Note Title 01-03-2012

Electric & Magnetic Circuits : Tutorial 4

Problem 1:

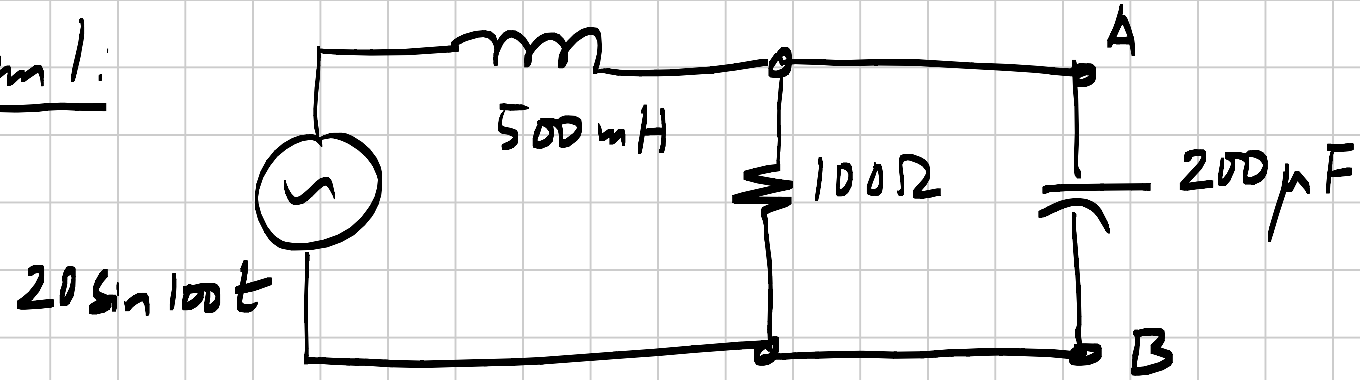
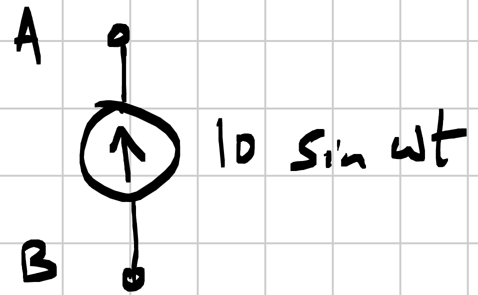


Fig. 1

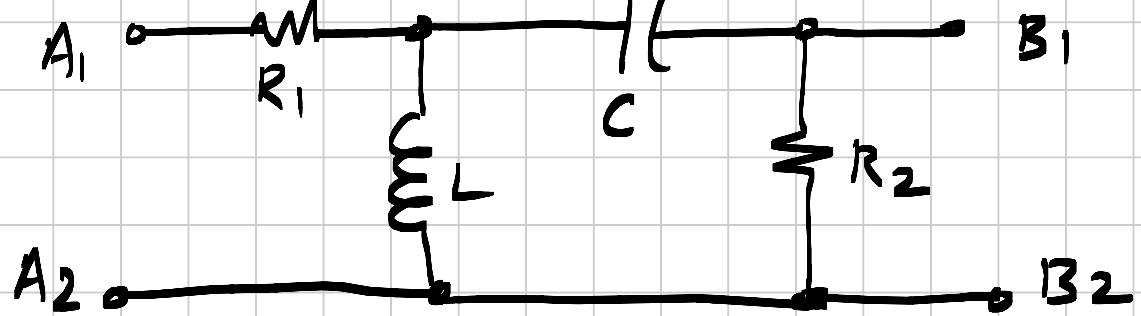
Determine all branch voltages and currents in steady state, and a phasor diagram representing these voltages and currents.

