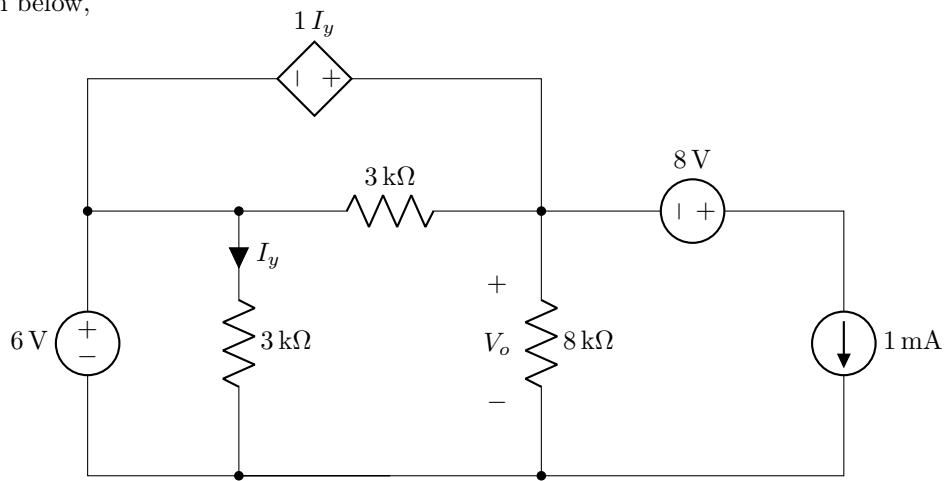


- ✓ No washroom breaks. Phones must be turned off. Using/carrying any notes during the exam is not allowed.
- ✓ At the end of the exam, both the **answer script** and the **question paper** must be returned to the invigilator.
- ✓ All **4 questions** are compulsory. Marks allotted for each question are mentioned beside each question.
- ✓ Proper units must be included for all calculated values. Marks will be deducted for missing or incorrect units.
- ✓ Symbols have their usual meanings.

■ Question 1 of 4

[CO2] [10 marks]

For the circuit shown below,

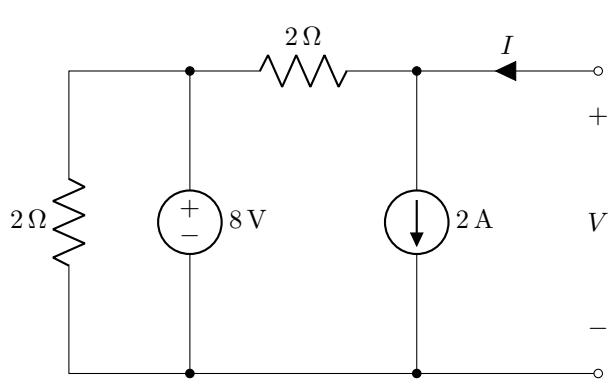


Apply the Principle of Superposition to determine the voltage V_o .

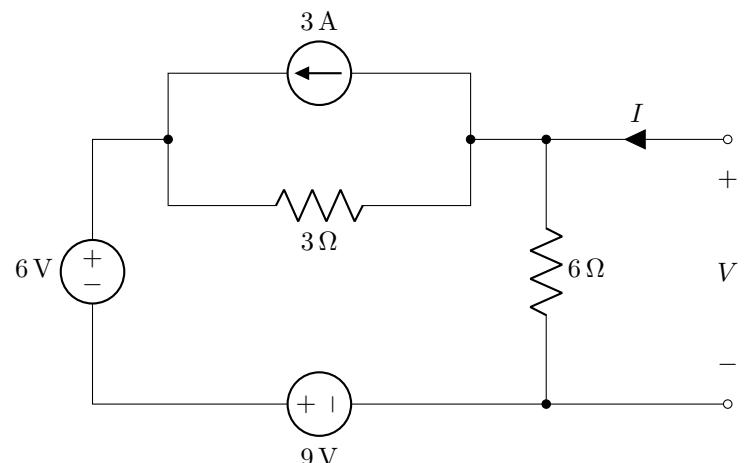
■ Question 2 of 4

[CO3] [10 marks]

By deriving the $I-V$ characteristic equations for both *Circuit 1* and *Circuit 2* shown below, show that the two circuits are equivalent.



Circuit 1



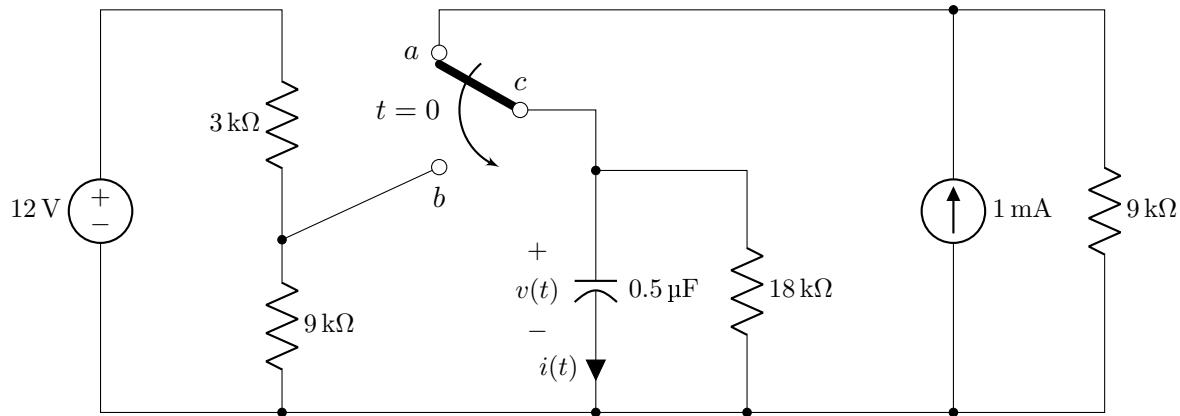
Circuit 2

■ Question 3 of 4

[CO3] [20 marks]

