Physics 333 **Electromagnetic Theory I** **Fall 2020**

Homework Assignment #1

(due Aug. 19, 2020, 11am, via gradescope)

1. Find the separation vector $\boldsymbol{\mathcal{R}}$ from the source point (4,1,6) to the field point (5,3,4). Determine its magnitude ($\mathcal{R}$), and construct the unit vector $\hat{\boldsymbol{\mathcal{R}}}$.

2. Using arrows of appropriate relative magnitude and direction, sketch a representative set of vectors for each of the following vector fields:

   (a) $\mathbf{f}(\mathbf{r}) = -y\,\hat{\mathbf{x}} + x\,\hat{\mathbf{y}}$

   (b) $\mathbf{g}(\mathbf{r}) = (-y\,\hat{\mathbf{x}} + x\,\hat{\mathbf{y}})/(x^2 + y^2)$

   (c) $\mathbf{h}(\mathbf{r}) = \hat{\mathbf{x}} + \hat{\mathbf{y}}$

3. Proof the equation before Eq.(1.18) in Griffiths's book, that is show that
   $(\mathbf{A} \times \mathbf{B}) \cdot (\mathbf{C} \times \mathbf{D}) = (\mathbf{A} \cdot \mathbf{C})\,(\mathbf{B} \cdot \mathbf{D}) - (\mathbf{A} \cdot \mathbf{D})\,(\mathbf{B} \cdot \mathbf{C})$
   Hint: Define the vector $\mathbf{E}$ to be $\mathbf{E} \equiv (\mathbf{A} \times \mathbf{B})$ and apply Eq. (1.15) to the left side of the equation you try to show. Then replace $\mathbf{E}$ again with $(\mathbf{A} \times \mathbf{B})$ and apply Eq. (1.17). Then just a bit more simplifying.

4. Griffiths 1.11