1. Capacitor Charge Sharing

Consider the following circuit:

In the first phase, all of the switches labeled $\phi_1$ will be closed and all switches labeled $\phi_2$ will be open. In the second phase, all switches labeled $\phi_1$ open and all switches labeled $\phi_2$ close.

(a) Draw polarity (+ and - signs) on the two capacitors $C_1$ and $C_2$. (It doesn’t matter which terminal you label + or –; just remember to keep these consistent through phases 1 and 2!)

(b) Draw the circuit in the first phase and in the second phase. Keep your polarity in part (a) in mind.

(c) Find the voltages and charges on $C_1$ and $C_2$ in the first phase. Be sure to keep the polarities of the voltages the same!

(d) Now, in the second phase, find the voltage $V_x$.

(e) (BONUS) If capacitor $C_2$ did not exist (i.e., had a capacitance of 0F), what would the voltage $V_x$ be?
2. Nodal Analysis

(a) Solve the following circuit in steady state using nodal analysis.

(b) After the circuit settles in steady-state from the previous part, disconnect the charged capacitors from the circuit and connect them in the configuration shown below. Polarity from part (a) is preserved. What are the voltages across, currents through and charge stored in each of the capacitors $C_1, C_2, C_3$ and $C_4$ in steady-state after the charge redistributes itself?