Problem 1:

Find the RMS values for both voltages shown. The formula for RMS is

\[ V_{\text{rms}} = \sqrt{\frac{1}{T} \int_0^T v(t)^2 \, dt} \]

\[ V(t) = \begin{cases} 2t & 0 < t < 1 \\ -1 & 1 < t < 2 \end{cases} \]

\[ V^2(t) = \begin{cases} 4t^2 - 8t + 4 & 0 < t < 1 \\ 1 & 1 < t < 2 \end{cases} \]

\[ V_{\text{rms}} = \sqrt{\frac{1}{T} \int_0^T v(t)^2 \, dt} \]

See Problem 2 on the next page.
Problem 2:

![Circuit Diagram]

Given:
- \( R_1 = 10 \, \Omega \)
- \( R_2 = 20 \, \Omega \)
- \( L = 4 \, \text{mH} \)
- \( C = 2 \, \mu\text{F} \)
- \( i_d(t) = 2 \, \text{A} \)
- \( v_d(t) = 4\sin(2\pi t) \, V \)

Find:
1. Solve the circuit for the \( V_{C2}(t) \) and \( i_2(t) \).
2. For any sinusoidal steady state part of the problem:
   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.
3. For partial credit, show circuits used.

For \( V_s = 0 \), \( i_s = 0 \)

\[ V_s(\frac{2\pi}{1}) = 4 \times \pi / 2 \]

\[ Z_R = 10 \times \angle 0 \]

\[ Z_L = j(2\pi)(4 \times 10^{-3}) = j(2\pi)(2 \times 10^{-3}) \]

\[ Z_{C2} = j\left(\frac{1}{2\pi(10^{-3})}\right) = j(2\pi(10^{-3})) \]

Combining:
- \( L = L_{d1} + L_{d2} \)
- \( V_{C2} = V_{C2(d1)} + V_{C2(d2)} \)

Solve for \( i_1, V_3 \)

\[ V_A \text{ MESH} \]

\[ \text{KVL M1} \]

\[ -V_s + Z_{L1} \cdot i_1 + Z_{C2} \cdot i_1 = 0 \]

\[ V_3 = (Z_{R1} + Z_{L1} + Z_{C2}) \cdot i_1 - (Z_{R2} + Z_{C2}) \cdot i_2 \]

\[ \text{KVL M2} \]

\[ (Z_{R1} + Z_{C2}) \cdot i_1 + Z_{C2} \cdot i_2 = 0 \]

\[ (Z_{R2} + Z_{C2}) \cdot i_1 + (Z_{R2} + Z_{C2}) \cdot i_2 = 0 \]

Conclusion: \( V_{C2(d2)} = Z_{C2} \cdot i_2 \)
**Problem 2:**

Given:
- $R_1 = 10 \, \Omega$, $R_2 = 20 \, \Omega$
- $L = 4\, \text{mH}$, $C = 2\, \mu\text{F}$
- $i(t) = 2 \, \text{A}$
- $v_d(t) = 4\sin(2\pi t) \, \text{V}$

Find:
1.) Solve the circuit for the $v_{C2}(t)$ and $i(t)$.
2.) For any sinusoidal steady state part of the problem:
   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.
3.) For partial credit, show circuits used.

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Diagram:

**Via Voltage Divider**

Given:
- $Z_L$, $Z_C$

Find:
- $v_L = \frac{Z_L}{Z_L + Z_C} \cdot v_T$

**Temperature**

- $Z_{eq} = Z_L + Z_R + \left(\frac{Z_{C1}Z_{C2}}{Z_{C1} + Z_{C2}}\right) / Z_{C1}$

- $V_{C2} = \frac{(Z_{C1} + Z_{C2}) / Z_{C2}}{Z_{eq}} \cdot V_T$