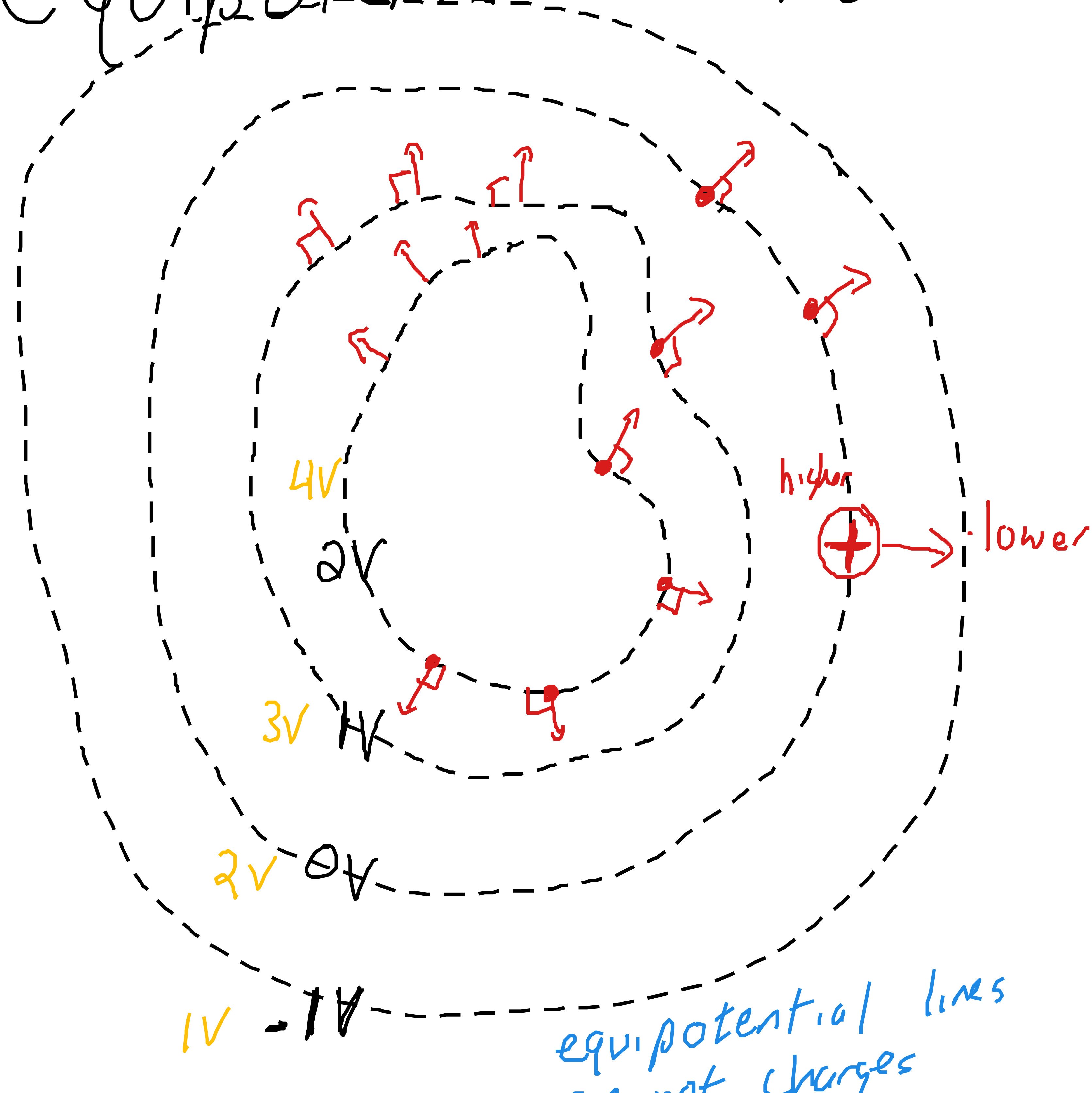
Equipotential Lines

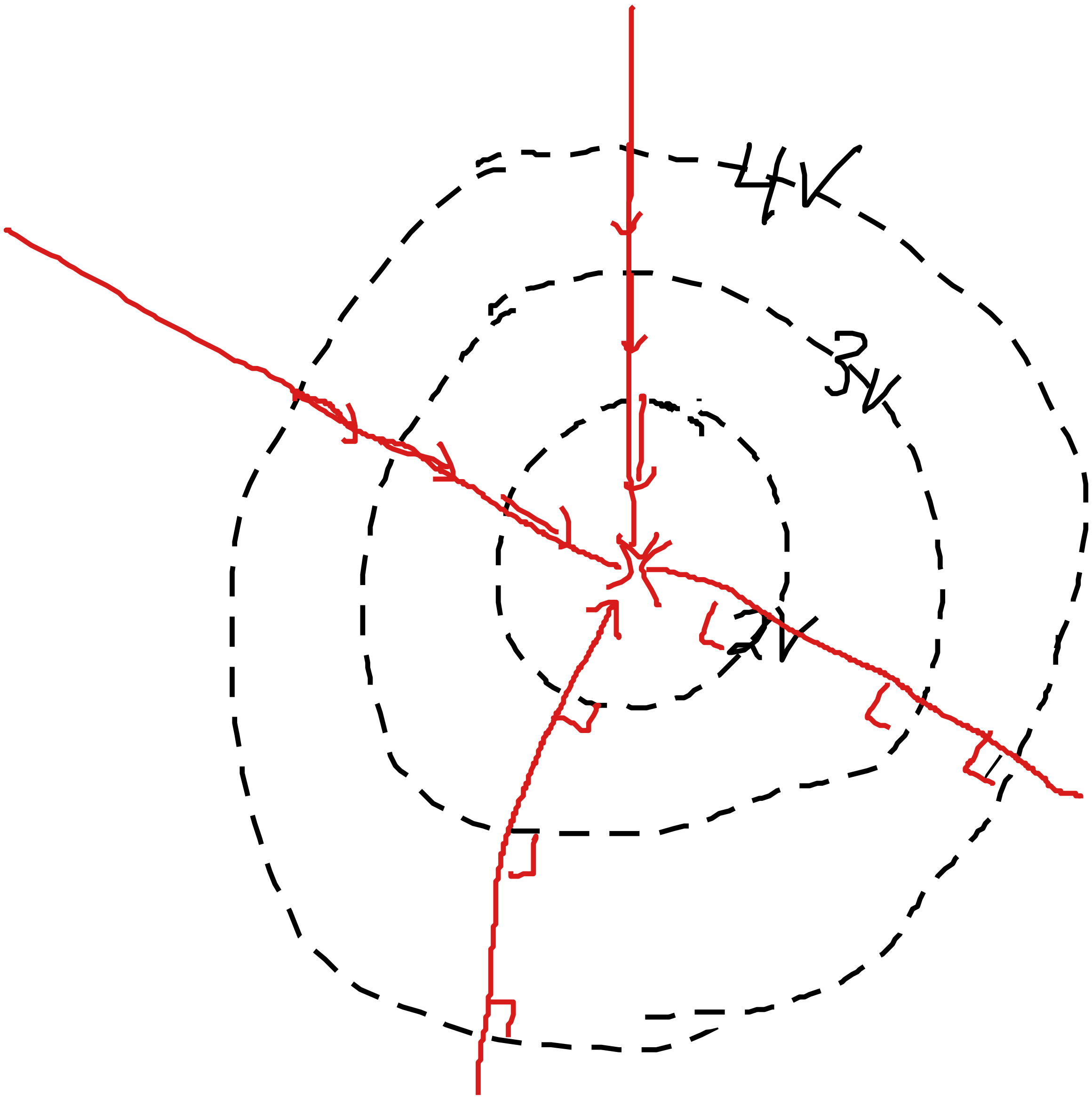


equipotential lines are not charges

Potential is like height.
Positive charges move downhill.

Charges are not "attracted to" or "repelled by" equipotential lines.

"Downhill vector" at any point is perpendicular to equipotential line there.



