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※請在答案卷內作答

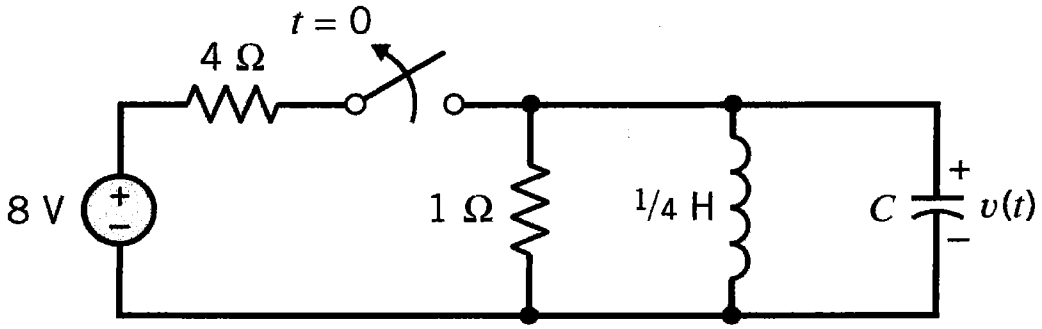
1. Consider the circuit in the figure below. The switch is opened at t = 0. Please answer the questions below (15%):

(a) Assume all nodal voltages and currents in the circuit has reached their steady states before t < 0. Please **calculate** the voltage across the capacitor, ***v(0)***, and the current flowing through the inductor, ***i(0)***, at t = 0? Please remember to specify the units for your answers。 (5%)

(b)Let **C = 1/4 F** and *v(t)* represent the voltage across the capacitor after t > 0. Is the voltage *v(t)* an **over-damped** response or an **under-damped** response? Please **explain** your answer clearly。(5%)

(c)If we want to ensure the voltage *v(t)* across the capacitor has an **over-damped** response after t > 0, what is **the maximum value for the capacitance** C? Please remember to specify the unit for your answer。 (5%)

參考用



注意:背面有試題

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2. Consider the circuit in the figure below. $v_{s1}(t)$ and $v_{s2}(t)$ are both sinusoidal signals given by the equations below:

$v_{S1}(t) = A_1 \cdot \sin(wt + 10°)$

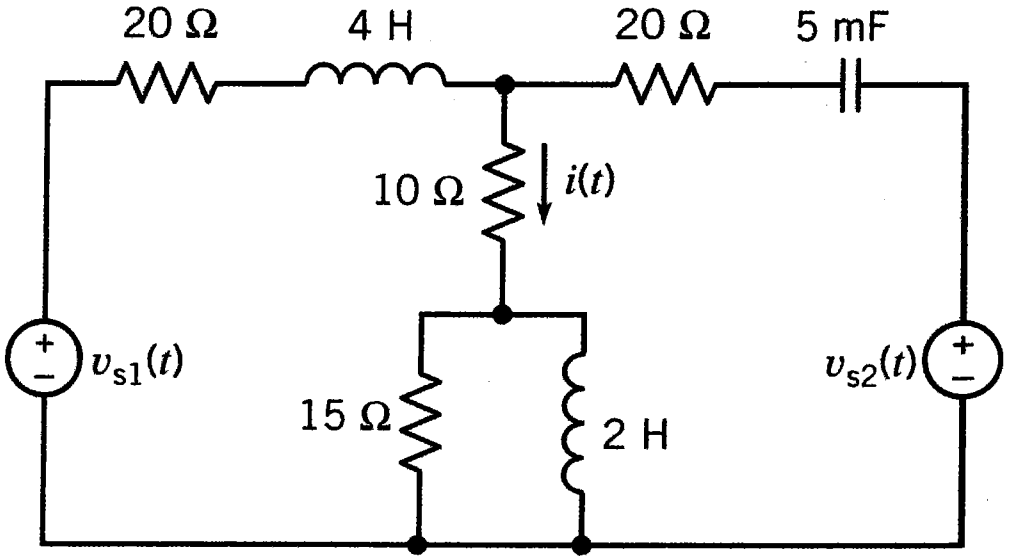
$v_{S2}(t) = A_2 \cdot \sin(wt + 80°)$

Let the steady-state response of i(t) be given as $i(t) = i_{s1}(t) + i_{s2}(t)$. According to the superposition rule, $i_{s1}(t)$ represents the steady-state response induced by $v_{s1}(t)$, and $i_{s2}(t)$ the steady-state response by $v_{s2}(t)$. Please answer the following questions (15%):

