Oregon State University
Department of Physics

Physics 431: Electrodynamics Capstone
Fall 2020

Assignment One

Due: Wednesday, September 30, 2020 (11:59 p.m.) **Points Possible:** 80

Written questions and problems are to be neatly written up as described in the syllabus and turned in via Gradescope. Remember that for Gradescope submissions *each problem must be written on a separate page*, with the problem number clearly indicated. I (or the TA) may choose only a subset of problems to grade carefully each assignment – we won't tell you in advance which those might be! – and rely on you to study the solutions to make sure you fully understand the remainder. Problems will be worth 10 points each unless otherwise stated.

As described in detail in the syllabus, any resources you consult (faculty, friends, books, papers, web sites, etc.) must be cited on a problem-by-problem basis. Individual web page urls, book chapter, section and page numbers etc. should be included; simply listing e.g. the site or the name of the book is not enough.

In most all problems, a good sketch or plot will be your friend. Any additional computer files (e.g. *Mathematica* or python code) should be *both* uploaded to *Canvas* **and** submitted with the rest of your Gradescope submission.

Reading:

Griffiths §2.3, §2.5, §3.1

***Griffiths* Problems:**

Chapter 2 Problems: 29, 30, 38, 39 *Extra Credit:* 53
Chapter 3 Problems: 2, 3

Other Problems:

1. (**20 points total**) Figure out how to plot vector fields in *Mathematica*, python, or whatever your preferred software tool is going to be, in both two- and three-dimensions. Plot the electric field of a dipole[1] as an example. Then figure out how to plot the associated *field lines* of those fields, and plot again for the dipole. Have some fun once you've figured it out and plot some other interesting field configuration(s). In particular, plot one field that has a non-zero divergence, and one that has a non-zero curl. Make sure that these features are obvious in your plots, and breifly explain why they are obvious. (These plots should be two-dimensional to make them easier to create and to study.) *For this activity feel free to Google your hearts out for assistance and examples. Cite your sources.*

[1] An *electric dipole* is simply a pair of equal and opposite charges $\pm q$ separated by a (usually small) distance d.