Problem 2:

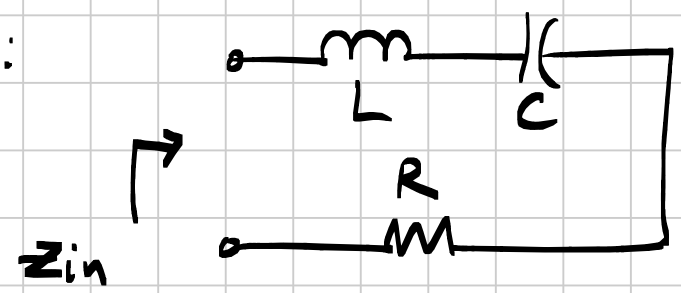


Repeat problem 1 when the current source shown is connected to terminals A & B in Fig. 1.

Problem 3: Determine the y-parameters of the following network.



Problem 4:



The series RLC network is excited by a voltage at the resonant frequency.

Determine (a) The energy stored in the network at any time.

(b) The energy dissipated in the resistor every cycle

(c) What is the ratio of the two energies above?

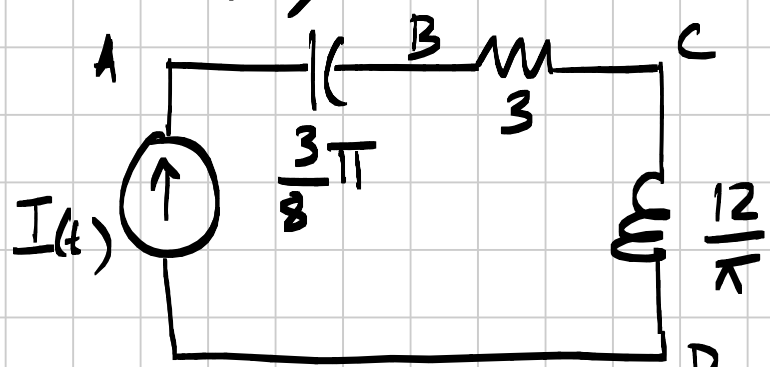
Problem 5: Represent the following in phasor notation

(a) $2\sin(30t)$ (b) $2\sin(30t+2)$ (c) $-2\sin(30t-5\pi/6)$

(d) $-2\cos(-30t+5\pi/6)$ (e) $-2\sin\left(30t-\frac{5\pi}{6}\right)+2\cos\left(30t-\frac{5\pi}{6}\right)$

(f) $2\sin(-30t+5\pi/6)+2\sin(30t+5\pi/6)$

Problem 6:



The following observations are made about the sinusoidal current source in the figure.

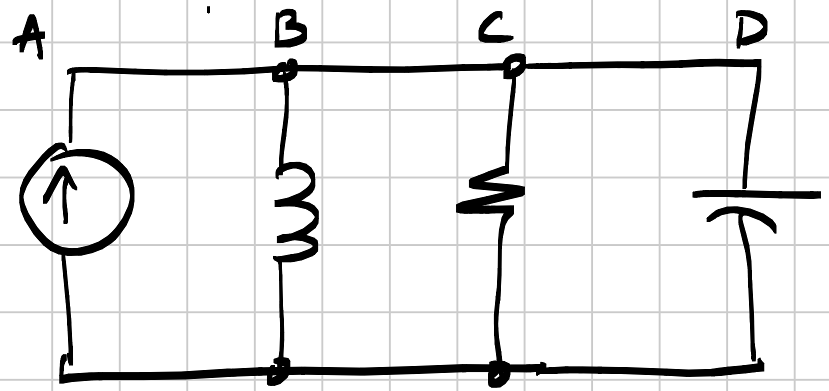
(a) At time t_1, $I = 10A$ and dI/dt is negative.
(b) At time $t_1 + 2$, $I = 10A$ and dI/dt is positive.

(c) In the time interval $t = t_1$ to $t = t_1 + 2$, $I(t)$ has never been more than 10 A.

(d) The energy stored in the inductance has a maximum value of $2400/\pi$ Joules.

Determine the steady state voltage waveforms across the inductor, resistor and capacitor. What is the energy dissipated in the resistor over one cycle?

