

Unit 6: Introduction to Electrodynamics  
Problems for practice

In example nos. 2, 3, and 4, “C” is some proportionality constant.

- 1) Find gradient of  $r$ , where  $r = |\vec{r}|$  and  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ . Can you interpret the result?
  - 2) Electric field in a region is given by  $\vec{E} = \frac{C\vec{r}}{\epsilon_0 a^3}$ , where “ $\epsilon_0$ ” is permittivity of free space, “ $a$ ” is some constant and  $\vec{r}$  is as defined above. Determine the charge density.
  - 3) An electric field is given by  $\vec{E} = C(xy\hat{i} + 2yz\hat{j} + 3xz\hat{k})$ . Can it be an electrostatic field?
  - 4) A vector field is expressed as  $\vec{v} = C(-3x\hat{i} + 3y\hat{j} - 3z\hat{k})$ . Can it represent a magnetic field?
  - 5) The electrostatic potential due to a certain charge distribution is given by:  
 $V(x, y, z) = -\frac{V_0}{a^4}(x^2yz + xy^2z + xyz^2)$  volt, where “ $V_0$ ” and “ $a$ ” are constants with dimensions of volt and metre respectively. Find electric field at a point A ( $a, a, 0$ ) in SI units.
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