1) Equivalent impedances

For the above circuit, determine the impedance between A and B as a single ratio (with s-domain impedance such as Ls, 1/Cs etc.)

2) Amplifier circuits

a. For the RL amplifier circuit, determine the relationship between Vout and Vin. As with RC amplifier circuits, KCL is a good starting point.
b. If $V_{in}=10\sin(\omega t)V$, with a frequency of 2kHz (remember to use radial frequency). Find $V_{out}$. 
3) Voltage/Current continuity

In the above circuit, the voltage is defined as follows:

\[ V_1 = \begin{cases} 
5V & t < 0 \\
0 & 0 < t 
\end{cases} \]  
(the voltage source turns off at t = 0)

a. At t=0⁻ (just before the voltage changes), determine the voltage across each resistor and the current through each resistor for the polarities indicated in the circuit.

b. At t=0⁺ (just after the voltage changes), determine the voltage across each component and the current through each component for the polarities indicated in the circuit.
In the above circuit, the voltage is defined as follows:

\[ V_1 = \begin{cases} 
5V & t < 0 \\
10V & 0 < t 
\end{cases} \]  
(the voltage source changes from 5V to 10V at \( t = 0 \))

c. At \( t = 0^- \) (just before the voltage changes), determine the voltage across each resistor and the current through each resistor for the polarities indicated in the circuit.

d. At \( t = 0^+ \) (just after the voltage changes), determine the voltage across each component and the current through each component for the polarities indicated in the circuit.

In the above circuit, the voltage source turns on at \( t = 0 \), \( V_1 = 20u(t) \). At \( t = 2E-4 \) [s], switch \( U_1 \) closes. (Only the value of \( R_1 \) is given but the variables \( C_1 \) and \( R_2 \) will be determined below.)

a. Determine \( C_1 \) such that the voltage across \( C_1 \) is 2.5 V when the switch closes.

b. Determine \( R_2 \) such that the steady state (\( t \gg \gg 0 \)) voltage across the capacitor is 7.5V.

c. At what time is the voltage across the capacitor 5V?
In the above circuit, switches U1 and U2 close at $t = 0$, and switches U3 and U4 close at $t = 0.5$ ms.

a. Determine the voltage across the capacitor as a function of time.

b. Determine the current across R1 as a function of time.