⇒ Superposition ⇐

Ans no.1

Superposition Principle:

According to superposition principle, if there are more than one voltage or current ~~co~~ source in a circuit, ~~the~~ each voltage or current source will act independently and then the sum of it and the current to it will give us the voltage drop ~~acr~~ across each components. Here, each sub-circuit will have only one independent source. This principle won't be valid for power because it supports linear quantity ~~at~~ while power is ~~a~~ a non linear quantity.

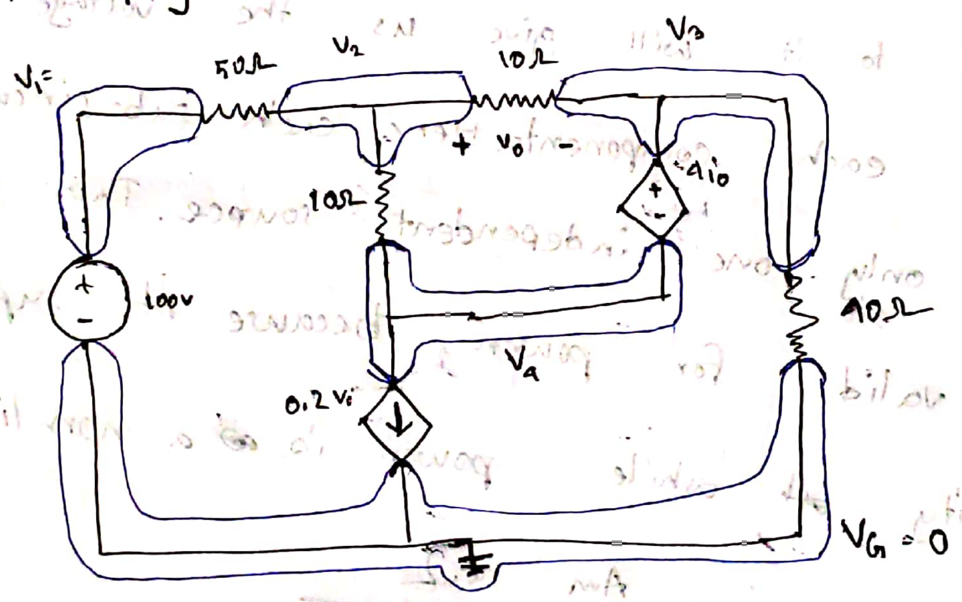
Ans no.2

"For the superposition principle method, some sources have to ~~on~~ ON and some have to be off while performing nodal analysis."

Here, in this technique in a circuit we turn off ~~all~~ all the the voltage and current source except one, and then perform nodal analysis. Here, voltage source is replaced by short circuit and current source is replaced by open circuit. ~~An~~ Any dependent source will be keept as it is.

Ans no. 3

Here, Keeping V = 100V active,



Using nodal analysis,

$V_0 = V_2 - V_3$ — (I)

$V_1 = 100V$ — (II)

$V_2\left(\frac{1}{50}+\frac{1}{10}+\frac{1}{10}\right) - \frac{V_1}{50} - \frac{V_3}{10} - \frac{V_4}{10} = 0$ — (III)

$V_3\left(\frac{1}{10}+\frac{1}{40}\right) - \frac{V_2}{10} + V_4\left(\frac{1}{10}\right) - \frac{V_2}{10} - 0.2(V_2-V_3) = 0$ — (IV)

$\Rightarrow V_3 - V_4 = -4\left(\frac{V_2-V_4}{10}\right)$

$\Rightarrow 10V_3 - 6V_4 - 4V_2 = 0$ — (IV)

