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1. (10%) Determine the values of R_1, R_2 and R_3 so that the entire circuit (as shown in Fig. 1(a)) is equivalent to the simpler circuit (as shown in Fig. 1(b)) for the purpose of creating the Norton equivalent of the circuit (as shown in Fig. 1(a)) when viewed from its port labeled *A*-*B*. **Find** the Norton equivalent of the circuit when viewed from *A*-*B* port.

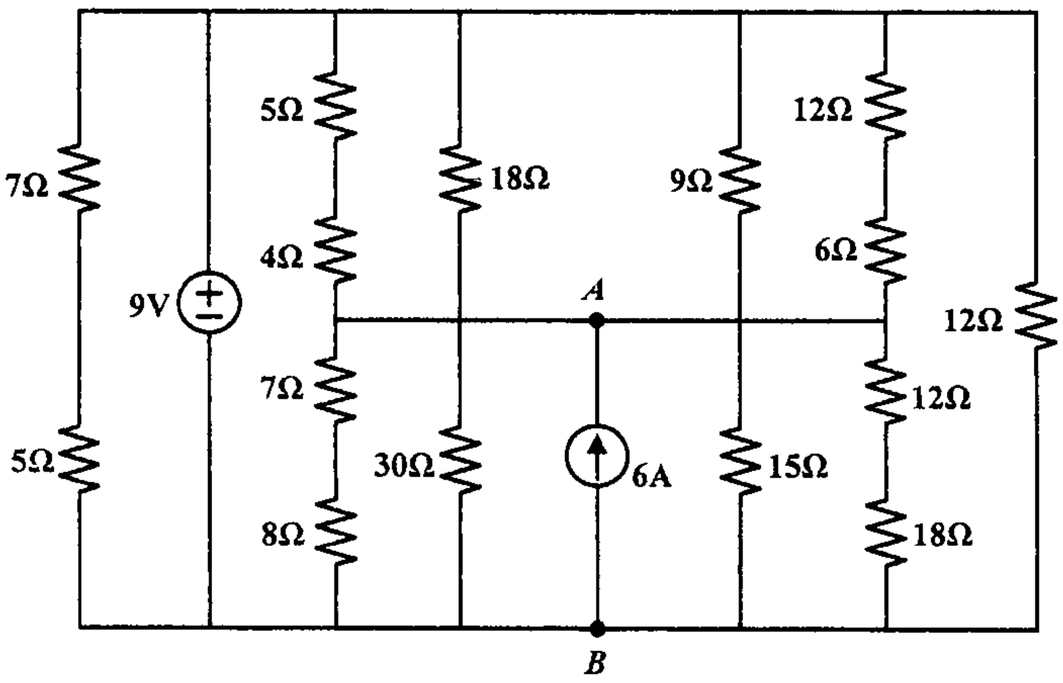

Fig. 1(a)

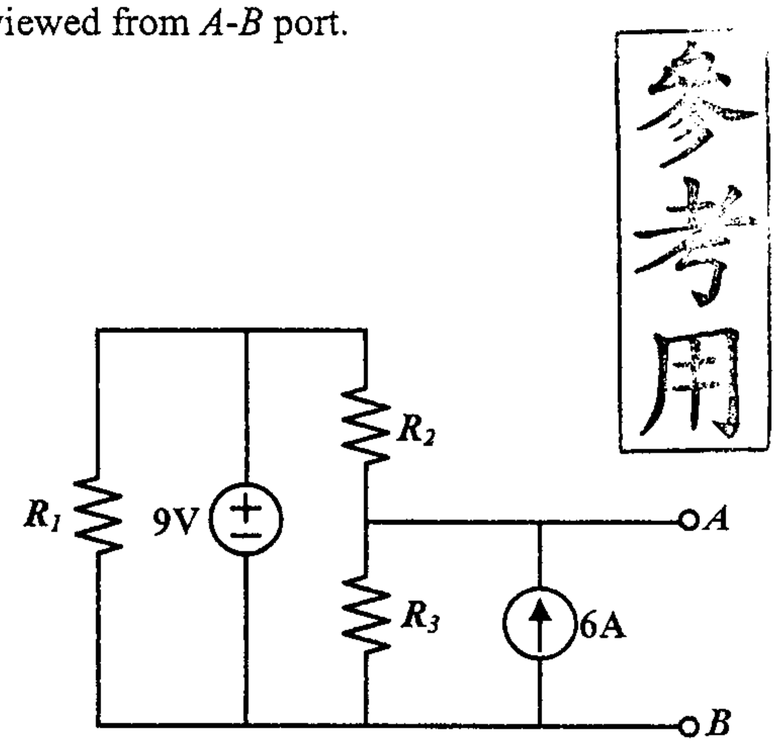

Fig. 1(b)

2. (15%) This problem involves a network that is implemented with four resistors and a current source as shown in Fig. 2(a). Its terminal characteristics are also given graphically below as shown in Fig. 2(b).

