

PHYSICS 507
2nd HOMEWORK-SPRING 2020
Prof. V. Lempesis

Hand in: Monday 17 February at 23:59

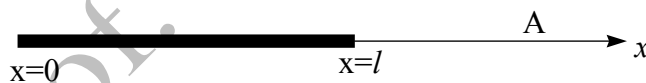
1. In problem 3.17 we showed, in the class, that in general the superposition principle for electrostatic field energy does not hold.
 - A) Could you show under which condition the superposition principle may hold for the total energy of a field created by the superposition of two other fields $\mathbf{E}_1$ and $\mathbf{E}_2$. (2 marks)
 - B) Could you suggest any such configuration made up by fields we have already seen in the class? (For example, spherical, ring, infinite wire, short wire, infinite plane etc) (1 mark)

Hint: Use the results of problem 3.17

2. The electric field at a point on the axis (take it z-axis) of a ring of radius r , and with uniform charge density λ (positive) is given by:

$$\mathbf{E} = \frac{\lambda}{2\epsilon_0} \frac{zr}{(z^2 + r^2)^{3/2}} \hat{\mathbf{k}}$$

- A) Derive an expression for the electric potential at this point. (4 marks).
 - B) What is the value of the potential as $z \gg r$? (1 mark)
3. A rod of length l is uniformly charged with a linear charge density λ . Find the electric potential at point A. (7 marks)



4. The potential of a static electric field is given by $V = \sin(xy)$. What is the charge density of the field that creates this potential? (5 marks)