(a) As the frequency w **increases**, $|i_{s1}(t)|$ will **Increase**? Remain **unchanged**? Or **Decrease**? Please **explain** your answer clearly. (5%)

(b) As the frequency w **increases**, $|i_{s2}(t)|$ will **Increase**? Remain **unchanged**? Or **Decrease**? Please **explain** your answer clearly. (5%)

(c) As the frequency w approaches infinite, the **phase angle of i(t)** (the overall response) would approach what value? Please **explain** your answer clearly. (5%)



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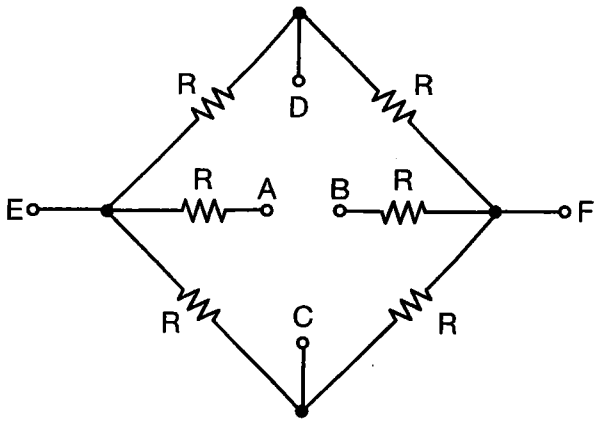
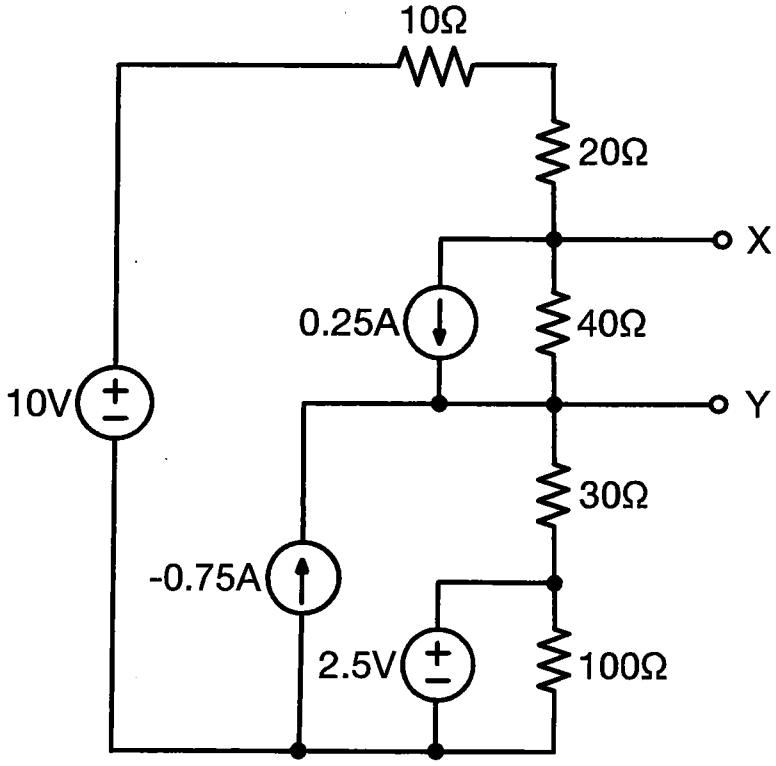
3. In the follwoing circuit, assume all of the resistors are equal with the same resistance R. Find the equivalent resistance at terminals A and B if

(a) Terminals C and D are shorted, (5%)

(b) Terminals E and F are shorted. (5%)



4. Use superposition to find the Thevenin and Norton equivalents with respect to terminals X and Y for the circuit in the following figure. (10%)