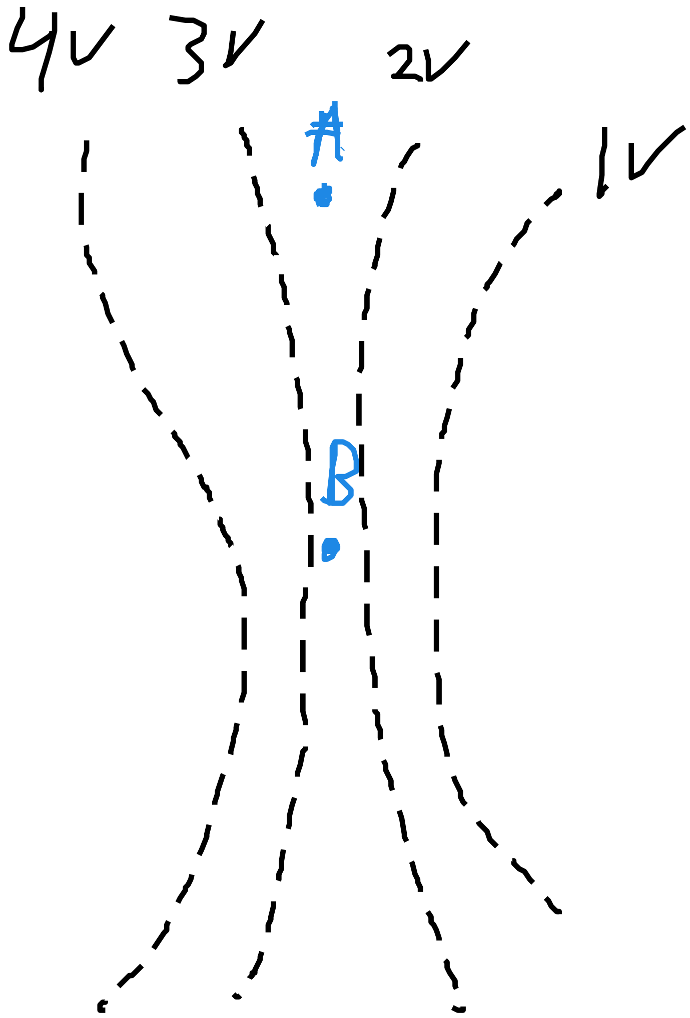
Imagine circles

Electric Field Lines

- point downhill
- perpendicular to equipotential lines
- smooth
- another way of understanding the landscape

B is steeper!

