Homework No. 06 (Fall 2020)

PHYS 520A: ELECTROMAGNETIC THEORY I

Department of Physics, Southern Illinois University–Carbondale Due date: Friday, 2020 Oct 9, 11.00am

- 1. (20 points.) Show that a configuration consisting of three charges with zero electric monopole moment and zero electric dipole moment is collinear. Hint: Let the three charges be q_1 , q_2 , and q_3 , and their positions be \mathbf{r}_1 , \mathbf{r}_2 , and \mathbf{r}_3 , respectively. Show that we can express $(\mathbf{r}_1 - \mathbf{r}_3) = a(\mathbf{r}_1 - \mathbf{r}_2)$ and $(\mathbf{r}_2 - \mathbf{r}_3) = b(\mathbf{r}_1 - \mathbf{r}_2)$. Find a and b.
- 2. (20 points.) Evaluate the monopole moment, the dipole moment, and the quadrupole moment of countable infinite identical charges, each having charge q, positioned on the x axis at $a, a/2, a/3, \ldots$, respectively.

Hint: Express the moments in terms of the Riemann zeta function $\zeta(s)$, which is well defined and finite for the particular values of s here.