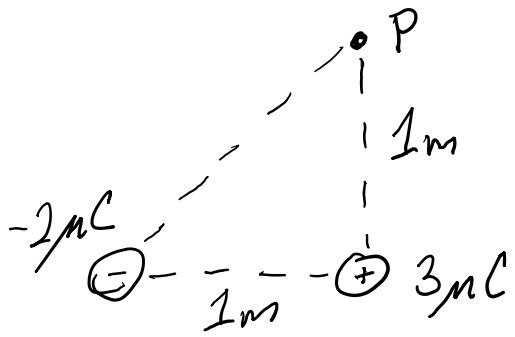
Practice Quizzam 3 Solutions

1. What is the electric potential at point P due to the two charges shown below?



For a point charge, $V = \frac{kq}{r}$.

Using superposition,

$$V = \frac{(9\times10^9 \frac{Nm^2}{C^2})(3\times10^{-6}C)}{1m} + \frac{(9\times10^9 \frac{Nm^2}{C^2})(-2\times10^{-6}C)}{\sqrt{2}\,m}$$

$$= 14000\,V$$

2. A electron is released from rest at the center of a parallel plate capacitor with a plate separation of d = 2 mm and voltage difference of ΔV = 100 V. In which direction does the electron move?
   a. Towards the positive plate.
   b. Towards the negative plate.
   c. In a direction parallel to the two plates.
   d. It remains stationary.

electron is negatively charged will be attracted to the positive plate (with higher voltage)

3. Below is a graph of electric potential along the x-axis.
   a. At which point is the magnitude of the electric field largest?

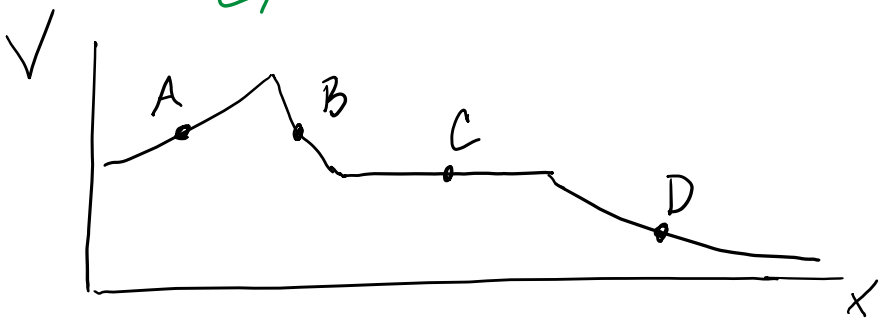
B, steepest (voltage changing fastest)

   b. At which point(s) is the electric field pointing in the negative x-direction?

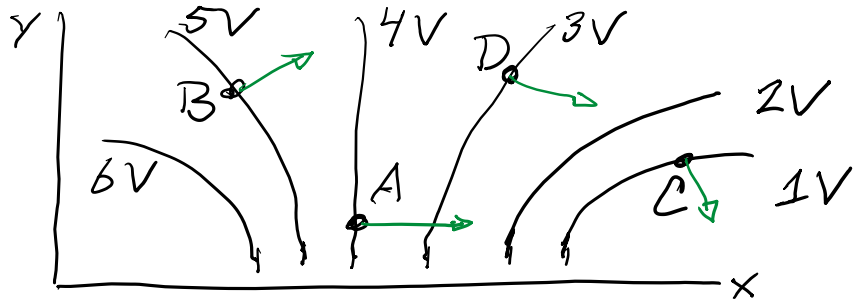
A, voltage increasing so E-field pointing left.

   c. Which point(s) might be inside of a conductor?

C, in a conductor E=0 so constant voltage.

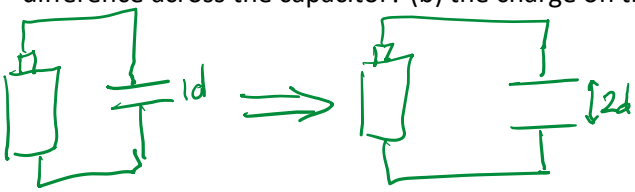


4. The below diagram shows a number of equipotential curves. Sketch the electric field at the points A, B, C and D.



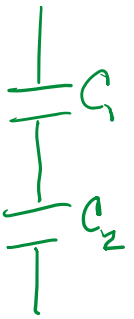
$\vec{E} = -\vec{\nabla}V$
points in direction of steepest descent, always ⊥ to equipotential lines. Strongest when lines are close.

5. A parallel plate capacitor with a plate separation of d is connected to a 3 V battery. If the plate separation is increased to 2d without disconnecting the battery, what happens to (a) the voltage difference across the capacitor? (b) the charge on the capacitator?



- voltage across capacitator fixed at 3V. by battery.
- Capacitance $C = \frac{\varepsilon_0 A}{d}$ halved.
- $Q = C\Delta V$ also halved.

6. There are two capacitors with capacitance C_1 = 3 μF and C_2 = 7 μF. What is the equivalent capacitance if they are connected (a) in series? (b) in parallel?



$C_{series} = \left(\frac{1}{C_1} + \frac{1}{C_2}\right)^{-1} = 2.1\,\mu F$

$C_{parallel} = C_1 + C_2 = 10\,\mu F$