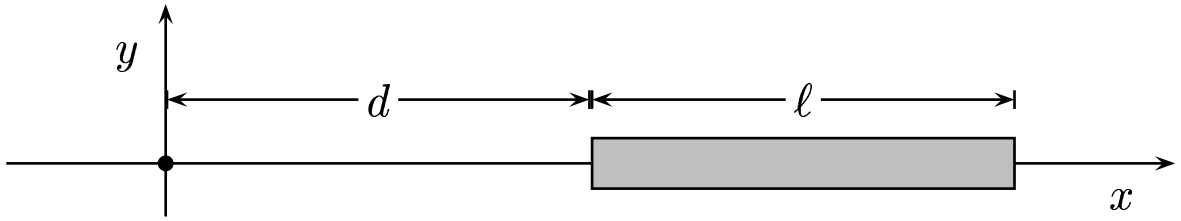
A rod with linear charge density $\lambda < 0$ and length ℓ lies along the x-axes with its left-hand end a distance d from the origin.



By inspection $\vec{E}$ is pointing along the positive x-axes, since the charge on the rod is negative $\lambda < 0$.

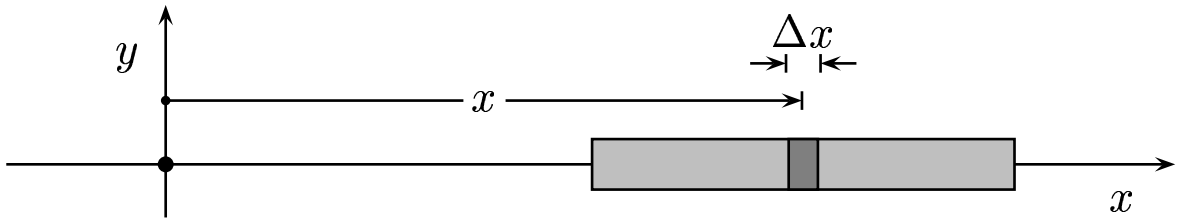
What is the magnitude of the electric field at the origin?

A) $\|\vec{E}\| = k\,\lambda \int_d^{d+\ell} \frac{1}{x^2}\,dx$

B) $\|\vec{E}\| = k\,\lambda \int_d^{\ell} \frac{1}{x^2}\,dx$

C) $\|\vec{E}\| = \frac{k}{\lambda} \int_d^{d+\ell} \frac{1}{x^2}\,dx$

D) $\|\vec{E}\| = \frac{k}{\lambda} \int_d^{\ell} \frac{1}{x^2}\,dx$



$$\text{Since} \quad \Delta E = k\,\frac{\Delta Q}{x^2} \quad \text{and} \quad \Delta Q = \lambda\,\Delta x$$

$$= k\,\frac{\lambda\,\Delta x}{x^2}, \quad \text{so}$$

$$E = \int \Delta E$$

$$= k\,\lambda \int_d^{d+\ell} \frac{1}{x^2}\,dx\,.$$

Answer **A**.

23.05-01˙Electric˙Field˙due˙to˙a˙Charged˙Rod 2004-3-24