Name: SOLUTION

1. For the circuit shown, the switch is in the open position for a long time before $t = 0$, when it is closed instantaneously.

   a. Write the values of the inductor voltage and current and the capacitor voltage and current at $t = 0^-$. (5 points).

   \[ v_L(0^-) = 0 \text{ V} \quad i_L(0^-) = 1 \text{ A} \]
   \[ v_C(0^-) = 8 \text{ V} \quad i_C(0^-) = 0 \text{ A} \]

   \[ i_L(0^-) = \frac{11}{11} = 1 \text{ A} \]
   \[ v_C(0^-) = 11 - 3 \times 1 = 8 \text{ V} \]

   b. Write the values of the inductor voltage and current and the capacitor voltage and current at $t = 0^+$. (10 points).

   \[ v_L(0^+) = 1 \text{ V} \quad i_L(0^+) = 1 \text{ A} \]
   \[ v_C(0^+) = 8 \text{ V} \quad i_C(0^+) = 1 \text{ A} \]

   \[ V_A = \frac{9}{1} \left( V_A - 11 \right) + \frac{9}{1} \left( V_A - 8 \right) + 1 = 0 \]
   \[ 2V_A = 18 \quad \Rightarrow \quad V_A = 9 \text{ V} \]

   \[ i_C(0^+) = \frac{9 - 8}{1} = 1 \text{ A} \]
   \[ v_L(0^+) = V_A - 8 \times 1 = 9 - 8 = 1 \text{ V} \]

2. Express the following waveform in terms of unit step and ramp functions ($u(t)$, $r(t)$). (10 points).

   \[ f(t) = r(t) - r(t-1) - 2u(t-1) + 3r(t-1) \]
   \[ -3r(t-2) - u(t-2) - r(t-2) + r(t-3) - 2u(t-3) + 2r(t-3) - 2r(t-4) + r(t-4) - r(t-5) \]

   OR

   \[ r(t) + 2r(t-1) - 2u(t-1) - 4(t-2) - u(t-2) + 3r(t-3) - 2u(t-3) - r(t-4) - r(t-5) \]