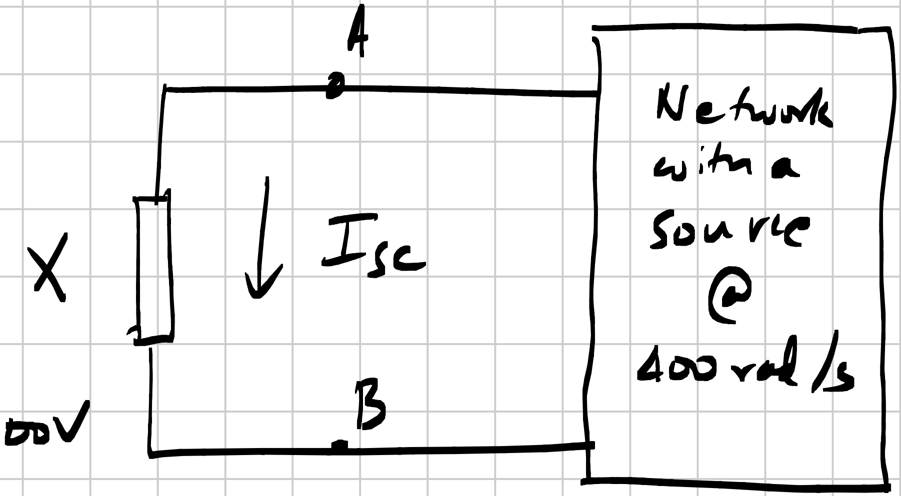
Problem 7:



In the network shown in the figure, the currents in the sections AB, BC and CD have maximum values of 5, 5 and 4 A respectively, and the maximum voltage across the parallel combination is 120 V. Determine the values of the impedances of the three branches of the network and the phase angle between I_{AB} & I_{CB}.

Problem 8:

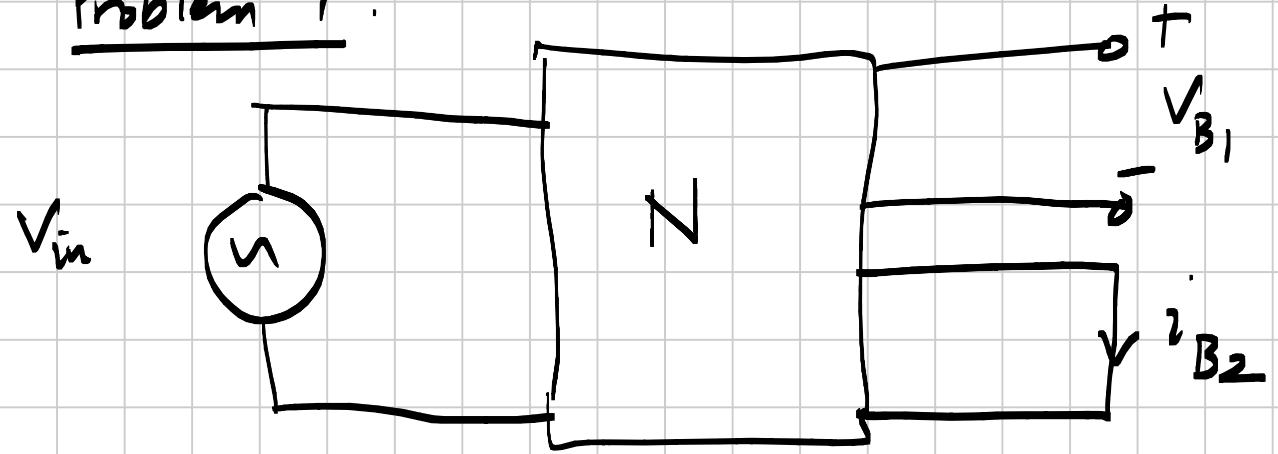
(a) When the element X across AB is a 2.5 μF capacitance, the voltage $V_{AB} = E_1$, where $|E_1| = 100V$



(b) When X is a 2H inductor, $V_{AB} = E_2$, where $|E_2| = 40V$, E_2 leads E_1 by 90°.

