Problems for week 2

January 20, 2016

Problem 1
Can the system of field lines shown in Fig. 1 represent an electrostatic field?

Problem 2:

a) (Griffiths, P.2.20) One of the two fields given below cannot represent a static electric field (\(k\) is just a constant of appropriate dimensions). Which one?

1. \(E = k(xy \hat{x} + 2yz \hat{y} + 3xz \hat{z})\)
2. \(E = k(y^2 \hat{x} + (2xy + z^2) \hat{y} + 2yz \hat{z})\)

Problem 3:
What is the electric field inside and outside a thin shell uniformly charged with charge \(Q\)? Using your result, sketch the field lines for a thin shell with a small opening.

Problem 4:
What is the electric field inside and outside a uniformly charged sphere, having charge density \(\rho\)? Using your result, find the electric field inside a small spherical void made in the aforementioned sphere.

Problem 5:

Figure 1: Strange looking field lines
The space is filled with charge distributed with density

\[ \rho = \rho_0 \exp(-\alpha r). \]

Find the electric field as a function of \( \vec{r} \). Investigate the dependence of \( E(r) \) for small and large \( r \) (what does “small” and “large” mean in this particular case?), sketch the dependence graphically.