

1 Linear Quadrupole (w/ series)

None

Consider a collection of three charges arranged in a line along the z -axis: charges $+Q$ at $z = \pm D$ and charge $-2Q$ at $z = 0$.

- (a) Find the electrostatic potential at a point \vec{r} in the xy -plane at a distance s from the center of the quadrupole. The formula for the electrostatic potential V at a point \vec{r} due to a charge Q at the point \vec{r}' is given by:

$$V(\vec{r}) = \frac{1}{4\pi\epsilon_0} \frac{Q}{|\vec{r} - \vec{r}'|}$$

- (b) Assume $s \gg D$. Find the first two non-zero terms of a power series expansion to the electrostatic potential you found in the first part of this problem.
- (c) A series of charges arranged in this way is called a linear quadrupole. Why?