Homework 5

Due time: 10 p.m. Dec. 3rd, 2024

Turn in your hard-copy hand-writing homework at the entrance of Room 3-324 SIST #3 Building.

Rules:

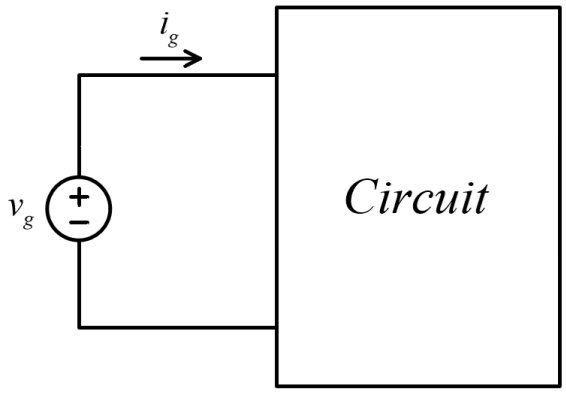
- Work on your own. Discussion is permissible, but extremely similar submissions will be judged as plagiarism.
- Please show all intermediate steps: a correct solution without an explanation will get zero credit.
- Please submit on time. No late submission will be accepted.
- Please prepare your submission in English only. No Chinese submission will be accepted.
- All final answers must be rounded to **two decimal places**.

1. The expression for the steady-state voltage and current in the terminals of the circuit seen in the figure are

$$v_g = 300\cos(5000\pi t + 78°)\,V$$
$$i_g = 6\sin(5000\pi t + 123°)\,A$$

(a) Transform the expressions of v_g and i_g into **phasor** form.

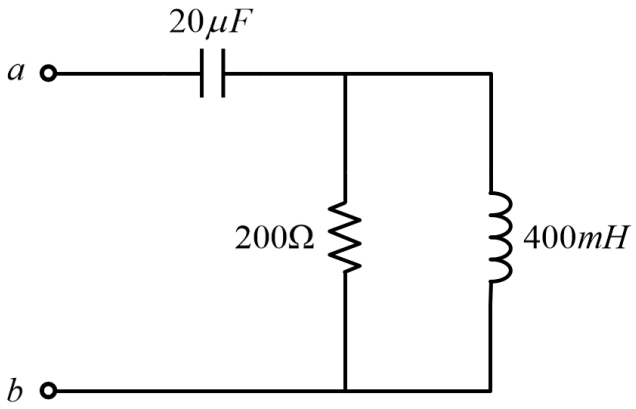
(b) What is the impedance seen by the source?



2. For the circuit shown below:

(a) Find the frequency (in radians per second) at which the impedance $\boldsymbol{Z_{ab}}$ is purely resistive.

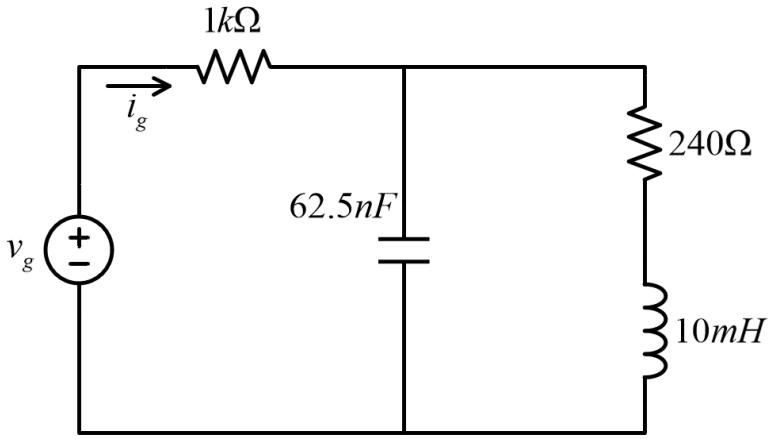
(b) Find the value of $\boldsymbol{Z_{ab}}$ at the frequency of (a).



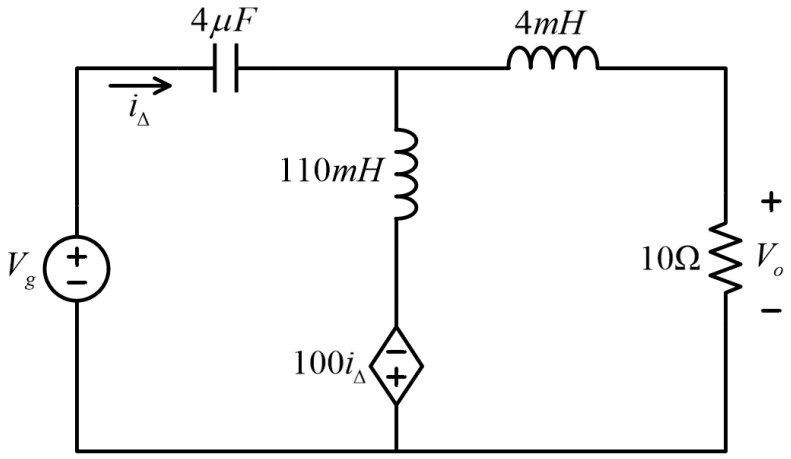
3. The frequency of the sinusoidal voltage source in the circuit is adjusted until i_g is in phase with v_g.

