

Introduction to Electric Fields Challenge Problems

Problem 1:

We have defined a vector field as a family of vectors, with a vector at every point in space. A scalar field can be likewise defined as a family of scalars, namely at every point in space the field has a value but no direction. Name as many examples of scalar and vector fields as possible.

Vector fields

Make a plot of the following vector fields:

(a) $\vec{v} = 3\hat{\mathbf{i}} - 5\hat{\mathbf{j}}$

(b) $\vec{v} = \vec{r}$

(c) $\vec{v} = \frac{\hat{\mathbf{r}}}{r^2}$

(d) $\vec{v} = \frac{3xy}{r^5}\hat{\mathbf{i}} + \frac{2y^2 - x^2}{r^5}\hat{\mathbf{j}}$

Problem 2:

Scalar fields

Make a plot of the following scalar functions in two dimensions:

(a) $f(r) = \frac{1}{r}$

(b) $f(x, y) = \frac{1}{\sqrt{x^2 + (y-1)^2}} - \frac{1}{\sqrt{x^2 + (y+1)^2}}$

MIT OpenCourseWare
<http://ocw.mit.edu>

8.02SC Physics II: Electricity and Magnetism
Fall 2010

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.