

How To Find the Electric Potential for a Given Charge Distribution

1. First, find the electric field in the region of interest (usually, you can use Gauss' Law...follow the Gauss' Law howto above).
2. Choose a point such that $V = 0$. You're free to define this to be any point in space. Often, it's convenient to choose $V = 0$ at infinity.
3. Now, set up a line integral which gives the potential difference ΔV between two points A and B .

$$\Delta V = V_B - V_A = - \int_A^B \vec{E} \cdot d\vec{l}, \quad (1)$$

This involves choosing:

- Point B, where you want to find the potential.
- Point A, a point where you *know the potential already*. This could be a point where you have defined the potential to be zero (often it's convenient to pick this point to be ∞), or it could be a point where you have already calculated the potential.
- A path to integrate along. To do the integral easily, choose a path that's parallel to the electric field. Then $\vec{E} \cdot d\vec{l}$ just becomes $E dl$.

What you are doing here is adding up all the potential differences along the line.

4. Plug in the electric field over the region where your line integral path runs, and do the integral.
5. Solve for V_B .