(a) What is the value of w in radians per second.

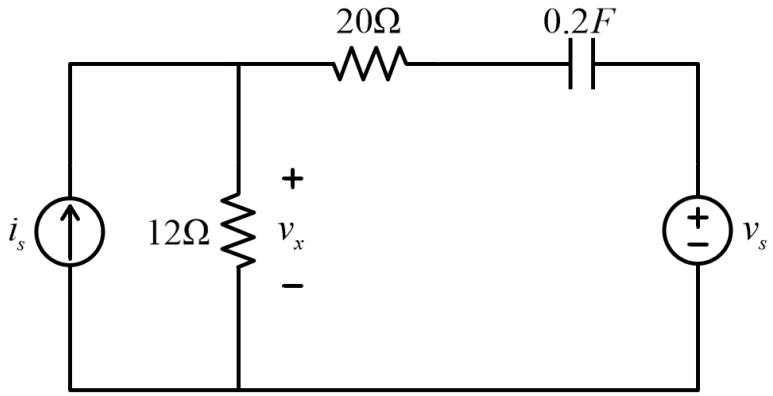
(b) If $V_g = 15coswt\,V$ (where w is the frequency found in (a)), what is the steady-state expression for i_g in **time domain**?



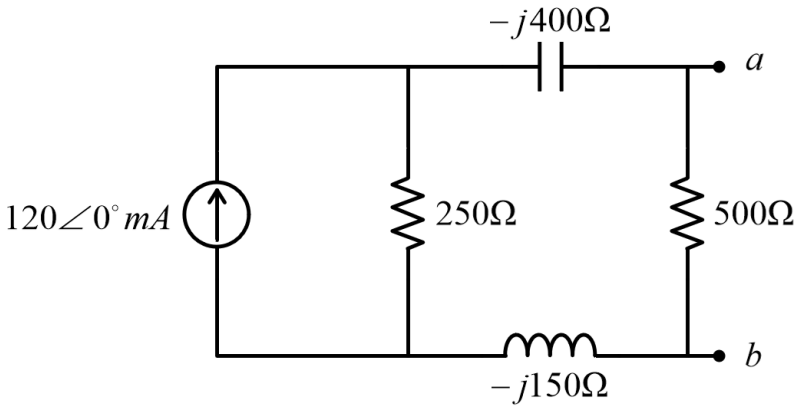
4. Use the nodal or mesh method to find $\boldsymbol{V_o}$ in **phasor domain** in the circuit if $V_g = 75cos5000t\,V$.



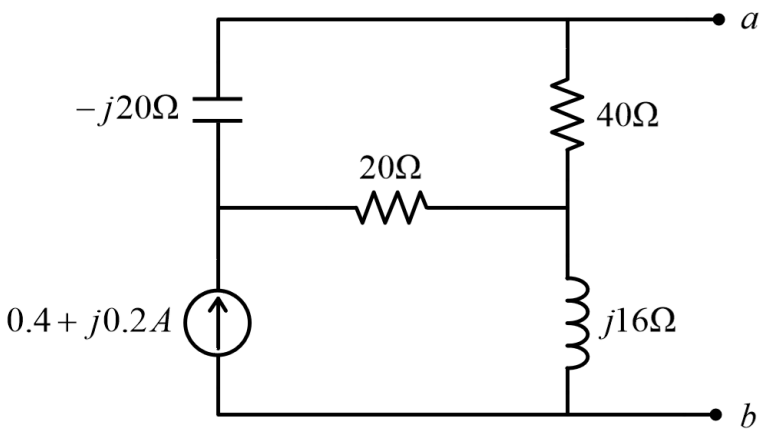
5. Use the superposition principle to obtain the steady-state expression for v_x in **time domain** in the circuit. Assume $v_s = 50sin2t\,V$ and $i_s = 12\cos(6t + 10^{\circ})A$.



6. Use source transformations to find the Thevenin equivalent circuit with respect to the terminals a, b for the circuits shown below.



7. Find the Thevenin equivalent circuit with respect to the terminals a, b for the circuit.



8. Compute $i_o(t)$ in the operational amplifier circuit if $v_s = 4\cos(10^4 t)\ V$.