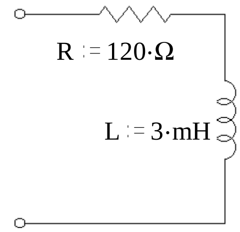
ECE 2210 Homework Ph3 Phasors c

Name________________________

Warning: This homework is longer than normal -- DO NOT put it off until the last minute.
In the week of the exam, lab will be replaced by a video lecture

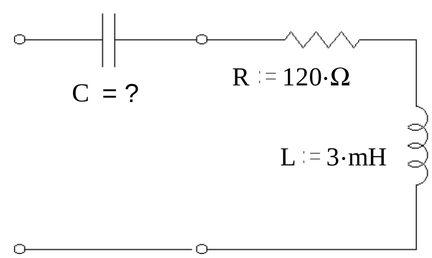
1. For the circuit shown, find the following:



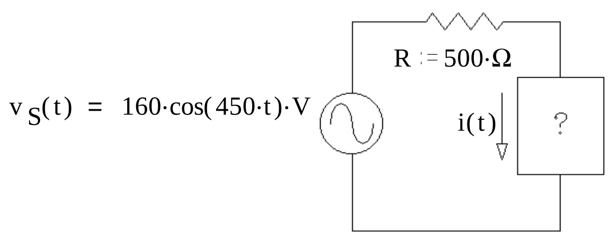
a) At what frequency would the magnitude of the total impedance be 240Ω?

b) At this frequency, what is the phase angle of the impedance?

c) At this frequency, you want to add a capacitor in series to make the circuit appear purely resistive (the impedance has no imaginary component). Find the value of the capacitor.



2. You need to design a circuit in which the current ($i(t)$) leads the voltage ($v_S(t)$) by 36^o of phase.
   a) What should go in the box: R, L, C?
   b) Find its value.



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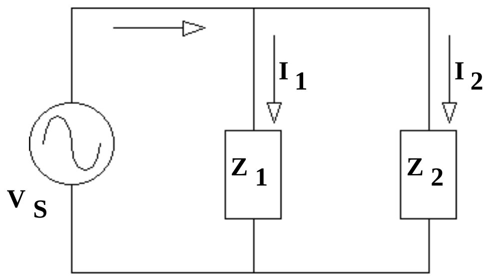
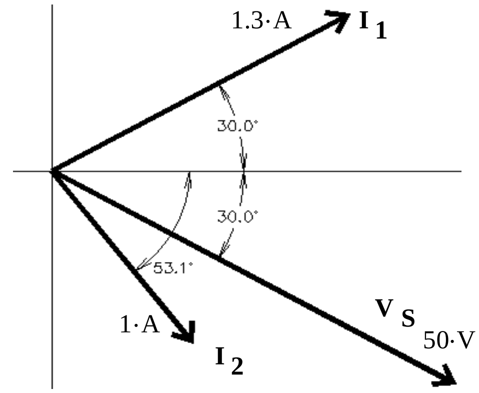
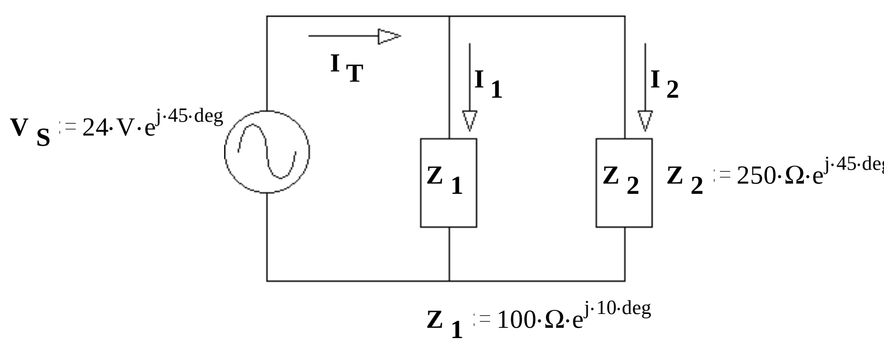
3. The phasor diagram at right shows the source voltage and two branch currents of a parallel circuit. Find the impedance of each of the two branches.