Here, solving the equations,

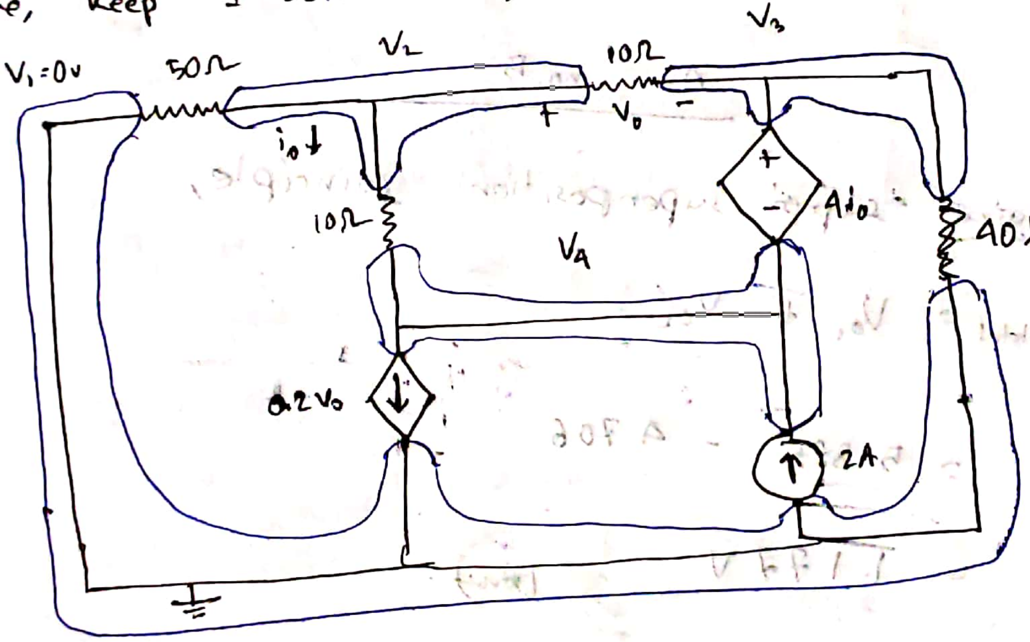
$V_2 = 21.569V$ $\qquad$ $V_3 = 15.686$

$V_4 = 11.765V$

$\therefore V_{o_1} = V_2 - V_3 = 5.883V$

Ans no. 4

Here, keep $I = 20A$ active,



Here,

$V_o = V_2 - V_3$.

$V_3 - V_4 = 4\left(\frac{V_2 - V_4}{10}\right)$

or, $10V_3 - 6V_4 - 4V_2 = 0$ — (1)

$V_2\left(\frac{1}{50} + \frac{1}{10} + \frac{1}{10}\right) - \frac{V_3}{10} - \frac{V_4}{10} = 0$ — (ii)

$V_3\left(\frac{1}{10} + \frac{1}{40}\right) - \frac{V_2}{10} + \frac{V_4}{10} - \frac{V_2}{10} + 0.2(V_2 - V_3) - 2 = 0$ — (iii)

$\therefore V_1 = 0V$ [Ground]

Solving the following equation,

$V_1 = 0$ $V_2 = 62.745$ V

$V_3 = 67.451$ $V_4 = 70.588$ V

Now,

$\therefore V_{O_2} = V_2 - V_3$

$= -4.706$ V

Ans no. 5

Applying ~~supp~~ superposition principle,

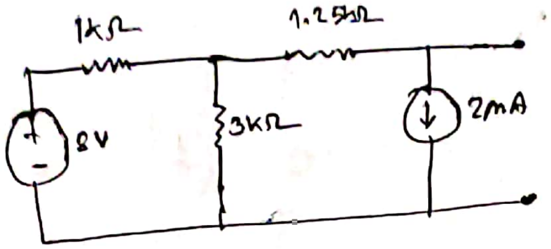
$V_{total} = V_{O_1} + V_{O_2}$

$= 5.883 - 4.706$

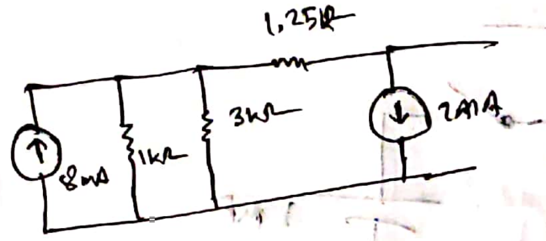
$= 1.177$ V (Ans)

