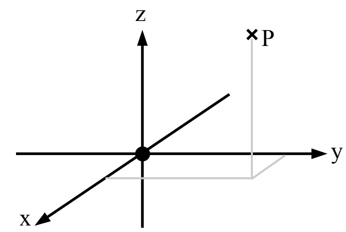
✯ TUTORIAL 1: POINTS, LINES AND RINGS, OH MY! ✯
Coulomb's Law and "script r"

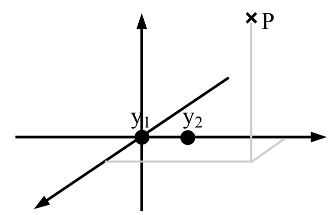
Part 1 – Constructing the Potential



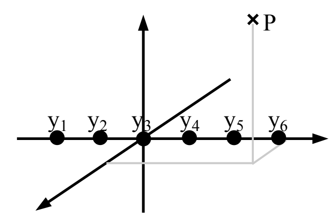
Recall from freshman physics that the potential at an arbitrary point P=(x,y,z) from a point charge, q, at the origin is given by

$$V = \frac{kq}{\sqrt{x^2 + y^2 + z^2}}$$

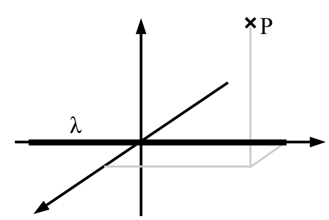
i. Using this, write an exact expression for the potential at P=(x,y,z) from two identical point charges located at (0,0,0) and $(0,y_2,0)$.



ii. Now write an exact expression for the potential at P=(x,y,z) from a string of N identical point charges along the y-axis.



iii. Write an expression for the potential at point P=(x,y,z) due to an infinite line of charge on the y-axis with uniform charge density λ.



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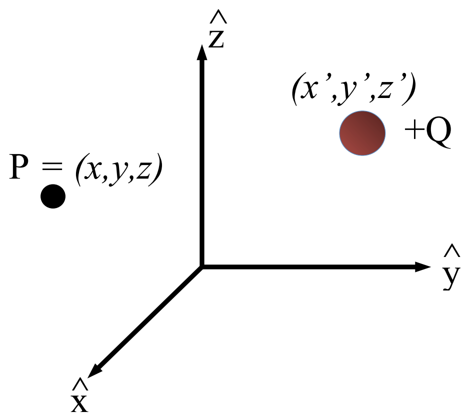
Part 2 – Script-r

There is a charge +Q at point (x' , y' , z').

We're concerned with the field at point P = (x,y,z).

i. Draw on the graph: $\vec{r}$, $\vec{r}\,'$, and $\vec{\mathscr{r}}$ (where $\vec{\mathscr{r}}$ is Griffiths' "script r").



ii. Express $\vec{\mathscr{r}}$ in terms of $\vec{r}$ and $\vec{r}\,'$.

iii. Now express the Cartesian ($\mathscr{r}_x$, $\mathscr{r}_y$, and $\mathscr{r}_z$) components of $\vec{\mathscr{r}}$ in terms of the Cartesian components of $\vec{r}$ and $\vec{r}\,'$. Keep your answers as simple as possible.

iv. Now go back to the question on the other side (Part 1, q iii) and rewrite your integral using Griffith's "script-r" notation. Which quantity in your equation does "script R" represent? Which quantity takes the place of the q from part 1-i?

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