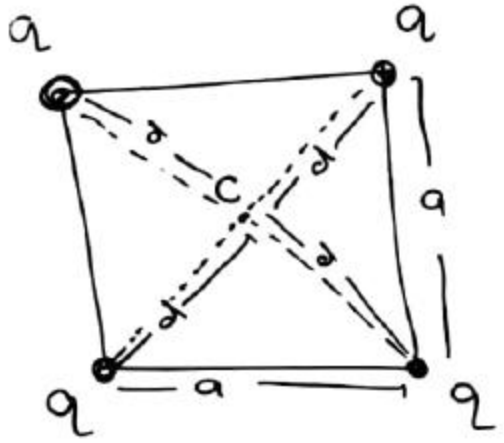
$$x+d = 4x$$

$$d = 3x$$

$x = \frac{d}{3}$ from q

& $\frac{4d}{3}$ from $(-16q)$

Find Electric field at Centre:-

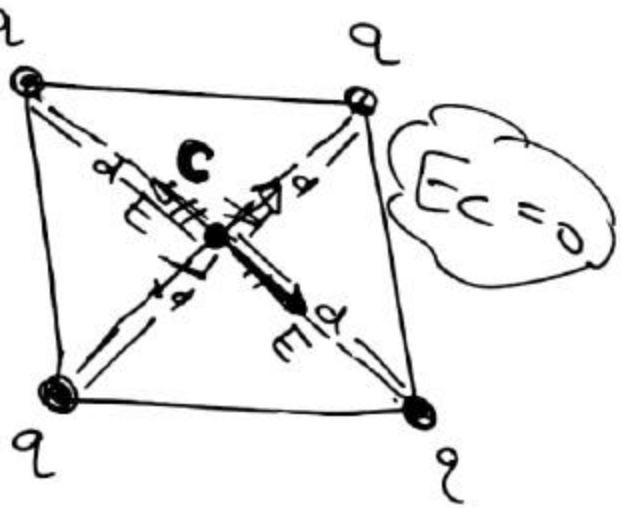


Square Side a

diagonal = $a\sqrt{2}$

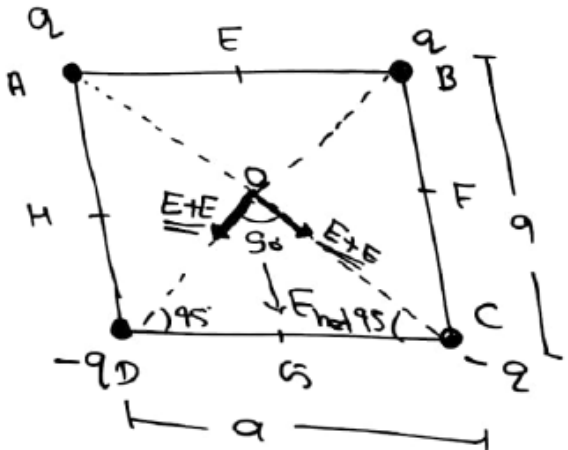
$2d = a\sqrt{2}$

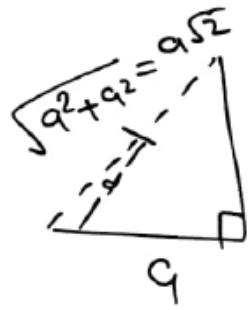
$d = \frac{a\sqrt{2}}{2} = \frac{a\sqrt{2}}{\sqrt{2}\times\sqrt{2}} = \frac{a}{\sqrt{2}}$



$E_C = 0$

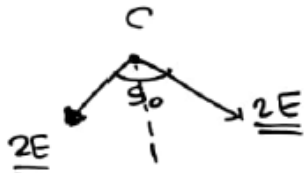
Q. Net Electric field at Centre of Square of side (a).

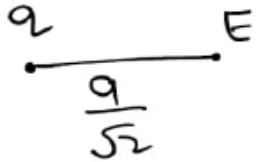




$d = a\sqrt{2}$

$\frac{d}{2} = \frac{a\sqrt{2}}{\sqrt{2}\times\sqrt{2}} = \frac{a}{\sqrt{2}}$





$E = \frac{Kq}{\left(\frac{a}{\sqrt{2}}\right)^2} = \frac{2Kq}{a^2}$

$E_{net} = \sqrt{(2E)^2+(2E)^2+2(2E)(2E)\cos 90^\circ}$

$= \sqrt{4E^2+4E^2}$

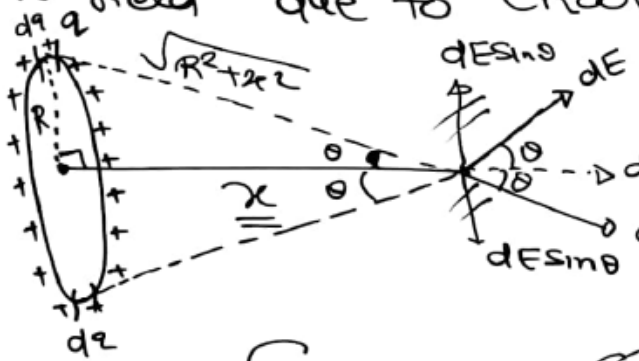
$= \sqrt{8E^2} = 2\sqrt{2}E$

$= 2\sqrt{2}\times\frac{2Kq}{a^2}$

$= \frac{4\sqrt{2}Kq}{a^2}$ toward OG

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

Electric field due to charged ring at axial point :



dE = Electric field due to small element dq charge.

$dE\cos\theta + dE\cos\theta = E_{net}$

$$\cos\theta = \frac{x}{\sqrt{x^2+R^2}}$$

$$E_{net} = \int dE\cos\theta \qquad K = \frac{1}{4\pi\varepsilon_0}$$

$$E_{net} = \int \frac{K\,dq}{(\sqrt{R^2+x^2})^2}\,\frac{x}{\sqrt{R^2+x^2}}$$

$$= \frac{Kx}{(R^2+x^2)\sqrt{R^2+x^2}} \times \int dq = \frac{Kqx}{(R^2+x^2)^{3/2}}$$

$$(R^2+x^2)^1 \times (R^2+x^2)^{1/2} = (R^2+x^2)^{3/2}$$

$$E_{net} = \frac{Kqx}{(x^2+R^2)^{3/2}}$$

=> Electric field due to charge ring at axial position