Answer on Question #68708 Physics / Electromagnetism

Two infinity linear charges are kept parallel $a = 0.1$ meter one another. If every charges included charge of $\lambda = 5$ micro columbe per meter, then what will be the value of force on unit length of the linear charges?

Solution:

The potential energy of interaction between linear charges is given by

$$U = \lambda V,$$

where V is the electric potential of infinite road

$$V = -\frac{\lambda}{2\pi\varepsilon_0}\ln a.$$

Thus

$$U = -\frac{\lambda^2}{2\pi\varepsilon_0}\ln a.$$

The force between charges

$$F = -\frac{dU}{da} = \frac{\lambda^2}{2\pi\varepsilon_0 a} = \frac{(5\times10^{-6})^2}{2\times3.14\times8.85\times10^{-12}\times0.1} = 4.5 \text{ N}.$$

Answers: $F = 4.5$ N.