PHYS 401: Electricity & Magnetism II
Due date: Wednesday, February 1, 2023

Problem set #1

Griffiths 4th Ed. problems

1) Problem 1.13
Let $\vec{r}$ be the separation vector from a fixed point (x', y', z') to the point (x, y, z), and let r be its length. Show that
(a) $\vec{\nabla}(r^2) = 2\vec{r}$
(b) $\vec{\nabla}(1/r) = -\hat{r}/r^2$
(c) What is the *general* formula for $\vec{\nabla}(r^n)$?

2) Problem 1.16
Sketch the vector function

$$\vec{v} = \hat{r}/r^2$$

and compute its divergence. The answer may surprise you … can you explain it?

3) Problem 1.27
Prove that the divergence of a curl is always zero.
Check it for the function $\vec{v}_a = x^2\hat{x} + 3xz^2\hat{y} - 2xz\hat{z}$.

4) Problem 1.28
Prove that the curl of a gradient is always zero.
Check it for $f(x, y, z) = x^2y^3z^4$.