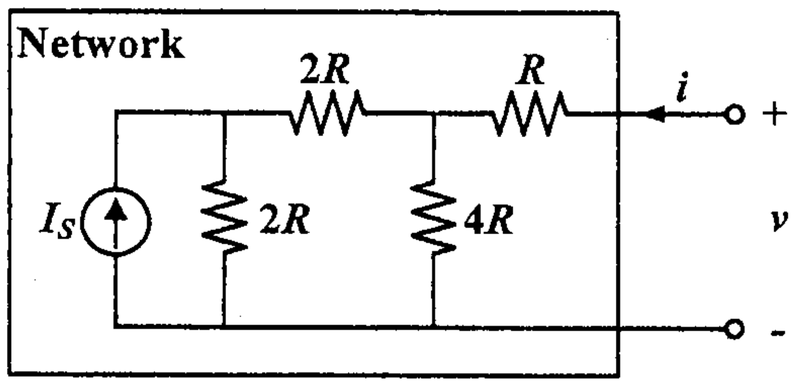

Fig. 2(a)

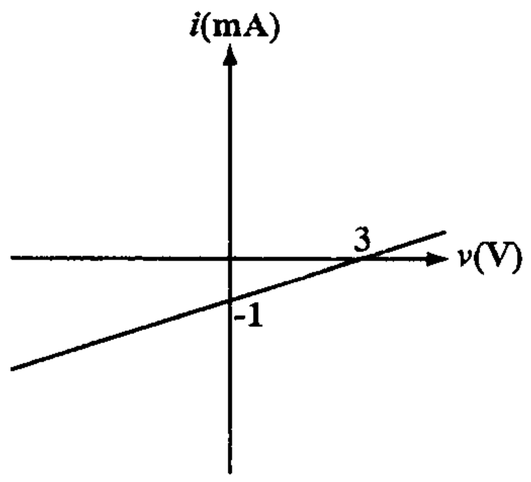

Fig. 2(b)

(a) (5%) From the graphical data given in Fig. 2(b), determine numerical values for the parameters of the Thevenin equivalent of the network.

(b) (5%) Determine numerical values for the parameters I_S and R that characterize the implementation of the network shown in Fig. 2(a).

(c) (5%) The network is connected to an external current source and resistor as shown in Fig. 2(c). Determine the value of its terminal voltage v given the external connection.

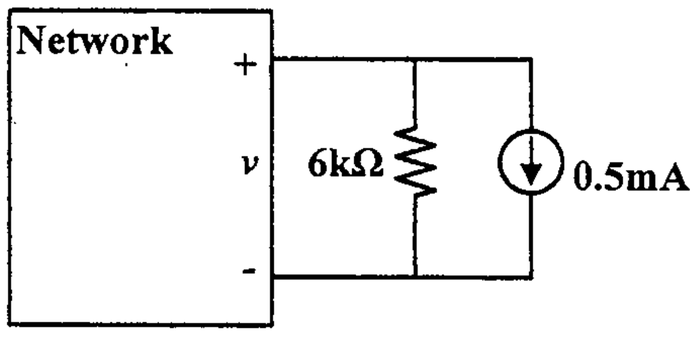

Fig. 2(c)