(c) Determine I_{sc}, the short circuit current flowing from A to B if X is replaced by a short, and its phase angle w.r.t E_1.

Problem 9:



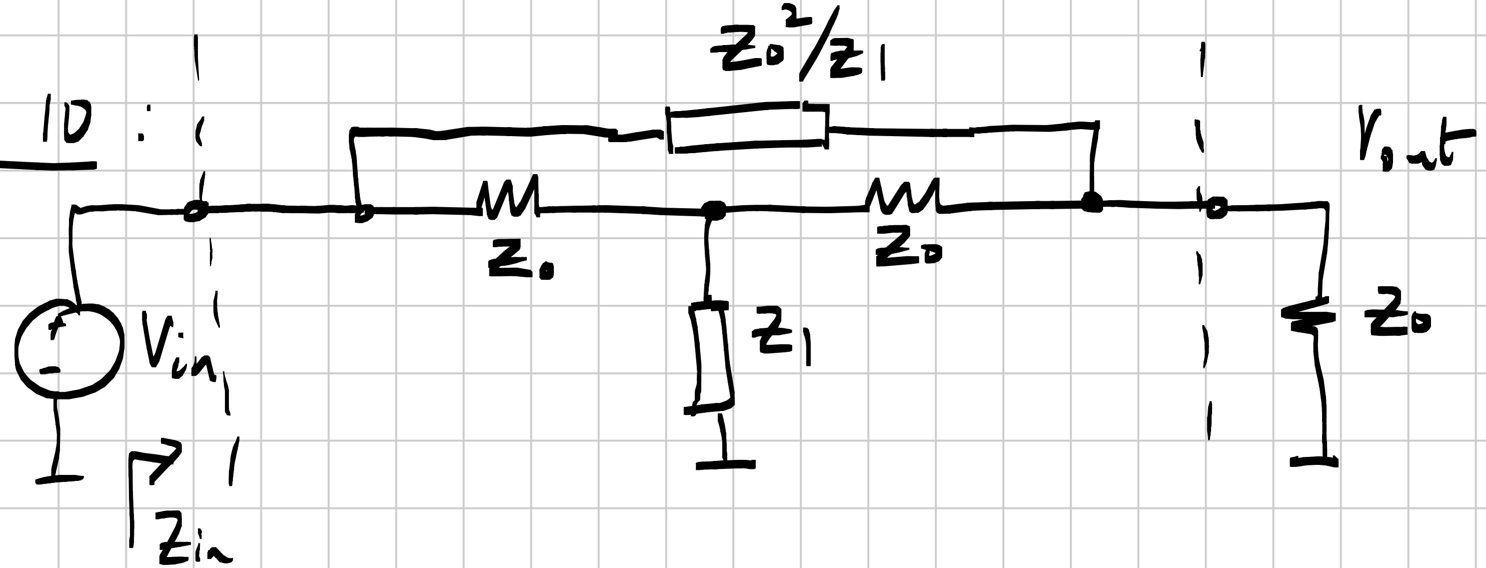
The network N consists of R, L & C and operates in steady state at freq. ω_1.

A particular branch voltage V_{B1} & branch current i_{B2} are denoted in phasor notation by V_A & I_B.