larger force



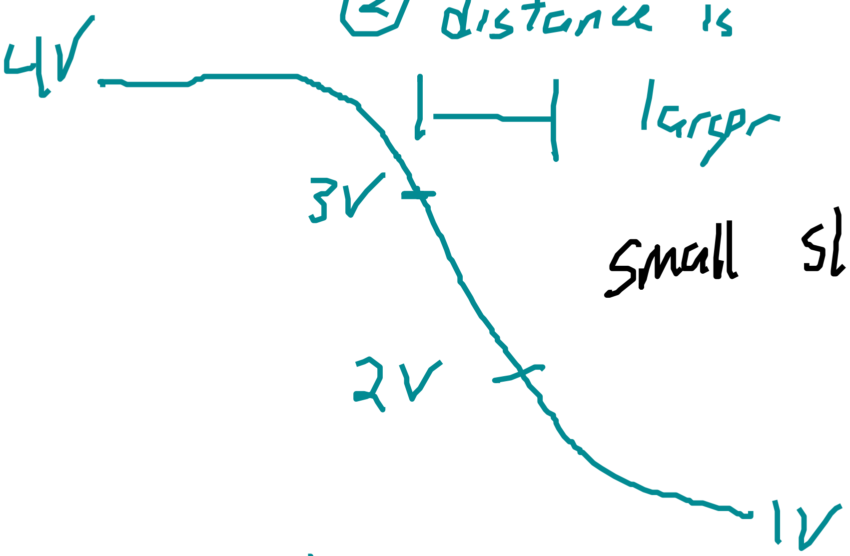
Landscape from side

① distance from 2V to 3V - very small

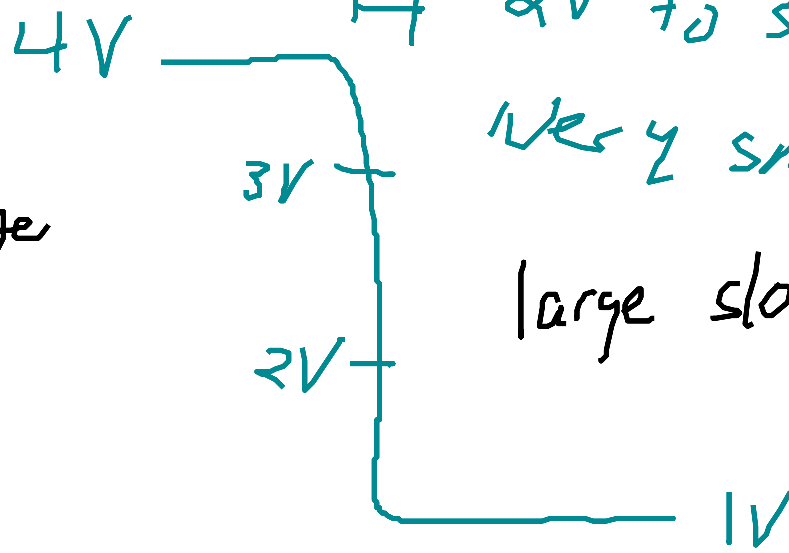
large slope

② distance is larger

small slope



less steep

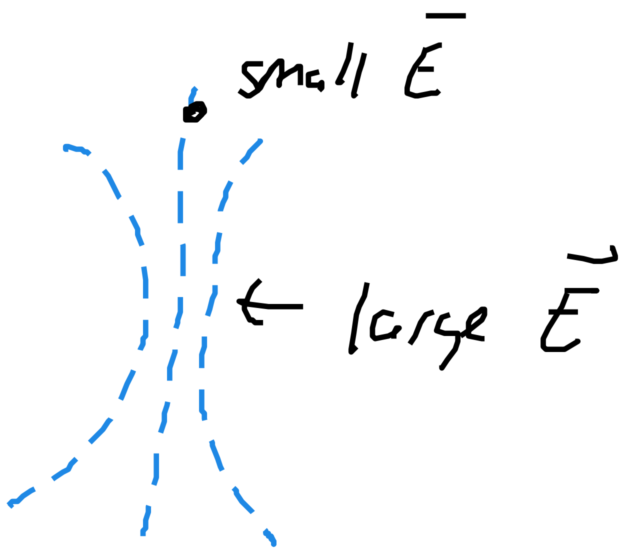


Steeper