注意：背面有試題

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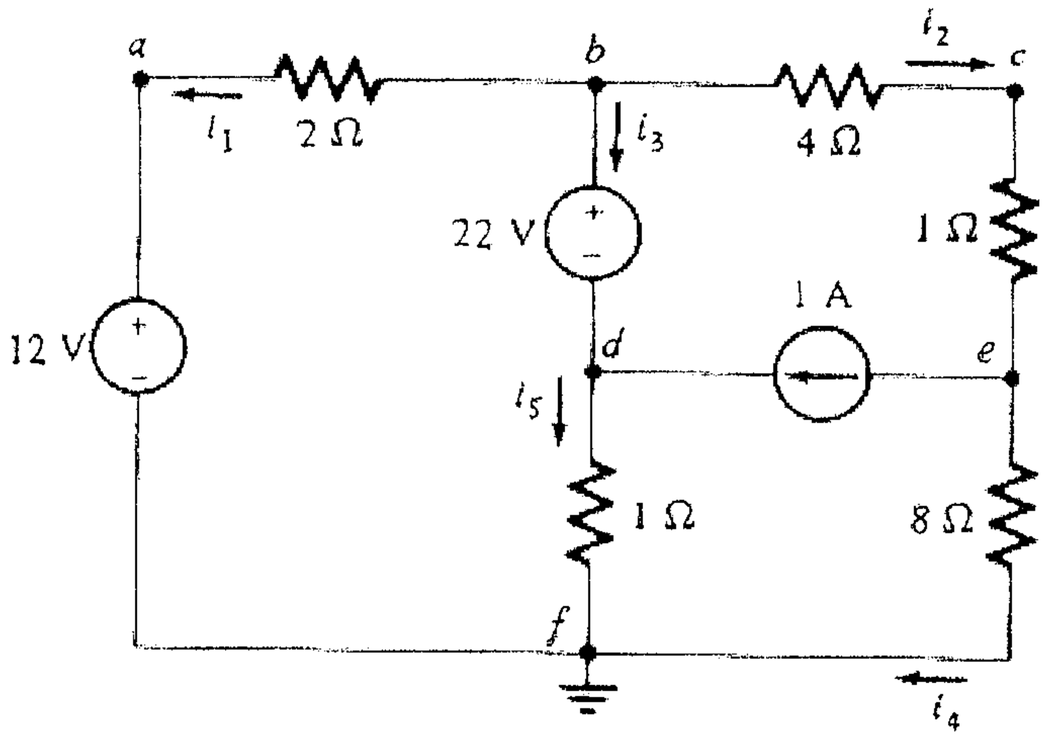
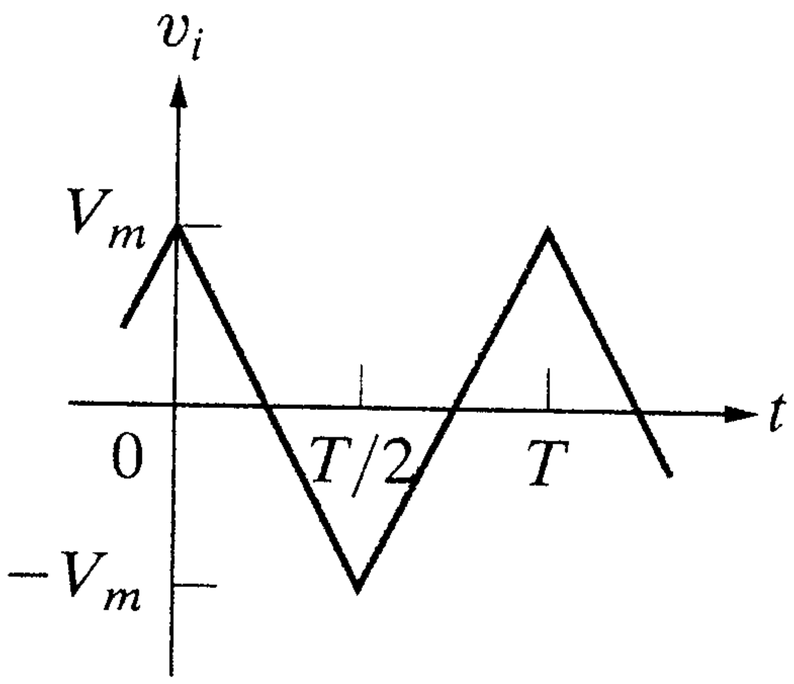
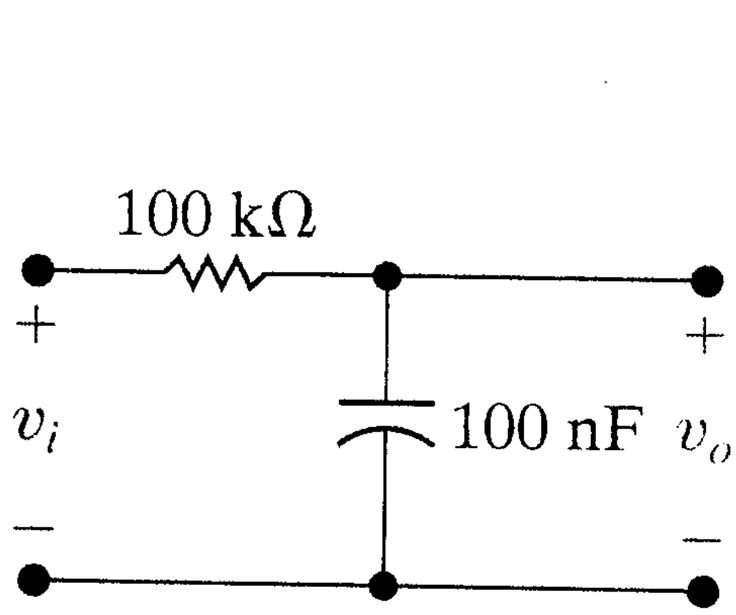
3. Find the values of all the node voltages (V_a to V_e) and all the branch currents (i_1 to i_5) in the following figure by using node-voltage method. (10%)



