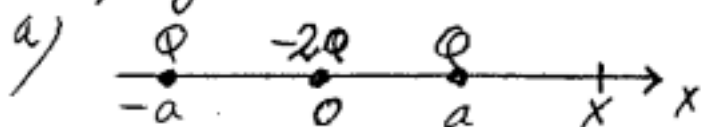


①

Forslag til løsning.

Oppgave 1.

a) 

Potensialet $V(x)$ vil bli en sum av potensialene fra de enkelte ladningene. En finner

$$V(x) = \frac{1}{4\pi\epsilon_0} \left(\frac{Q}{|x-a|} - \frac{2Q}{|x|} + \frac{Q}{|x+a|} \right)$$

[Videre regning gir: $V(x) = \frac{Q}{4\pi\epsilon_0} \frac{2a^2}{x(x^2-a^2)}$ for $x > a$.

$$V(x) = \frac{2Q}{4\pi\epsilon_0} \frac{a^2 - ax + x^2}{x(x^2 - a^2)} \text{ for } 0 < x < a. \quad V(x) = V(-x) \quad (x < 0).]$$

b) Elektrisk felt for $x > a$.

$$E(x) = - \frac{\partial V}{\partial x} = \frac{-Q}{4\pi\epsilon_0} \frac{\partial}{\partial x} \left(\frac{1}{x-a} - \frac{2}{x} + \frac{1}{x+a} \right)$$

$$= \frac{Q}{4\pi\epsilon_0} \left[\frac{1}{(x-a)^2} - \frac{2}{x^2} + \frac{1}{(x+a)^2} \right] =$$

$$\frac{Q}{4\pi\epsilon_0} \left[\frac{x^2 + 2ax + a^2 + x^2 - 2ax + a^2}{(x^2 - a^2)^2} - \frac{2}{x^2} \right] = \frac{2Q}{4\pi\epsilon_0} \left[\frac{x^2 + a^2}{(x^2 - a^2)^2} - \frac{1}{x^2} \right]$$

$$= \frac{2Q}{4\pi\epsilon_0} \frac{x^4 + a^2x^2 - (x^4 - 2a^2x^2 + a^4)}{x^2(x^2 - a^2)^2} = \frac{2Q}{4\pi\epsilon_0} \frac{a^2(3x^2 - a^2)}{x^2(x^2 - a^2)^2}$$