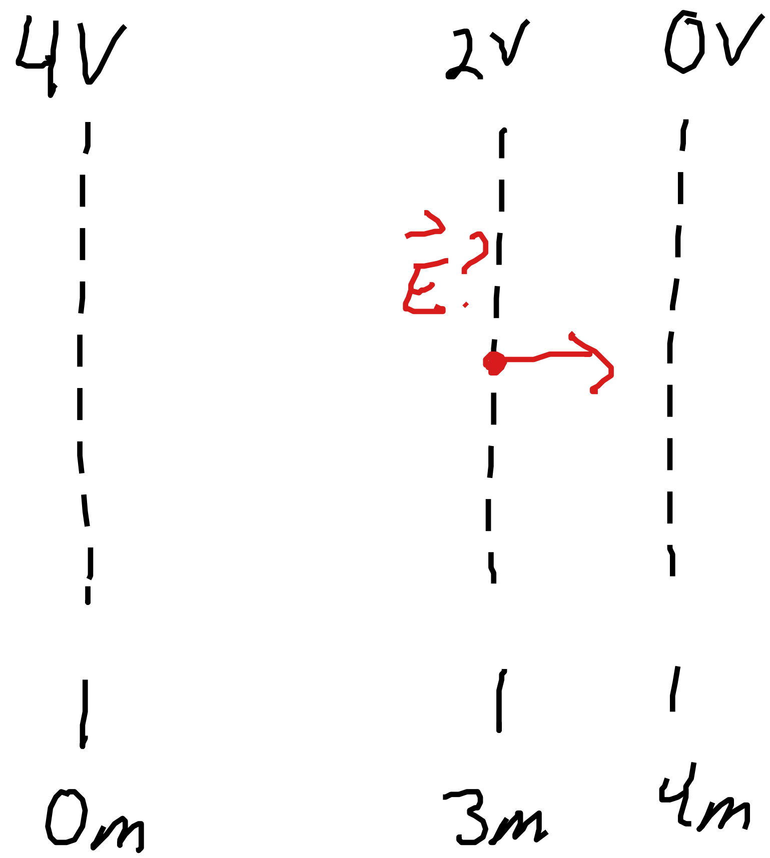
Electric Field Vector

$\vec{E}$

- downhill
- ⊥ to equipotentials
- magnitude is proportional to how steep the terrain is (slope)



$$E = \frac{\Delta V}{d} \text{ for small } d$$

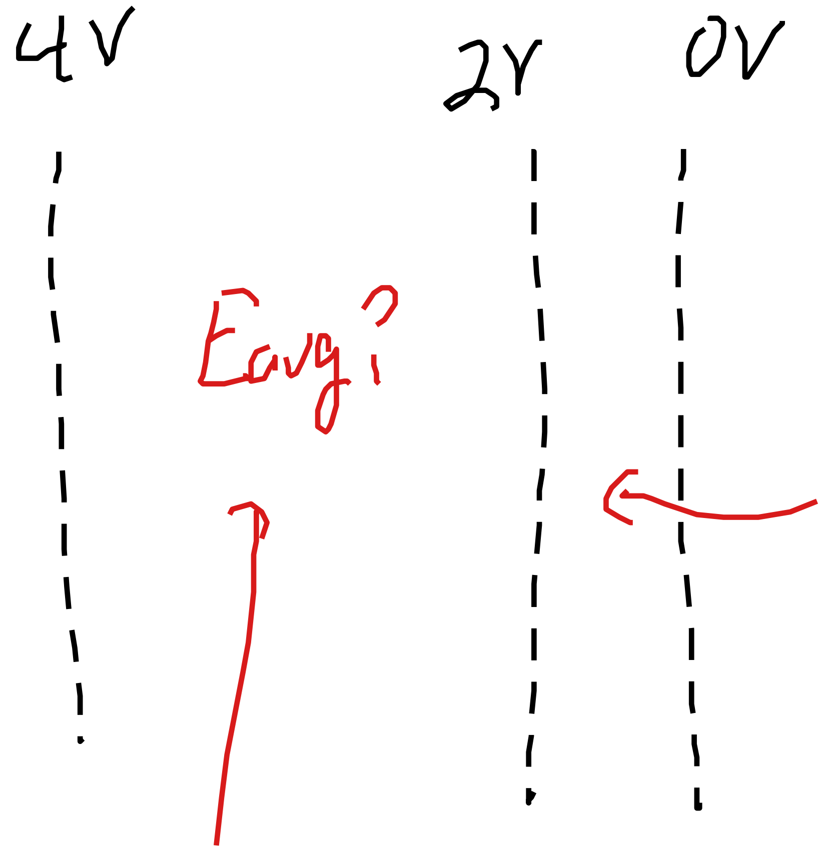


$$E = \frac{\Delta V}{d}$$

What is d?

