Homework No. 06 (Fall 2020)<br>PHYS 520A: ELECTROMAGNETIC THEORY I<br>Department of Physics, Southern Illinois University-Carbondale<br>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 $\left(\mathbf{r}_{1}-\mathbf{r}_{3}\right)=a\left(\mathbf{r}_{1}-\mathbf{r}_{2}\right)$ and $\left(\mathbf{r}_{2}-\mathbf{r}_{3}\right)=b\left(\mathbf{r}_{1}-\mathbf{r}_{2}\right)$. 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.