→ Transient Analysis ⇐

Ans no. 1



i)



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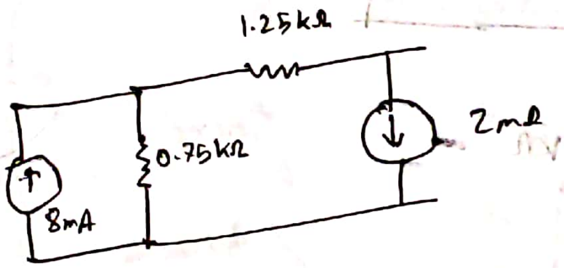

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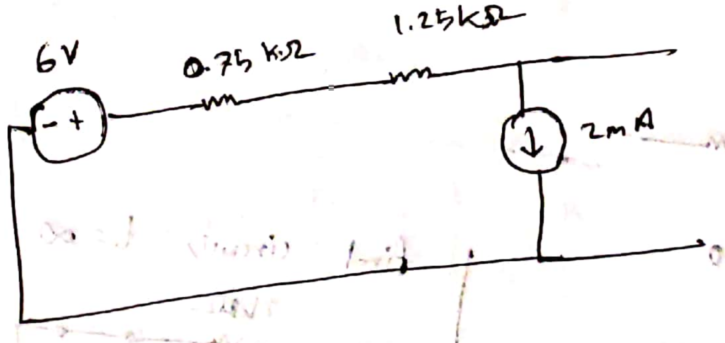

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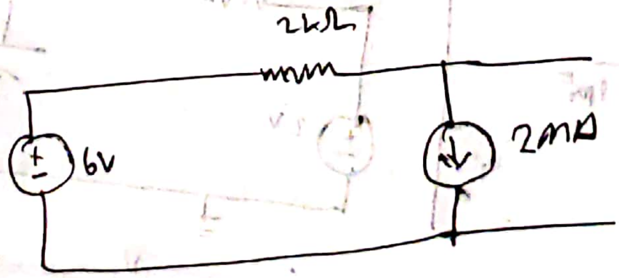

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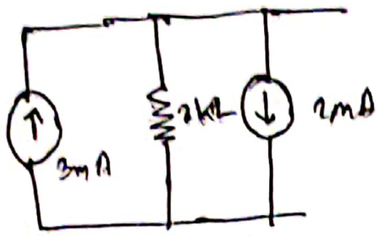
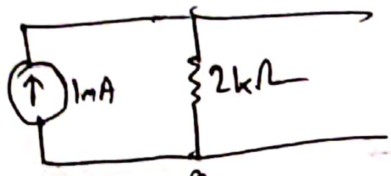


vi)



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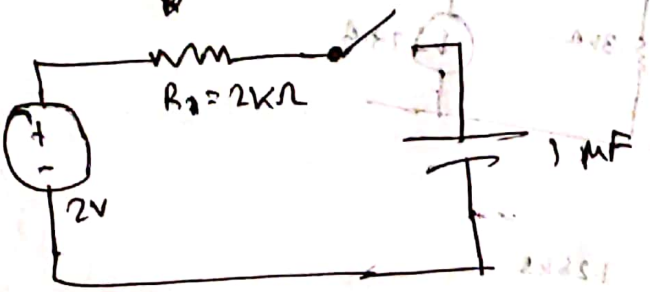


