Equipotentials

- Lines of constant electric potential
  like "Contour maps" of electric potential

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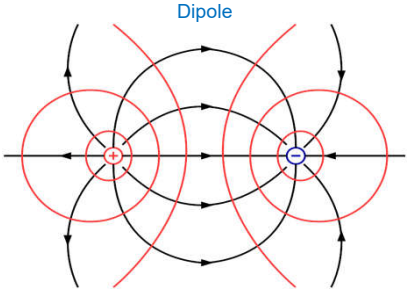
$$\underbrace{E_x = -\frac{\partial V}{\partial x} \qquad E_y = -\frac{\partial V}{\partial y} \qquad E_z = -\frac{\partial V}{\partial z}}$$

Produces $\vec{E}$ in direction of greatest decrease in V
which is perpendicular to line of constant V.

- Perpendicular to electric field

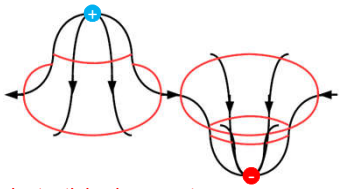
Electric Field Lines and Equipotentials

Dipole



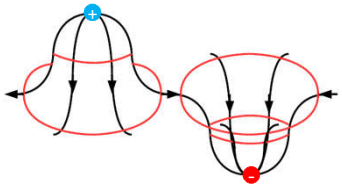
Electric Field Lines and Equipotentials

Dipole



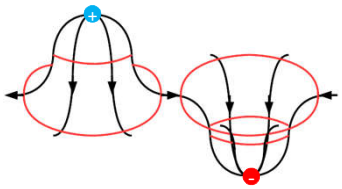
- Equipotentials along contours
- Field lines along steepest descent

Gradient: direction and magnitude of steepest incline. $\vec{\nabla} = \frac{\partial}{\partial x}\hat{\imath} + \frac{\partial}{\partial y}\hat{\jmath} + \frac{\partial}{\partial z}\hat{k}$



$$\vec{E} = -\vec{\nabla}V = -\frac{\partial V}{\partial x}\hat{\imath} - \frac{\partial V}{\partial y}\hat{\jmath} - \frac{\partial V}{\partial z}\hat{k}$$

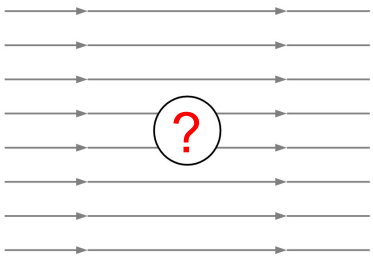
$$\Delta V = -\int \vec{E} \cdot d\vec{s}$$



$$\vec{E} = -\vec{\nabla}V = -\frac{\partial V}{\partial x}\hat{\imath} - \frac{\partial V}{\partial y}\hat{\jmath} - \frac{\partial V}{\partial z}\hat{k}$$

Example: The potential in a region is expressed as $V = 3axy - 4by^2$. Determine the electric field in the region.

Example: A conductor is placed in an electric field. What are the shape of the field lines and equipotentials near the conductor?



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