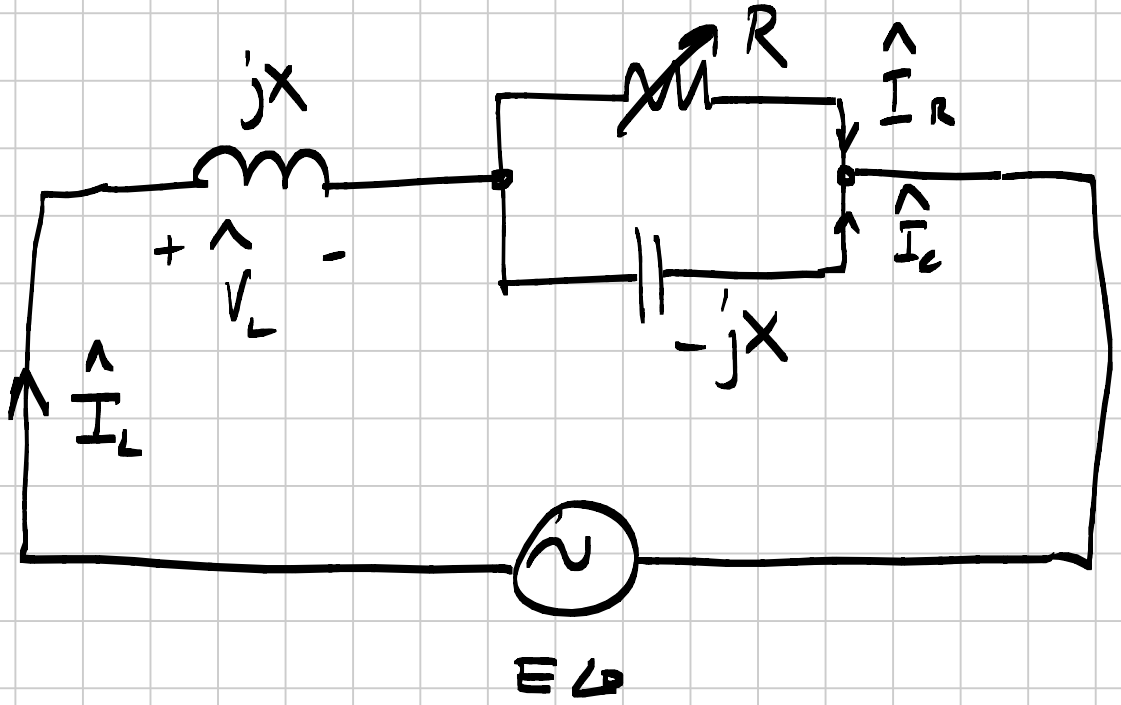
EC1010: Electrical and Magnetic circuits.

Note Title 1/28/2013

Problem set #9 (Due on 11th Apr. 2014)

Problem 1 :



The inductor and capacitor have the same reactance at the

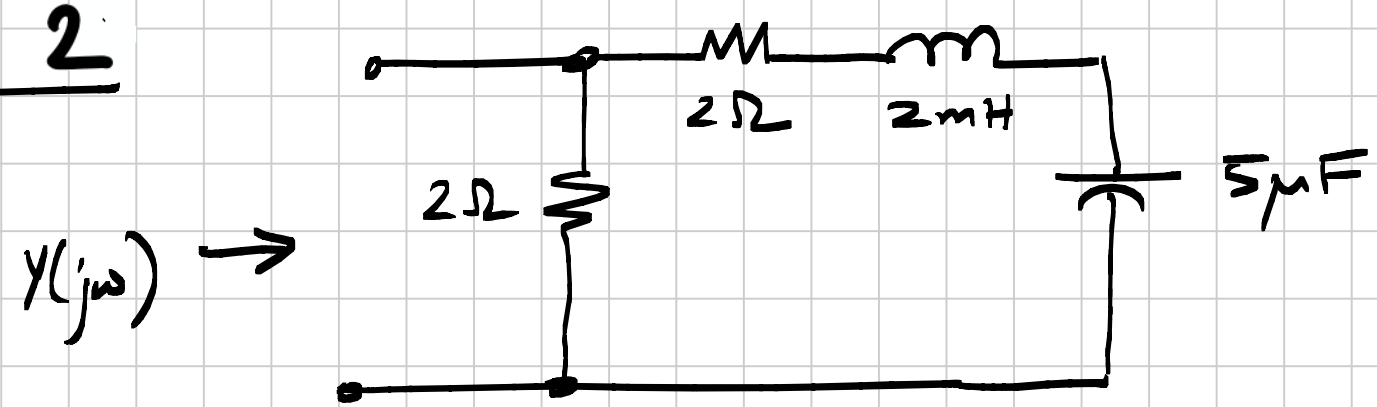
frequency of excitation.