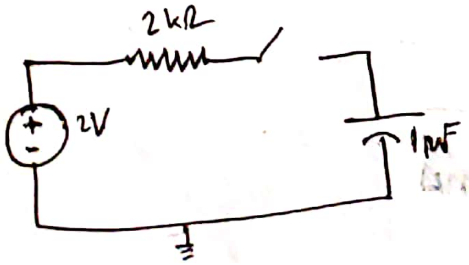
$\therefore V_1 = 2V, \quad R_1 = 2K\Omega$

Now,

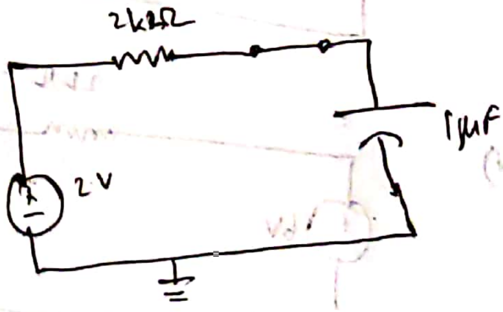
at ~~t=0~~,

Hence,

Initial Circuit, $t=0^-$



final circuit, $t=\infty$



$i_0 = \frac{V_1}{R_1} = 1mA$

$i_\infty = 0 \, mA$

Now,

$$i(t) = 0 + (1-0)\,e^{-t/2\times10^{-3}}$$

$$= 1\,e^{-t/2\times10^{-3}}$$

$$= 1\,e^{-500t}$$

(Ans.)

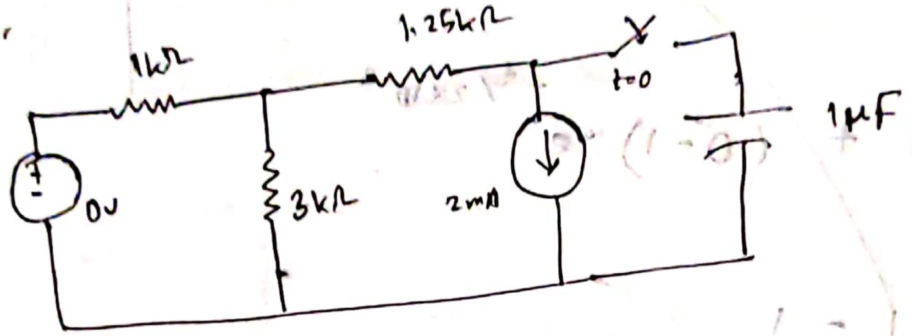
Here,

$$\tau = R \times C$$

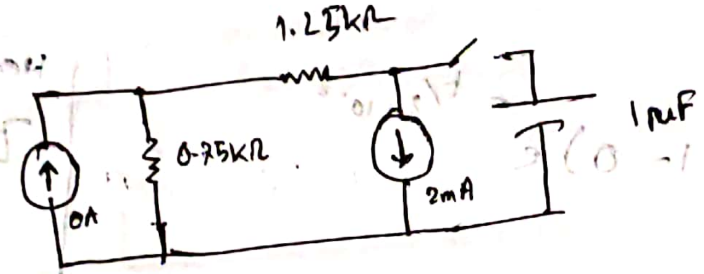
$$= 2\times10^{-3}$$

Ans no. 2

Given,

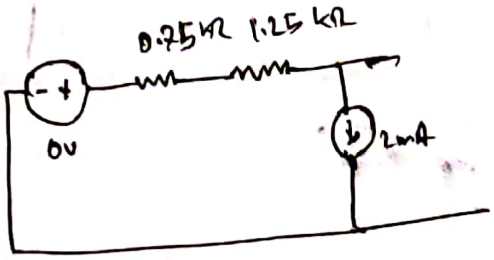


i)



[1 kΩ & 3kΩ parallel

ii)



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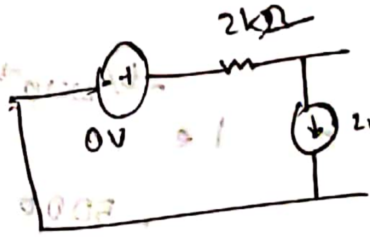