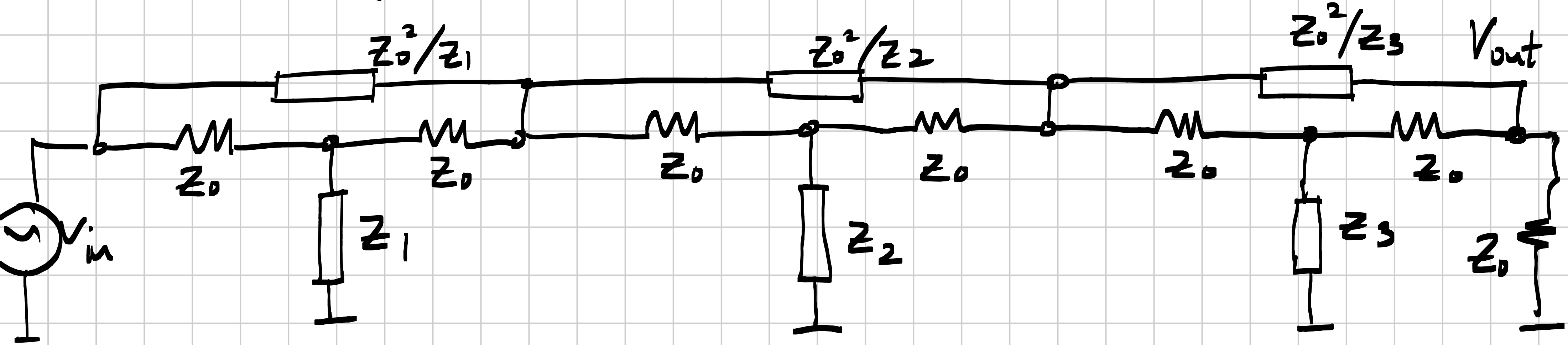
(a) Now all resistors and inductors in the network are multiplied by the number k, while all capacitors are divided by k. Determine V_{B1} & i_{B2}, in phasor notation.

(b) In the original network, all inductors and capacitors are decreased by "k" (Resistors are not changed), and input frequency is increased by k. Determine V_{B1} & i_{B2} now.

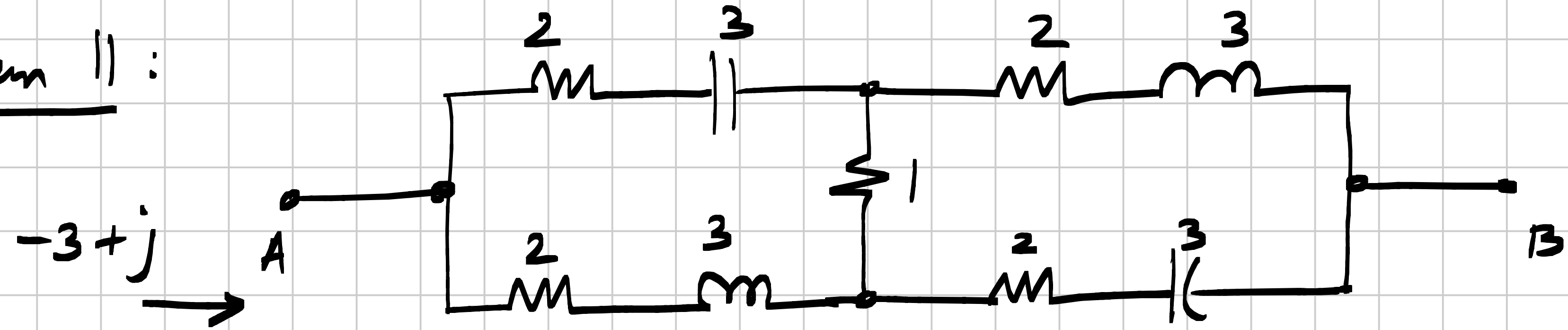
Problem 10 :



Determine the looking-in impedance Z_{in} and V_{out}/V_{in}. Do the same for the network below.