Analyze the Transient Behavior of the following circuits to answer the following questions:

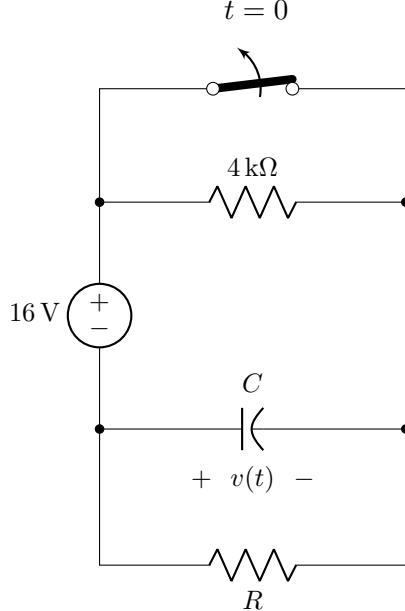
- (a) The switch in the circuit shown below is moved from position *a* to position *b* at $t = 0$, while position *c* remains fixed.



- (i) [10 marks] Determine the capacitor voltage $v(t)$ as a function of time for $t > 0$.
 (ii) [2 marks] Determine the capacitor current $i(t)$ as a function of time for $t > 0$.
 (iii) [2 marks] Determine the amount of energy gained or lost by the capacitor.
- (b) When the switch in the following circuit opens at $t = 0$, the voltage across the capacitor is given by

$$v(t) = -12 - 4e^{-t/3} \text{ V}, \quad t > 0$$

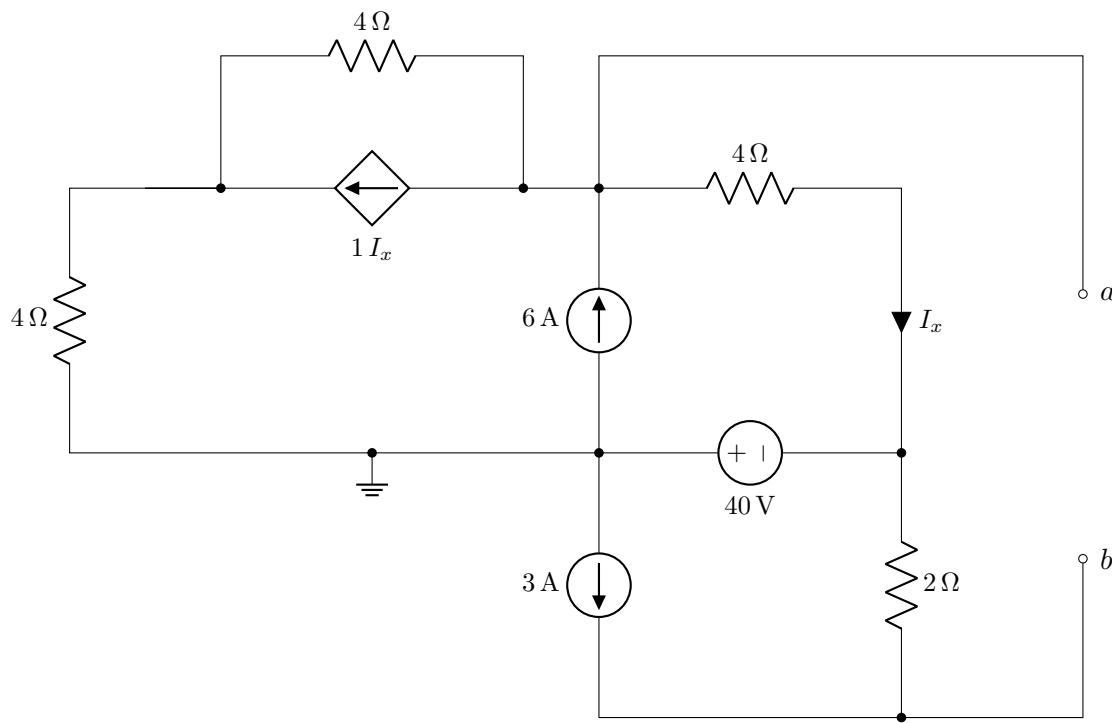
where t is in milliseconds.



- (i) [1 mark] Determine the transient duration of the circuit.
 (ii) [1 mark] What are the voltages across the capacitor before and after switching.
 (iii) [4 marks] Using the values obtained in (i) and (ii), determine the values of R and C .

■ Question 4 of 4**[CO2] [15 marks]**

For the circuit shown below,



Apply Thevenin's Theorem or Norton's Theorem to determine the **maximum power** that the circuit can deliver to any load connected between the terminals *a* and *b*.