4. a) Find all the currents, $\mathbf{I_1}$, $\mathbf{I_2}$, and $\mathbf{I_T}$.



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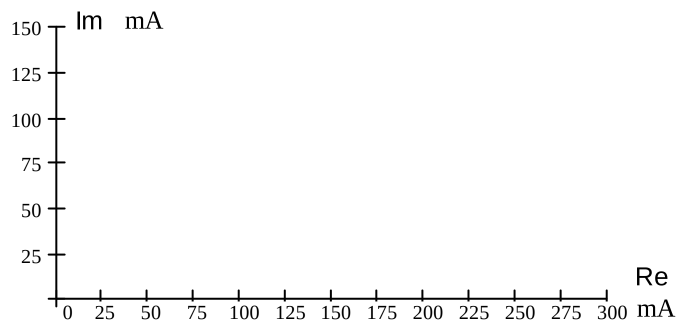
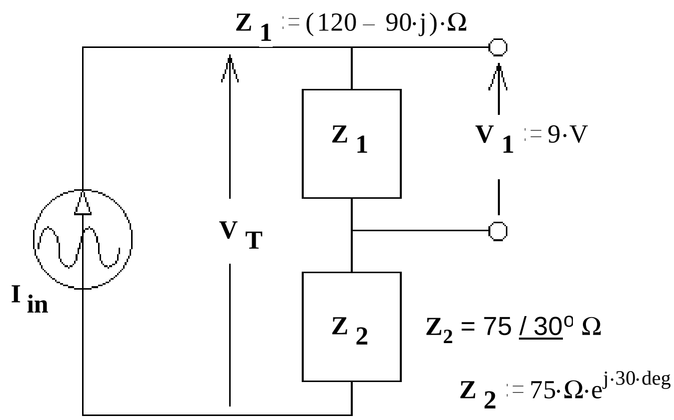


b) Draw a phasor diagram showing $\mathbf{I_1}$, $\mathbf{I_2}$, and $\mathbf{I_T}$ to scale so that you can show that they obey KCL.

5. a) Find the AC current source, $\mathbf{I_{in}}$ in polar form.

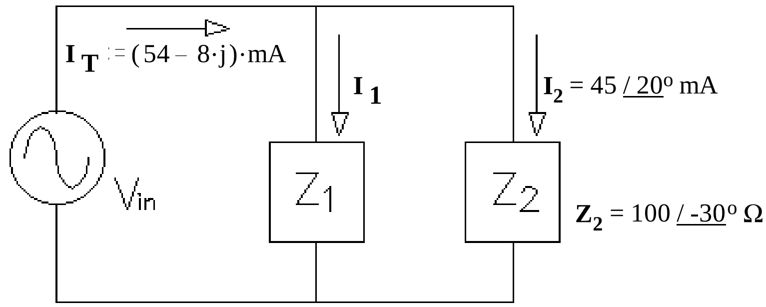


b) Find $\mathbf{V_T}$.

c) Choose one: i) The source current leads the source voltage.

ii) The source current lags the source voltage.

6. a) Find $\mathbf{Z_1}$.



b) To make $\mathbf{Z_1}$ in the simplest way, what part(s) would you need? Just determine the needed part(s) from the list below and state why you made that choice, don't find the values.

resistor	capacitor	inductor	power supply	current source
Thevenin resistor	Ideal transformer	voltmeter	ammeter	scope

c) Choose one: i) $\mathbf{I_2}$ leads the source voltage ($\mathbf{V_{in}}$) ii) $\mathbf{I_2}$ lags the source voltage ($\mathbf{V_{in}}$)

d) Choose one: i) $\mathbf{I_1}$ leads $\mathbf{I_2}$ ii) $\mathbf{I_1}$ lags $\mathbf{I_2}$

