TEAM NAME (printed): _____ **SOLUTIONS** _____

Team members **PRESENT** (printed full names): _____

_____

_____

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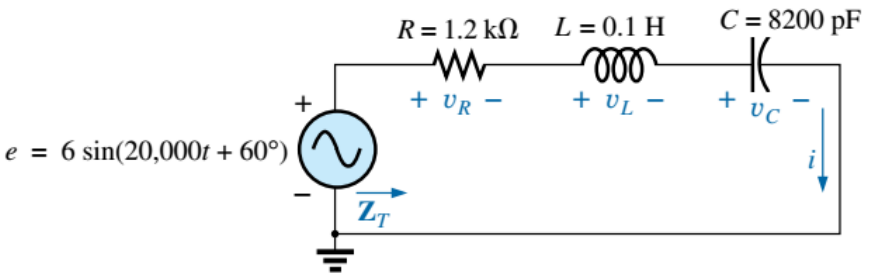
All 7 questions are equally weighted. Show your work and BOX-IN your final answer for credit.



For the circuit shown above, answer the following questions:

1. Determine **ZT**

$Z_T = R + jX_L - jXc$

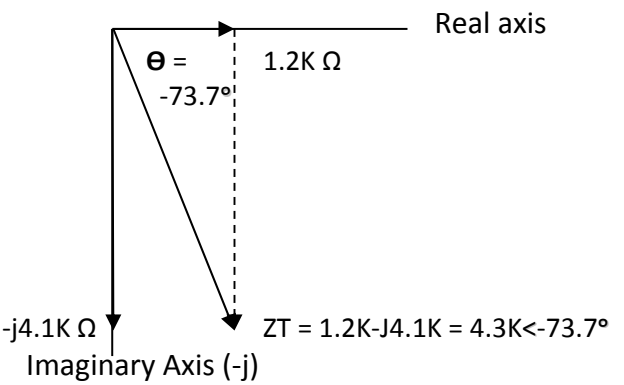
$Z_T = 1.2K + j\ 2.0K - j\ 6.1K$

$Z_T = 1.2K - j\ 4.1K$ (circuit is mostly capacitive)

$Z_T = 4.27K\ \Omega < -73.7°$

ZT = 4.3K Ω < -74°

2. Draw the impedance diagram (titled and labeled, angles shown)

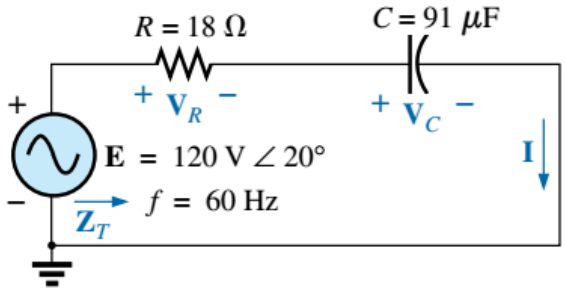


3. Find the current **I**, in phasor form

$E = 4.2V_{rms} < +60°$

$I = E/ ZT = (4.2V_{rms} < +60°)/(ZT = 4.27K < -73.7°)$ = **$1.0mA_{rms} < 134°$**

✓ ICE man



Note: **E** = 120VRMS < 20°

For the circuit shown above, answer the following questions:

4. Determine **ZT**

ZT = R – jXc

ZT = 18 Ω – j29.1 Ω

ZT = 34.2 Ω < -58.3°

ZT = 34 Ω < -58°

5. Find **Vc** in phasor form

Need: Xc = 1/ (2*π*f*C) = 29.1 Ω < -90°

Will use Vdivider to find Vc

Vc = Vs (-jXc/ ZT) = (120V_{rms} < +20°)/(29.1 Ω < -90°/ 34.2 Ω < -58.3°)

Vc = (120V_{rms} < +20°)/ (0.85 Ω < -32°) = (102.1V_{rms} < -11.7°)

102Vrms < -12°

Check KVL: Vr = (120V_{rms} < +20°)/(18 Ω < 0°/ 34.2 Ω < -58.3°) = (63.2V_{rms} < +78.3°)

Does Vs = Vc + Vr? (102.1V_{rms} < -11.7°) + (63.2V_{rms} < +78.3°)

✓ Vs = (120.1V_{rms} < +20.1°) **(good enough, it checks!)**

6. Find the average power delivered to the circuit

$P_{avg} = V_{rms} * I_{rms} * \cos(\Theta_V - \Theta_I)$ (don't have I_{rms})

$I_{rms} = V_{rms} / Z_T$ = (120V_{rms} < +20°)/(34.2 Ω < -58.3°) = 3.51A_{rms}< 78.3°

$P_{avg} = V_{rms} * I_{rms} * \cos(\Theta_V - \Theta_I)$ = 120V_{rms} * 3.51A_{rms} * cos (20°-78.3°) = 221 Watts

Check this:

✓ $P_{avg} = Vr_{rms}^2 / R$ = (63.2V_{rms})^2 / 18 Ω = 222 watts (rounding?)

221 Watts

7. Is the power factor for this circuit leading or lagging? Explain.

The voltage is at +20° and the current is at +78.3°. Therefore, the current **leads** the voltage.