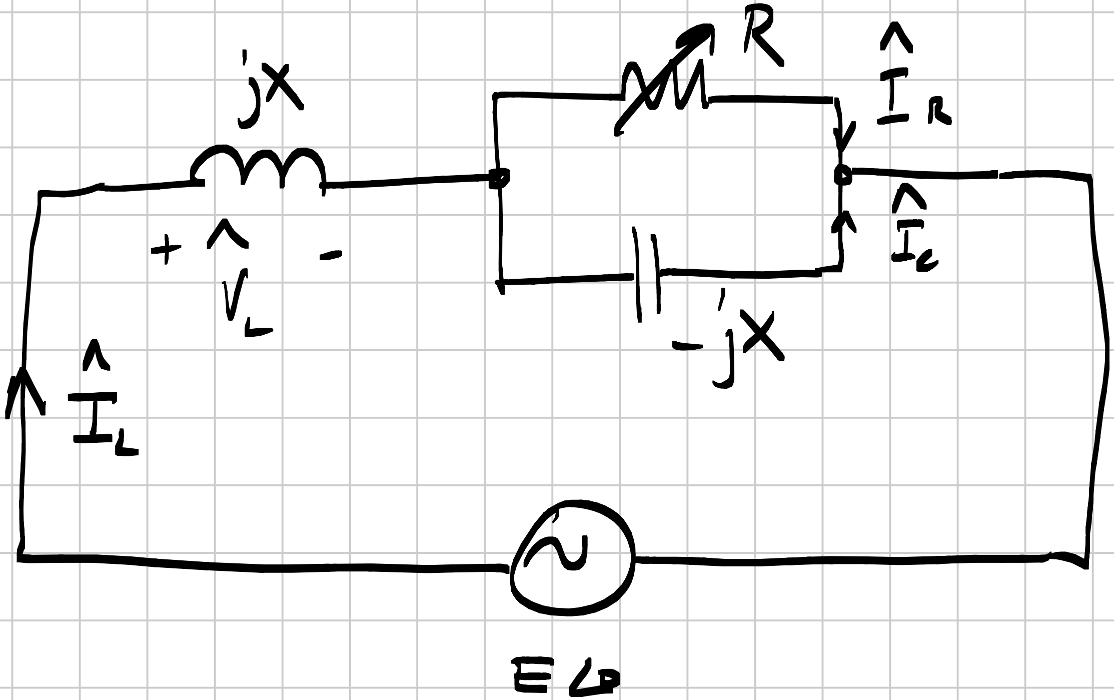
Problem 11:



All resistance & reactance values are in ohms.

A current $(-3+j)$ enters the network at A and leaves at B. Determine the current through the $1\,\Omega$ resistor.

Problem 12 :



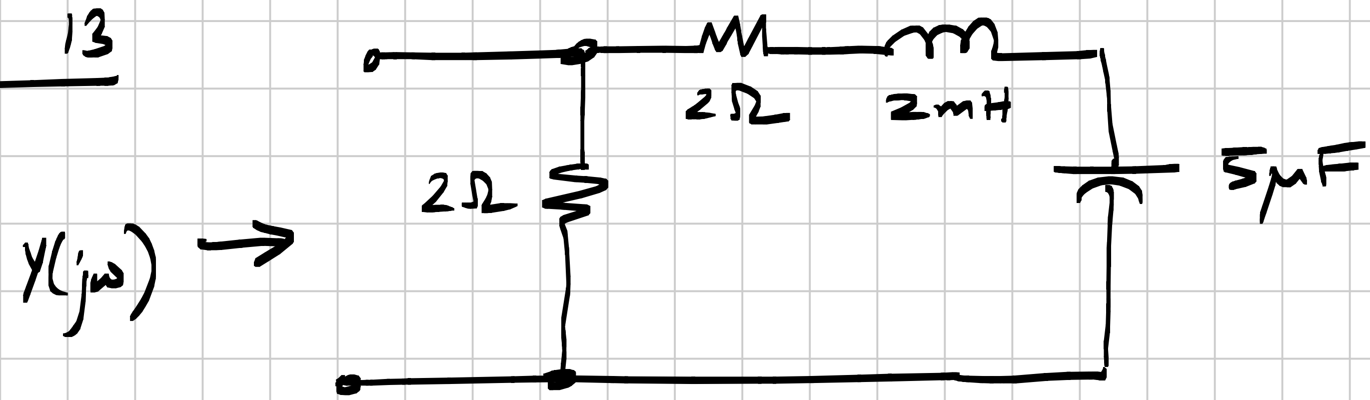
The inductor and capacitor have the same reactance at the frequency of excitation.