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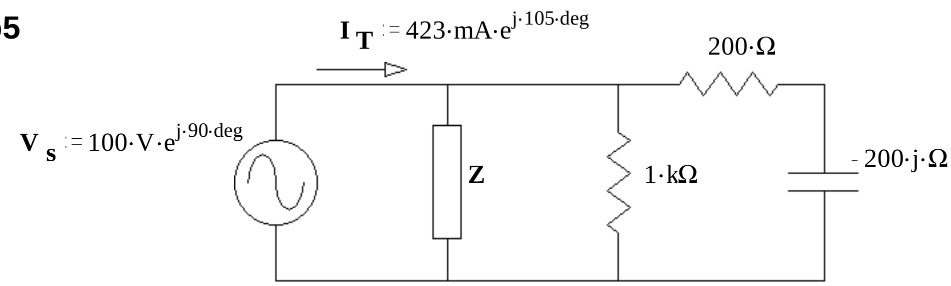
7. Find **Z**.



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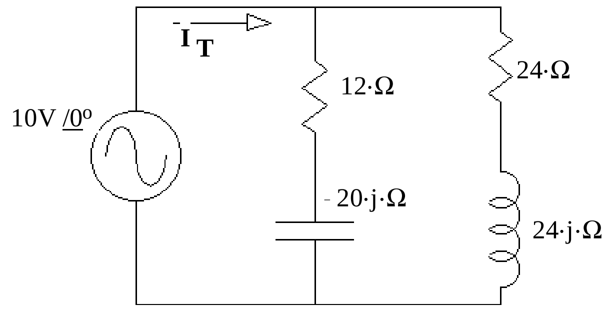
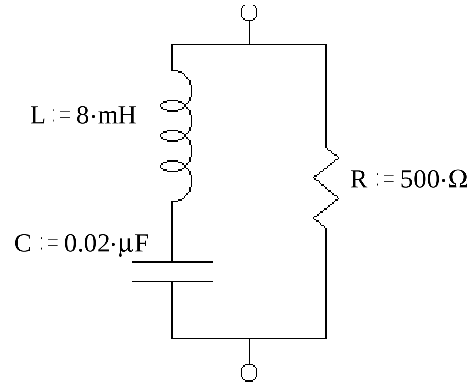
8. a) Find the total impedance of the circuit.



b) Find $\mathbf{I_T}$.

9. Find $\mathbf{Z_{eq}}$ in simple polar form.

$f := 8000 \cdot Hz$



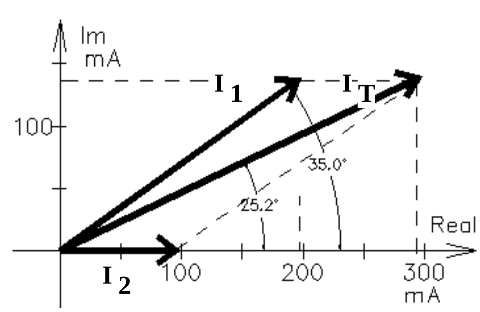
Answers

1. a) $11 \cdot kHz$ b) 60^o c) $0.0694 \cdot \mu F$

2. a) C b) $6.12 \cdot \mu F$

3. $\mathbf{Z_1} = (19.2 - 33.3 \cdot j) \cdot \Omega$ $\mathbf{Z_2} = (46.0 + 19.6 \cdot j) \cdot \Omega$

4. a) $(0.197 + 0.138 \cdot j) \cdot A + 0.096 \cdot A = 0.293 + 0.138j \cdot A$ b)



5. a) 60 $\underline{/ 36.87^o}$ mA b) 11.54 $\underline{/ 21^o}$ V c) i)

6. a) 172 $\underline{/ 53.4^o}$ Ω b) phase angle > 0, resistor and inductor

   c) i) d) ii)

7. 657 Ω $\underline{/67.4^o}$ 8. a) 21.86Ω $\underline{/-20.38^o}$ b) 0.457A $\underline{/20.38^o}$

9. 382Ω $\underline{/-40.2^o}$