Assignment 2

Physics 321
Electrodynamics I

Due on Friday, September 13th, 2024

Class date: September 6th, 2024.
Reading: pp. 12–24, review of vector calculus derivatives.

Problem 1

Griffiths 1.13 c – evaluating the gradient of the magnitude of the separation vector. Just do part c., then check your result using the answers to parts a. and b. In addition to part c., suppose we take the gradient with respect to the primed variables, let

$$\nabla' \equiv \hat{\mathbf{x}}\frac{\partial}{\partial x'} + \hat{\mathbf{y}}\frac{\partial}{\partial y'} + \hat{\mathbf{z}}\frac{\partial}{\partial z'},$$

and evaluate $\nabla'(\mathscr{r}^n)$.

Problem 2

Sketch the vector field:

$$\mathbf{A} = \frac{-y\,\hat{\mathbf{x}} + x\,\hat{\mathbf{y}}}{x^2 + y^2}.$$

Calculate its curl and divergence . . . are you surprised?

Problem 3

A generic "spherically symmetric" vector field has the form $\mathbf{E} = E(r)\,\hat{\mathbf{r}}$ for $\mathbf{r} = x\,\hat{\mathbf{x}} + y\,\hat{\mathbf{y}} + z\,\hat{\mathbf{z}}$, $r = \sqrt{x^2 + y^2 + z^2}$, $\hat{\mathbf{r}} = \mathbf{r}/r$, and $E(r)$ an arbitrary function of r. What is the curl of $\mathbf{E}$? How about the divergence?