1. Circle T (true) or F (false) for each of these statements.

(a). T F At the resonant frequency $\omega_0$, circuit impedance is purely real.
(b). T F The RMS voltage value is greater than the maximum voltage value.
(c). T F Capacitors in series add.
(d). T F The average power of a purely capacitive load is zero.
(e). T F An inductive load has a lagging power factor.

2. Equivalent Capacitance and Inductance:

2(a). Find the equivalent capacitance $C_{eq}$ for the capacitive circuit below.

\[ C_{eq} = \]
2(b). Find the equivalent inductance $L_{eq}$ for the inductive circuit below.

\[ L_{eq} = \]

3. Sinusoidal Voltage, Phasor Voltage and RMS Voltage:
A sinusoidal voltage is given by $v(t) = 25 \cos(2000t + \pi/3)$.

3(a). What is the phasor voltage $V$?

$V = $

3(b). What is the radial frequency $\omega$?

$\omega = $

3(c). What is the phase offset $\phi$ in both radians and degrees?

$\phi = $ in radians \hspace{1cm} \phi = $ in degrees

3(d). What is the RMS value $V_{RMS}$ of $v(t)$?

$V_{RMS} = $
4. Phasor Domain and Source Transformation:
Consider the RLC circuit below. The sinusoidal voltage source is given by \(v_s(t) = 5 \cos(5000t)\).

\[
\begin{array}{c}
\text{4 µF} \\
\text{5 kΩ} \\
\text{10 mH}
\end{array}
\]

4(a). Convert the circuit to the phasor domain and draw it below.

4(b). Find the total circuit impedance \(Z_{eq}\).

\[
Z_{eq} = \ldots
\]
4(c). Does $Z_{eq}$ have any reactive component?  
(circle one): Yes No

4(d). Use source transformation to find the phasor voltage $V_2$ across the 10 mH inductor. Also find the corresponding sinusoidal voltage $v_2(t)$. Draw a small sketch of each source transformation that you make.  
**Hint:** You can use your result from 4(b) if you only transform the circuit once.

$$V_2 =$$

$$v_2(t) =$$
5. Thévenin’s Equivalent Circuit in Phasor Domain:
Consider the circuit below. The voltage source $V_s$ and all impedences shown are in phasor form.

\[ V_s = 10 \angle 0^\circ \]

5(a). Find the open-circuit phasor voltage $V_{TH}$ across terminals a and b of the Thévenin equivalent circuit.

$V_{TH} =$
5(b). Find the Thévenin impedance $Z_{TH}$ of the Thévenin equivalent circuit, by finding the equivalent impedance between terminals a and b.

$$Z_{TH} = \underline{\text{ }}$$

6. Maximum Power Transfer:

6(a). Using the circuit in the previous problem 6, what value of load impedance $Z_L$ maximizes the average (real) power transferred to the load $Z_L$? You don’t have to prove what value will provide maximum power, just use the appropriate value of $Z_L$ that does provide maximum power.

$$Z_L = \underline{\text{ }}$$

6(b). Using the value of $Z_L$ obtained above, find the average (real) power $P_L$ absorbed by the load $Z_L$.

$$P_L = \underline{\text{ }}$$
7. Power Factor and Average, Reactive, Complex and Apparent Power:
Consider the circuit below.

\[ V = 50 \angle 0^\circ \]

\[ Z_L = 100 + j173.2 \Omega \]

7(a). Find the average power \( P \) absorbed by the load impedance \( Z_L \).

\[ P = \]

7(b). Find the reactive power \( Q \) absorbed by the load impedance \( Z_L \).

\[ Q = \]

7(c). Find the complex power \( S \) absorbed by the load impedance \( Z_L \), and the apparent power \(|S|\).

\[ S = \quad |S| = \]

7(d). Compute the power factor for the load impedance \( Z_L \).

\[ pf = \]

7(e). Is the power factor leading or lagging? (circle one): leading    lagging