4. Suppose there is a single loop formed by serially connecting a capacitor (20 μF), an inductor (5 H), a switch, and a resistor (5 kΩ). Before t=0, the switch is open and a voltage drop of 30 V is across the capacitor. Then the switch is closed at t=0. Please draw the circuit and find the expressions of the loop current and of the voltage across the resistor for t>0. (15%)

5. (15%) Derive the first three nonzero terms in the Fourier series of the steady-state output voltage $v_o(t)$ if $V_m=100\pi^2$ mV and the period of the input voltage is 100π ms.





注意：背面有試題

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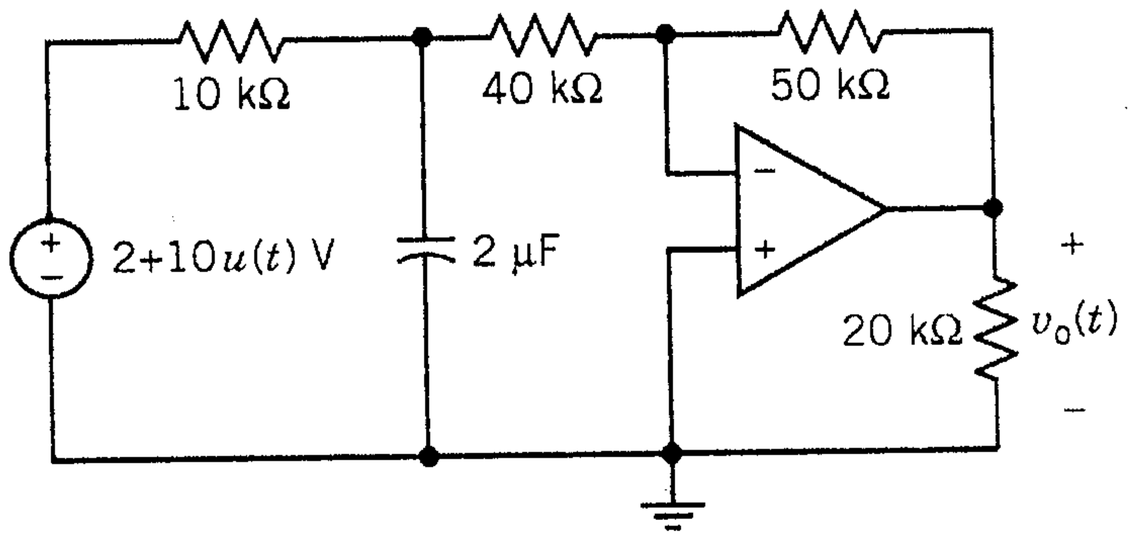
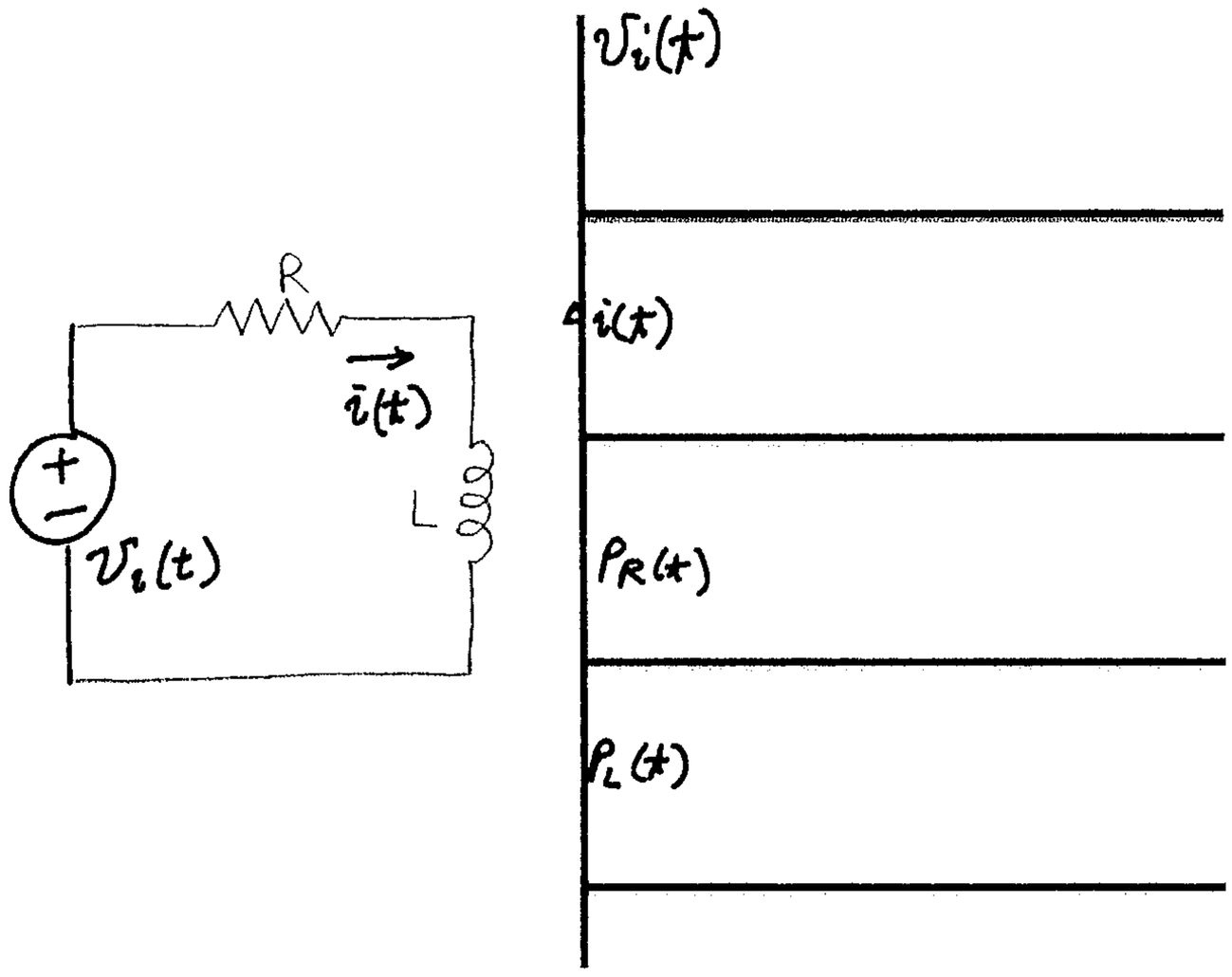
6. (10%) Find the output voltage $v_o(t)$ for the circuit below.