(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.

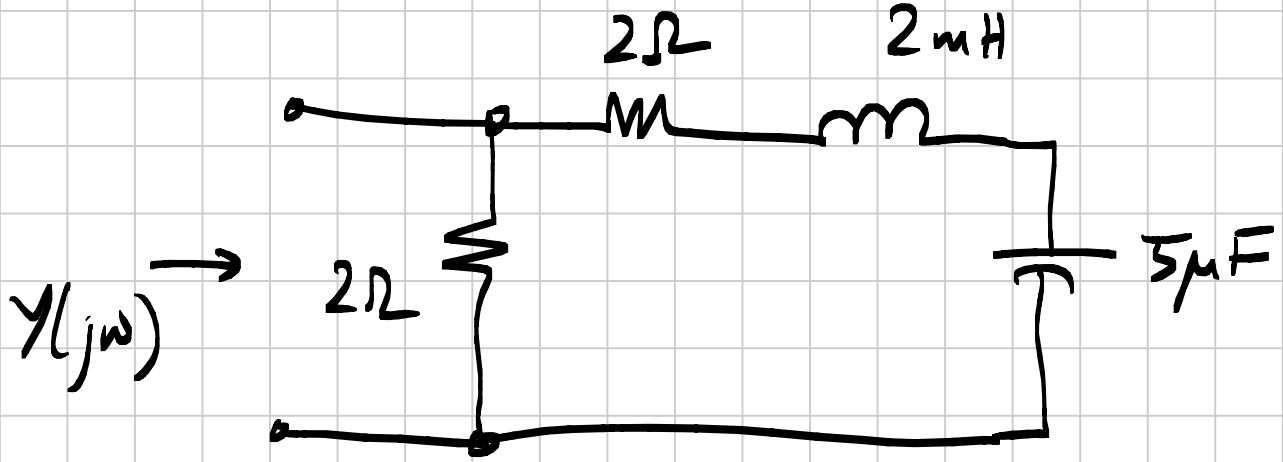
(c) Draw the loci of (i) V_C (ii) I_C (iii) I_L and V_L as R is varied from 0 to ∞.

Problem 2



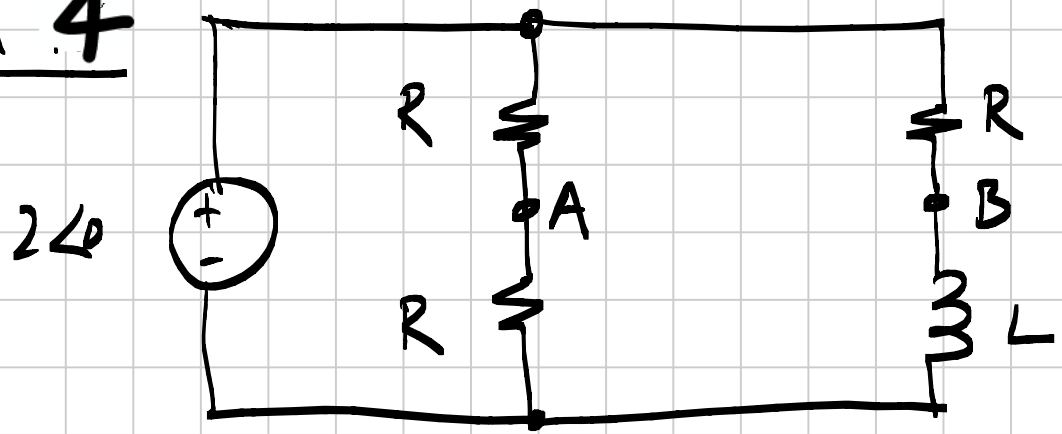
Compute $Y(j\omega)$ and draw its locus as ω varies from 0 to ∞.

Problem 3



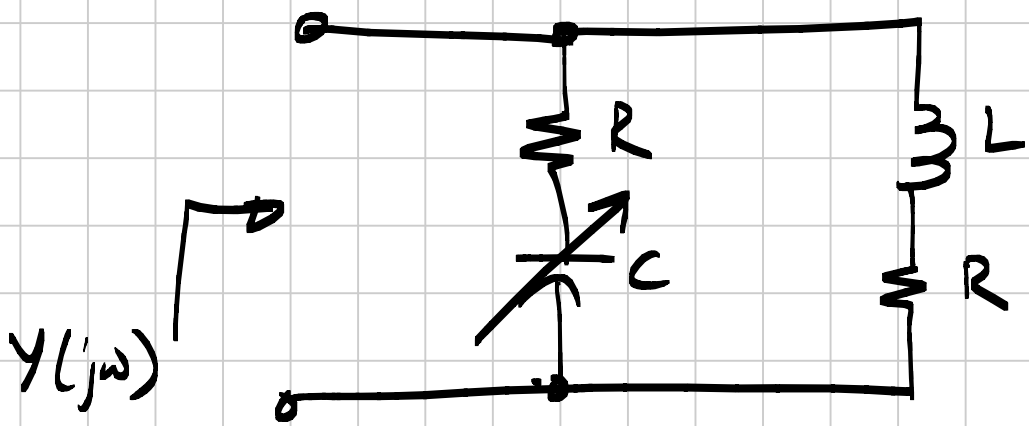
Draw the locus of $Y(j\omega)$ as ω varies from 0 to ∞.