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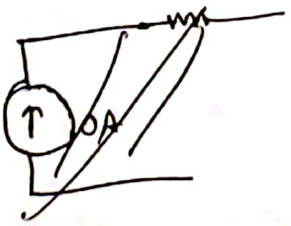

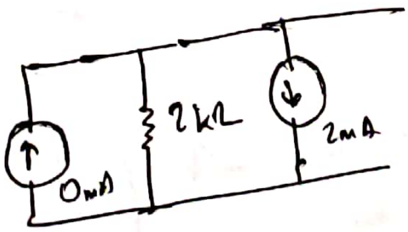

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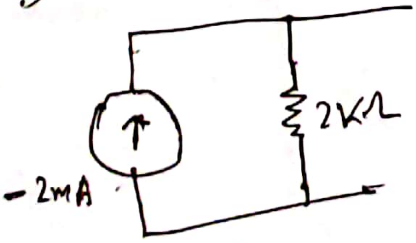
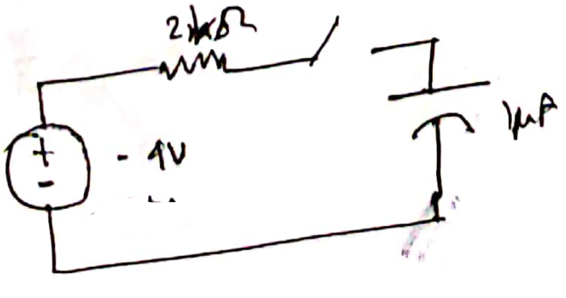


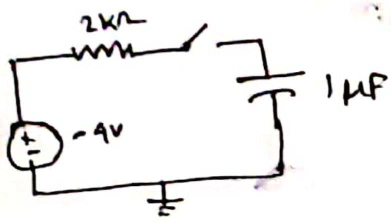
v)



Now,

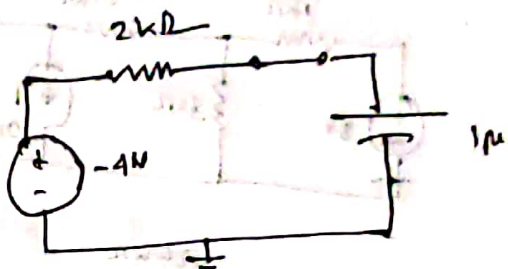
Initial circuit,

$t = 0$



$i_0 = -2mA$

Final circuit.



$i_\infty = 0mA$

$\tau = R \times C = 2 \times 10^{-3}$ s

Here,

$i_{c_1}(t) = i_\infty + (i_0 - i_\infty) e^{-t/\tau}$

$= 0 + (-2 - 0) e^{-500t}$

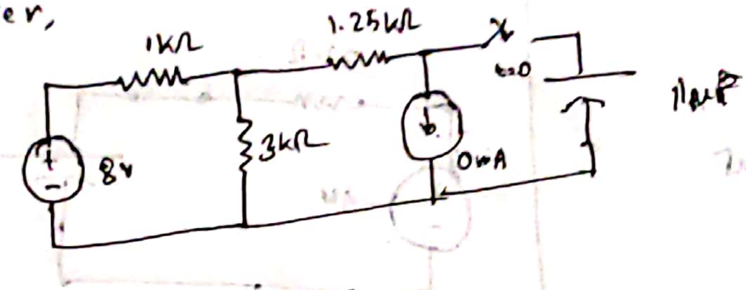
$= -2e^{-500t}$.

