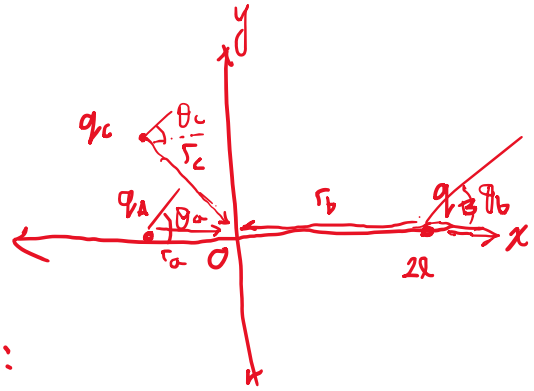
Electric Fields

1. Calculate the electric field at the origin resulting from the following point charges:

- **Charge A: $q_A = 2Q$; A(-l,0)**
- **Charge B: $q_B = -5Q$; B(2l,0)**
- **Charge C: $q_C = -Q$; C(-l,l)**



$$\vec{E} = \frac{kq_i}{r^2}\hat{r}$$

$$\sum \vec{E}_x = \vec{E}_a \cos\theta_a + \vec{E}_b \cos\theta_b + \vec{E}_c \cos\theta_c$$

$$= \frac{k(2Q)}{l^2} - \frac{k(-5Q)}{(2l)^2} + \frac{k(-Q)}{(l\sqrt{2})^2}\cdot\left(+\frac{\sqrt{2}}{2}\right)$$

NOTICE:

$\theta_A = 0°$; $\theta_B = 180°$; $\theta_C = -45°$

$$= \frac{2kQ}{l^2} + \frac{5kQ}{4l^2} - \frac{kQ}{2\sqrt{2}l^2}$$

$$= \boxed{\frac{kQ}{l^2}\left(7 - \frac{1}{2\sqrt{2}}\right)\hat{x}}$$

$$\sum \vec{E}_y = \vec{E}_a \sin\theta_a + \vec{E}_b \sin\theta_b + \vec{E}_c \sin\theta_c$$

$$= E_c \sin\theta_c = \frac{k(-Q)}{(\sqrt{2}\,l)^2}\left(-\frac{\sqrt{2}}{2}\right) = \boxed{\frac{kQ}{2\sqrt{2}l^2}\hat{y}}$$

So, $\sum \vec{E} = \vec{E}_x + \vec{E}_y$

2. The electric field of some point charge is…

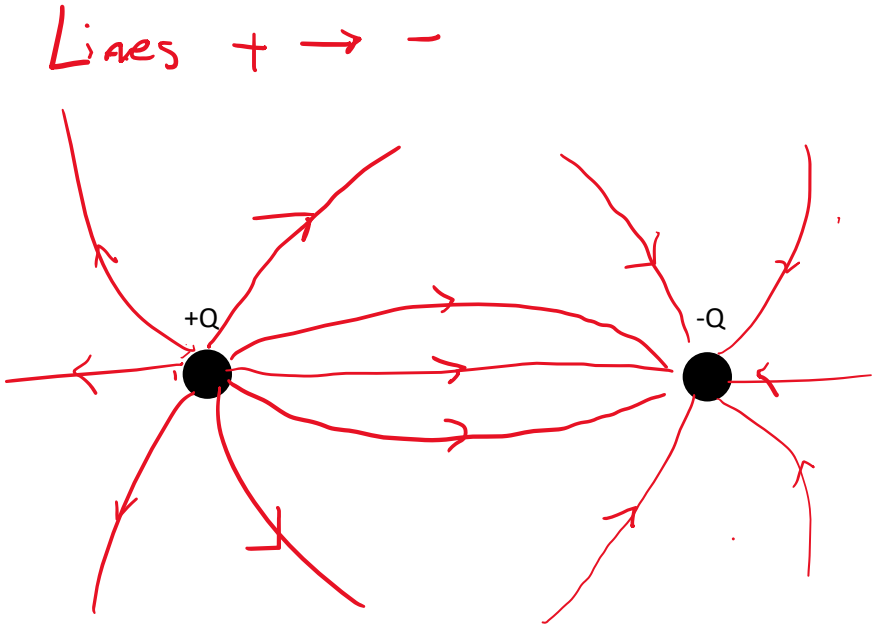
$$\vec{E} = \frac{-.005}{r^2}\hat{r}$$

What is the magnitude of the charge? Is the charge positive or negative?

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}\hat{r} = -.005\frac{\hat{r}}{r^2}$$

$$Q = -4\pi\varepsilon_0(.005) = \boxed{-\frac{\pi\varepsilon_0}{50}}$$

3. Draw the field lines for the following distribution of charge (Q > 0).



How about this distribution (infinite plane of uniform, negative charge)?