Problem 4



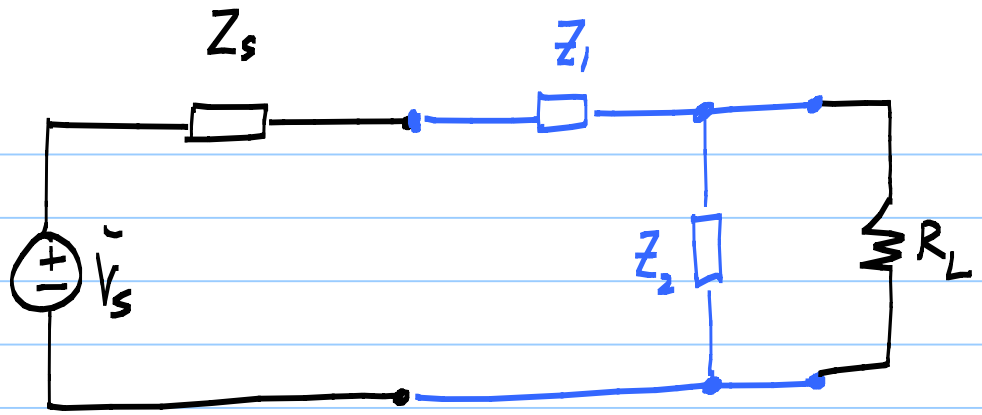
Use a locus diagram to show that the magnitude of V_{AB} does not change with frequency.

Problem 5



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

(6)



$\tilde{V}_s, Z_s$ is a source with a complex impedance.

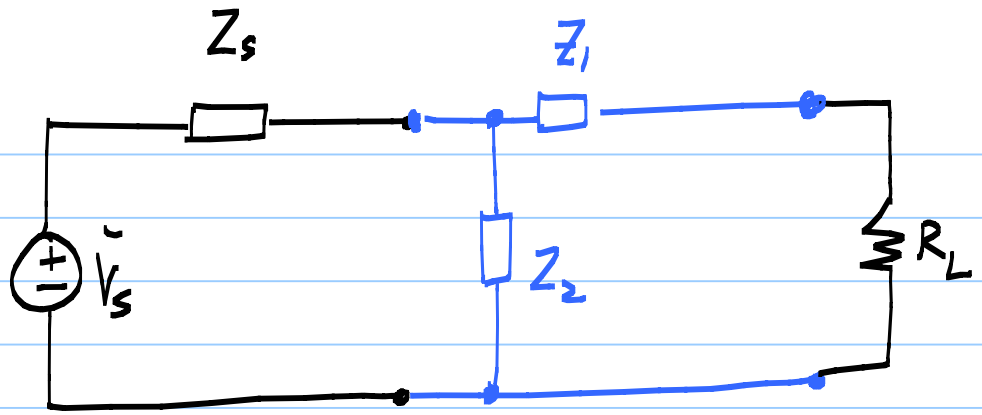
The matching network, shown in blue consists of only lossless components (obviously, to avoid wasting any power).

It should be such that R_L draws the maximum available power from the source

Draw neat locus diagrams for all 4 possible choices for Z_1 & Z_2 and two possibilities for Z_s (positive & negative imaginary parts)

Comment on values of R_L which can be matched and the type of elements in the matching network which give the most freedom to match

(7)



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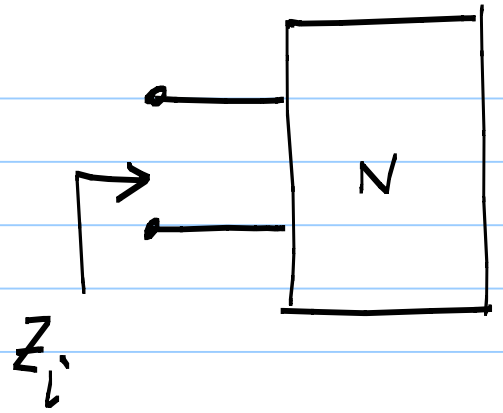

N consists of an arbitrary interconnection of passive elements (R, L, C). What can you say about the resistive part of Z_i? (Reason out clearly)