(a) Calculate I_R, the current through the resistor, in terms of E, X & R.

(b) Draw a phasor diagram indicating the current through and voltage across R, L, C and the source.

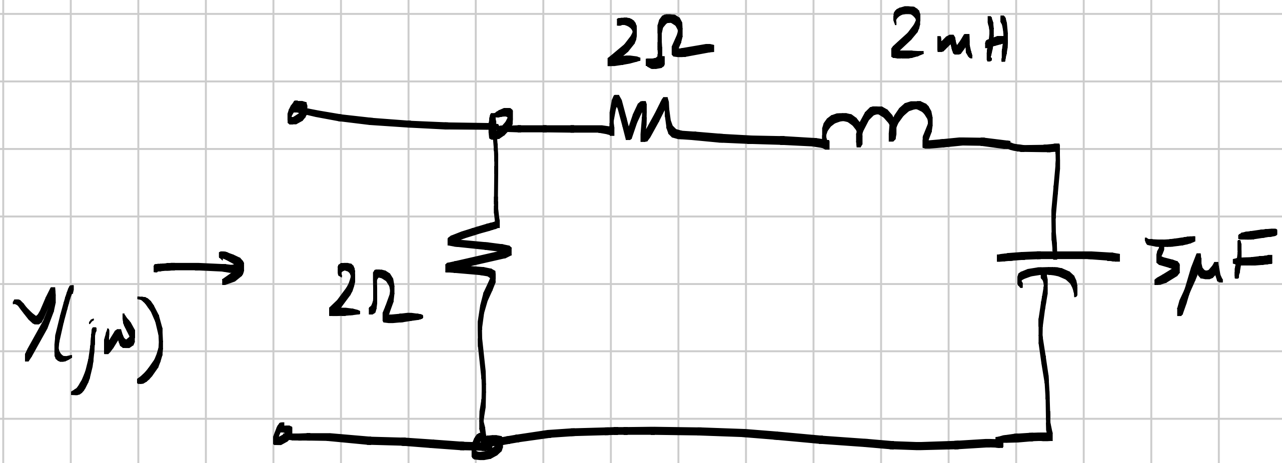
(c) Draw the loci of (i) V_C (ii) I_C (iii) I_L and V_L as R is varied from 0 to ∞.

Problem 13



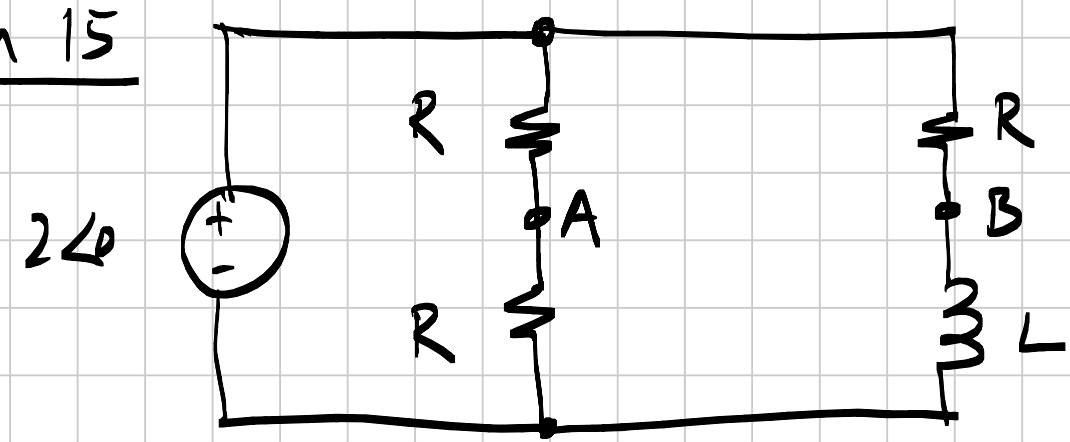
Compute $Y(j\omega)$ and draw its locus as ω varies from 0 to ∞.