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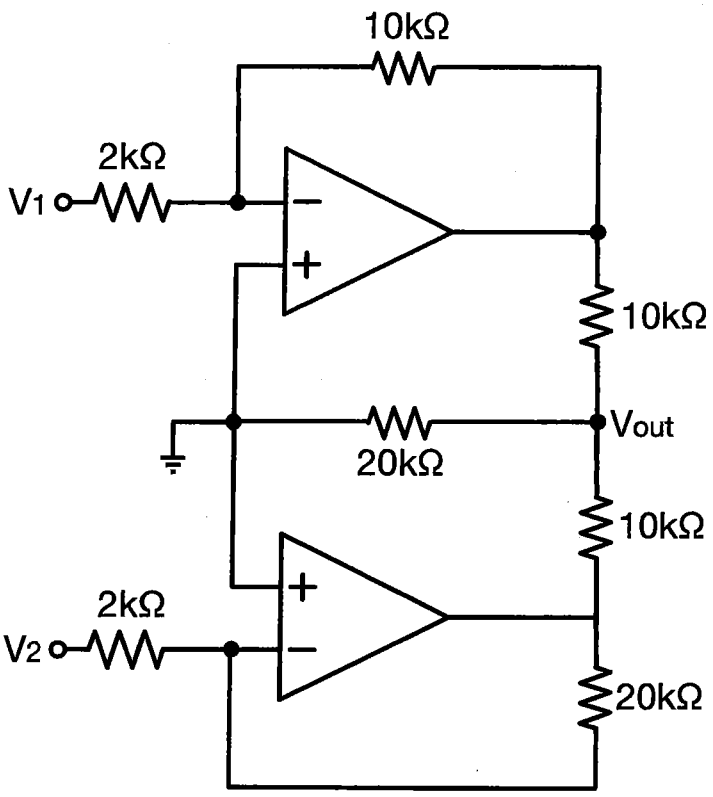
5. In the following figure, assume the operation amplifiers are ideal with infinite input impedance, zero output impedance, and infinite voltage gain. Express v_{out} in terms of v_1 and v_2. (10%)



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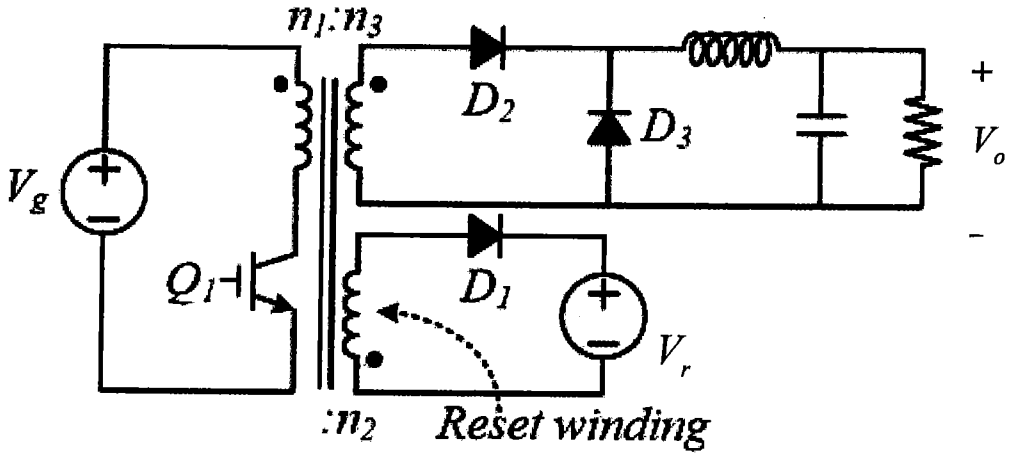
6. A forward converter with a reset winding and an auxiliary voltage source Vr is as shown. Assume the input voltage Vg is constant, and the transistor operates with a duty ratio of D, and the transformer turns ratios are as illustrated.

(a) Calculate the average value of output voltage Vo. (5%)

(b) What is the minimum voltage of Vr that causes the transformer magnetizing current to be reset to zero by the end of the switching period? (10%)

(c) Please explain why the forward converter needs this reset winding. (5%)



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7. The three-phase and single-phase power system in the figure operate under these conditions:

- The two systems deliver the same total complex power to the load.
- The two systems have the same line-to-line voltages.
- The two systems have the same transmission efficiency.
- The distance from source to load is the same.
- The resistance of the power line is proportional to its length divided by the cross-section area of the wire.

Show that the transmission line in a three-phase system requires 25% less copper than the single-phase system. (20%)