Ans no. 13

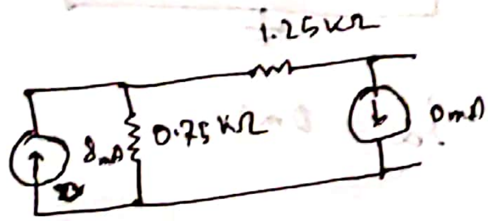
P.T.O

Ans no.3

Given,



i)



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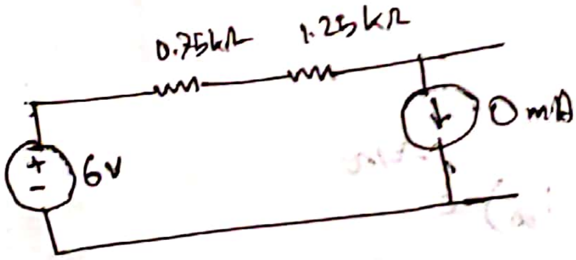

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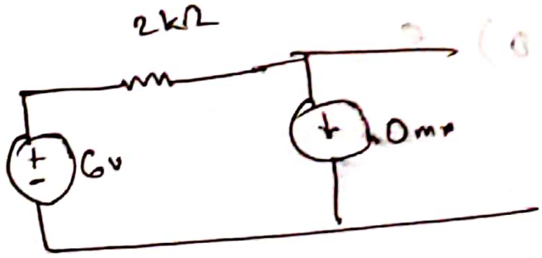

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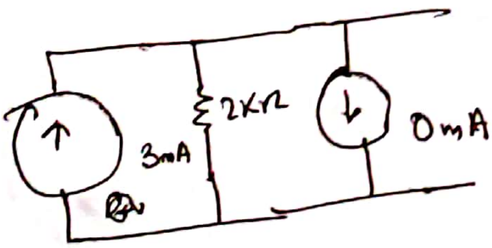

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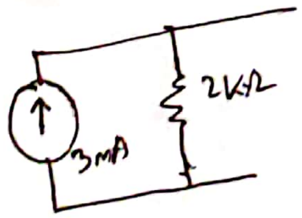

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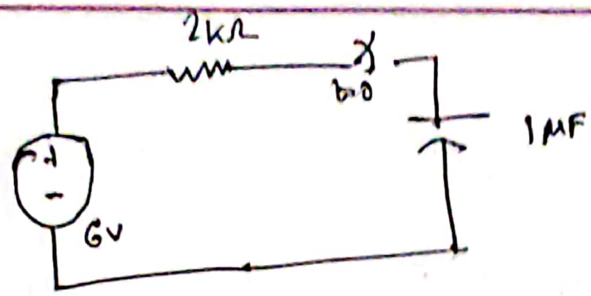
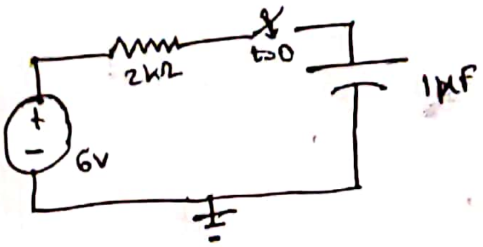


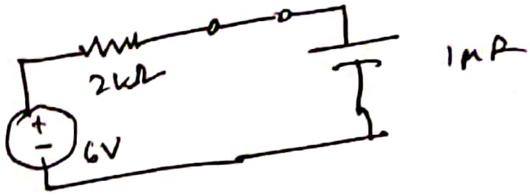
Now,

Initial circuit, $t = (0^+)$



$i_0 = 3\,mA$

Final circuit, $t = \infty$



$i_\infty = 0\,mA$

Now $\tau = R \times C = 2 \times 0^{-3}$

Now,

$$i_{c2}(t) = i_\infty + (i_0 - i_\infty)\, e^{-t/\tau}$$

$$= 0 + (3 - 0)\, e^{-500t}$$

$$= 3\, e^{-500t}$$

Ans no. 4

$$i_{c(t)} = i_{c1}(t) + i_{c2}(t)$$

$$= -2e^{-500t} + 3e^{-500t}$$

$$= 1e^{-500t} = i_c(t)$$

∴ Superposition principle is working for the circuit.