Problem 14



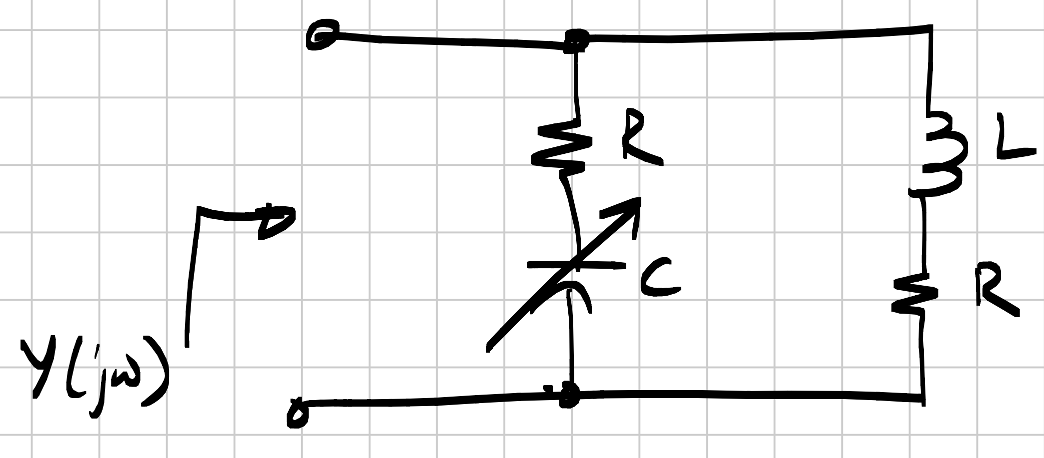
Draw the locus of $Y(j\omega)$ as ω varies from 0 to ∞.

Problem 15



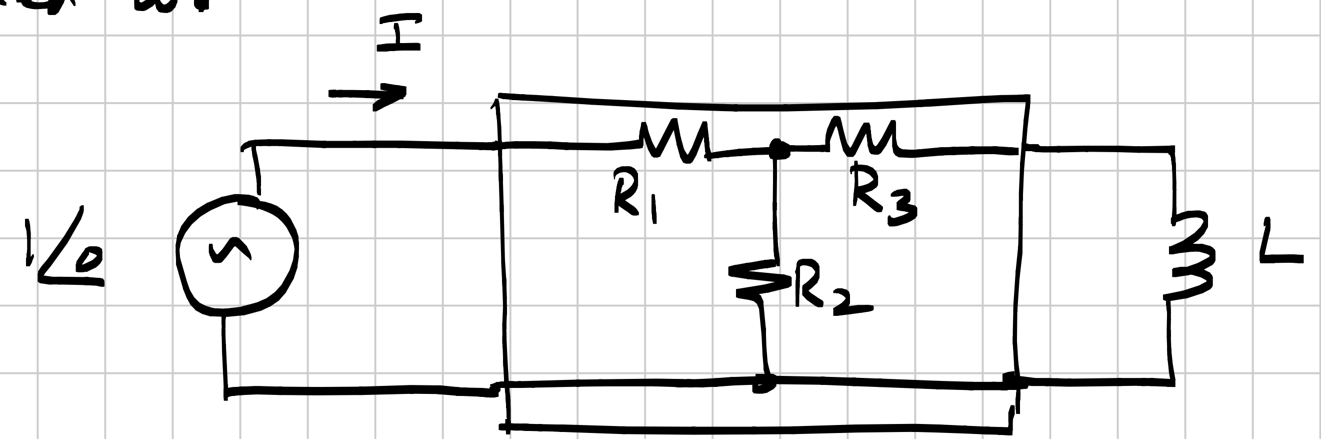
Use a locus diagram to show that the magnitude of V_{AB} does not change with frequency.

Problem 16



Plot the admittance locus of Y as C is varied, for some fixed ω.

Problem 17



Draw the locus of I as ω varies from 0 to ∞.