7. (15%) For the given RL circuit, R=10ohm, L=100mH. The input voltage is $v_i(t)=10cos(100t)$ V

(a) (8%) Please find the steady state representation of the current $i(t)$. Calculate the instantaneous power $p_R(t)$ of the resistor and $p_L(t)$ of the inductor. Sketch the waveforms of $i(t)$, $p_R(t)$ and $p_L(t)$ with respect to $v_i(t)$.

(b) (7%) Please calculate the complex power, average power, and reactive power associated with the voltage source. How is the complex power related to instantaneous power $p_R(t)$ and $p_L(t)$?



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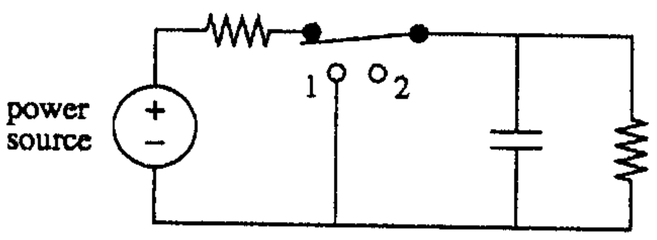
參考用

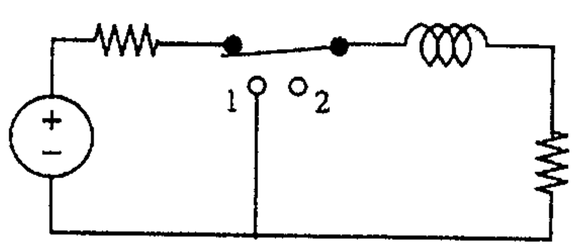
8. (10%)

(a) (5%) What are the conditions for this signal $V_1(t)\cos(\omega_1 t)+V_2(t)\cos(\omega_2 t)$ to have a phasor representation? Please explain your answer.

(b) (5%) If you were asked to disconnected the load from the power source in the following circuits, which switch position will you choose? Explain your answer.



Circuit A



Circuit B