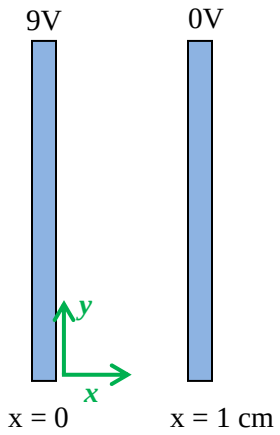
Lesson #14: Laplace's Equation **Name:** _____

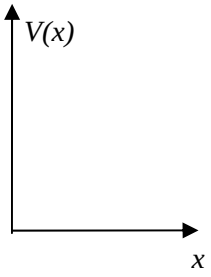
Study Sections 3.1 to 3.2.3 and then answer the following questions:

1. A 9-V battery is connected across a large (~infinite) capacitor, and the right conductor is grounded. Between the plates the potential will only vary in the *x* direction, so this is in effect a 1D problem.

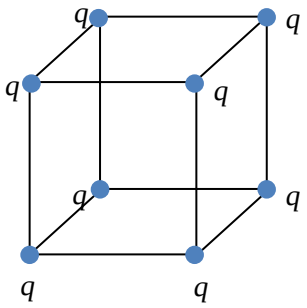
   Solve Laplace's equation in 1D to find the potential function $V(x)$ between the plates. Your solution should be specific to the given boundary conditions. Show your work.



2. Sketch your solution as a function of *x*, and label the values of the *V* and *x* intercepts.



3. Consider the cubic arrangement of fixed charges shown. If we place a positive charge in the very center of the cube, would it be in stable equilibrium? Explain your answer in terms of the concepts from Section 3.1 of Griffiths.



4. In Section 3.2.1 of Griffiths, a point charge is held above an infinite conducting plane. The author finds the potential everywhere above the *x*-*y* plane by replacing the conducting plane with a second point charge, claiming it will give the same answer (Eq 3.9).

   Why is this justified? Why does this "trick" give the same potential as in the original problem?

5. Does Eq. 3.9 give the correct potential beneath the conducting plane ($z < 0$) in the original problem?