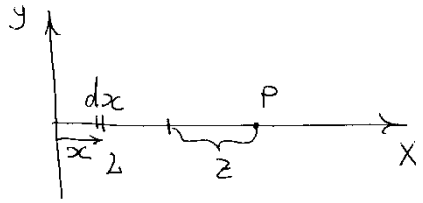
Answer on Question #81290, Physics / Electromagnetism

Question:

A straight line segment of length L (see Figure below) carries a uniform line charge λ. Find the electric field a distance z above one end of the straight line. Indicate the direction of the electric field vector. Check that your formula is consistent with what you would expect for the case z L.

Solution:



In the point P a part of L with the length dx gives $dE = \frac{kq}{(z+L-x)^2} = \frac{k\lambda dx}{(z+L-x)^2}$, therefore according to superposition principle the electric field vector modulus

$$E = \int_0^L \frac{k\lambda dx}{(L+z-x)^2} = \frac{kL\lambda}{(z+L)z} .$$

In case of $z \square L$ $E = \frac{kq}{z^2}, where \ q = \lambda L$.

If λ>0 the direction of E is from the segment, otherwise – toward it.

The answer:

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