Problem 1

Given:
\[ R_1 = 1 \Omega, \quad R_2 = 2 \Omega \]
\[ L = 1 \text{H}, \quad C = 0.5 \text{F} \]
\[ v_s(t) = 6\sin(2t) \text{ V} \]

Find:
1. Solve the circuit for the \( v_d(t) \) by:
   a. Show conversion to phasors.
   b. Show conversion to impedances.
   c. Show how you would find the solution. It is NOT necessary to calculate the solution.

\[ v_s(t) = 6\sin(2t) = 60\sin(\frac{2\pi}{2}t) \]
\[ \omega = 2\pi \text{ rad/sec} \]
\[ v_s(j\omega) = 60e^{-j\pi/2} = 60e^{-90} = 0 - j60 \]

b) \[ Z_{R_1} = R_1 = 1 \Omega \]
\[ Z_{R_2} = R_2 = 2 \Omega = 2 - j0 \]
\[ Z_L = j\omega L = j(2)\Omega, \quad 0 - j = 2.45\times10^6 \]
\[ Z_{eq} = \frac{1}{\frac{1}{Z_{R_1}} + \frac{1}{Z_{R_2}} + \frac{1}{Z_L}} = 1.45\times10^6 + j90 \]

\[ V_0 = V^+ - V^- = \left( \frac{Z_{R_1} + Z_L + Z_{R_2}}{Z_{R_1} + Z_{R_2} + Z_L} \right) V_s \]
\[ = \frac{1}{3} \times (3 + 155 - 3) = 3.33 \]
\[ V_0 = -4 \text{ V} \]