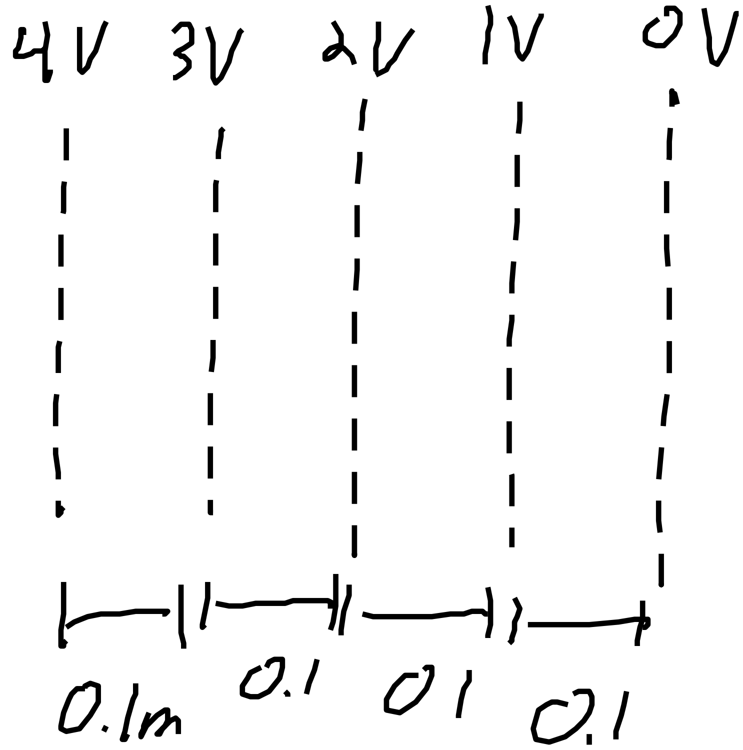
Problem: the changes are too rapid here

$E_{avg} = \frac{\Delta V}{d}$ between two equipotential lines



$\frac{2V - 0V}{4m - 3m} = \frac{2}{1} = 2\frac{V}{m}$

$E_{avg} = \frac{4V - 2V}{3m - 0m} = \frac{2}{3}\frac{V}{m}$



$E = \text{constant}$

$E = \frac{\Delta V}{d} = \frac{1V}{0.1m}$

$= 10 \frac{V}{m}$

$\vec{E}$ points in direction a $\oplus$ target charge will feel a force in

force a charge feels → $\vec{F} = q_+ \vec{E}$ ← electric field at the charge

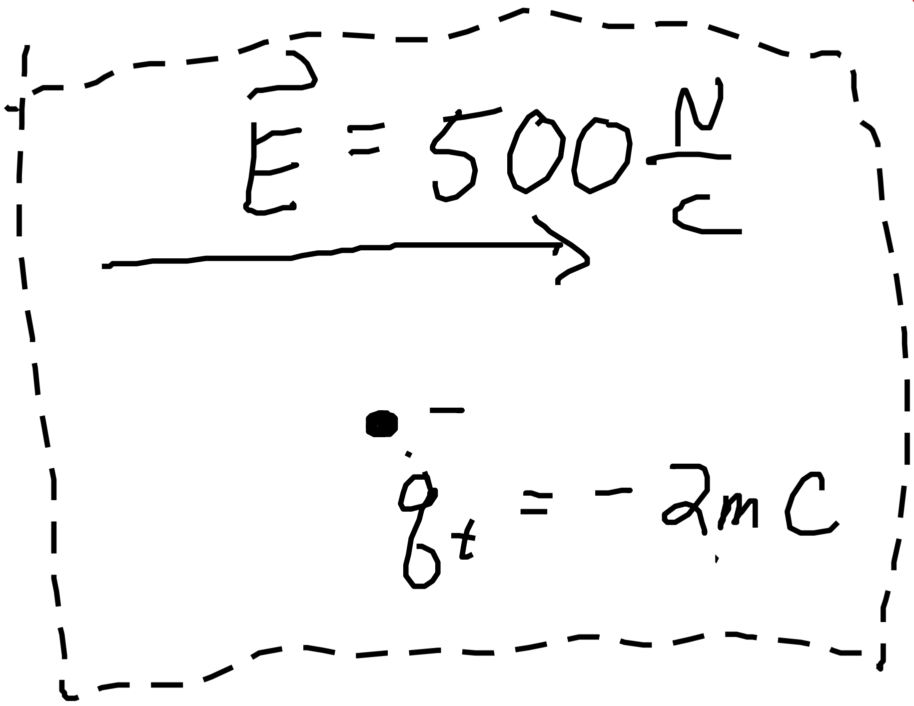
Compare

$PE = q_+ V$

Units: $E = \frac{\Delta V}{d} = \frac{F}{q_+}$

$\frac{V}{m} = \frac{N}{C}$

either one



$\vec{E}$ is uniform inside this box

What force does charge feel?

sign = direction

$\vec{F} = (-2\,mC)(500\frac{N}{C} \rightarrow)$

$= (2m)(500)N(- \rightarrow) = 1N \leftarrow$

⊖ feel a force in opposite direction of $\vec{E}$