

Physics 423, Spring 2019 Homework Set # 1

1. The following exercises are not required, but you may find them helpful if you are rusty with vectors (Read §1.1)
 - (a) Find the angle between any two body diagonals of a cube.
 - (b) Figure 1.12 in Griffiths illustrates geometrically that

$$\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C}) = \mathbf{B} \cdot (\mathbf{C} \times \mathbf{A}).$$

Verify this relation explicitly using component form.

- (c) Griffiths defines the “separation vector” as $\mathbf{z} = \mathbf{r} - \mathbf{r}'$, where the “field point” \mathbf{r} and the “source point” \mathbf{r}' are position vectors. If the source point is $[1, 6, 4]$ and the field point is $[2, 4, 2]$, find the separation vector \mathbf{z} , its magnitude $|\mathbf{z}|$, and the unit vector $\hat{\mathbf{z}}$.
2. Due Friday, Jan 11 (Read §1.2):
 - (a) Griffiths problem 1.13
 - (b) Griffiths problem 1.16
 - (c) Find the curl of $(\hat{\mathbf{z}} \times \frac{\hat{\mathbf{r}}}{r})$.
 3. Due Monday, Jan 14:
 - (a) Calculate the Laplacian of $A + Bx + Cy + Dxy + E(x^2 - y^2)$, where the capital letters are all constants.
 - (b) Show that the curl of a gradient is always zero, $\nabla \times \nabla \mathbf{B} = 0$. You might suppose it is zero for the same reason that $\mathbf{A} \times \mathbf{A} = 0$, but it's not that simple.
 - (c) Show that the divergence of a curl is always zero.