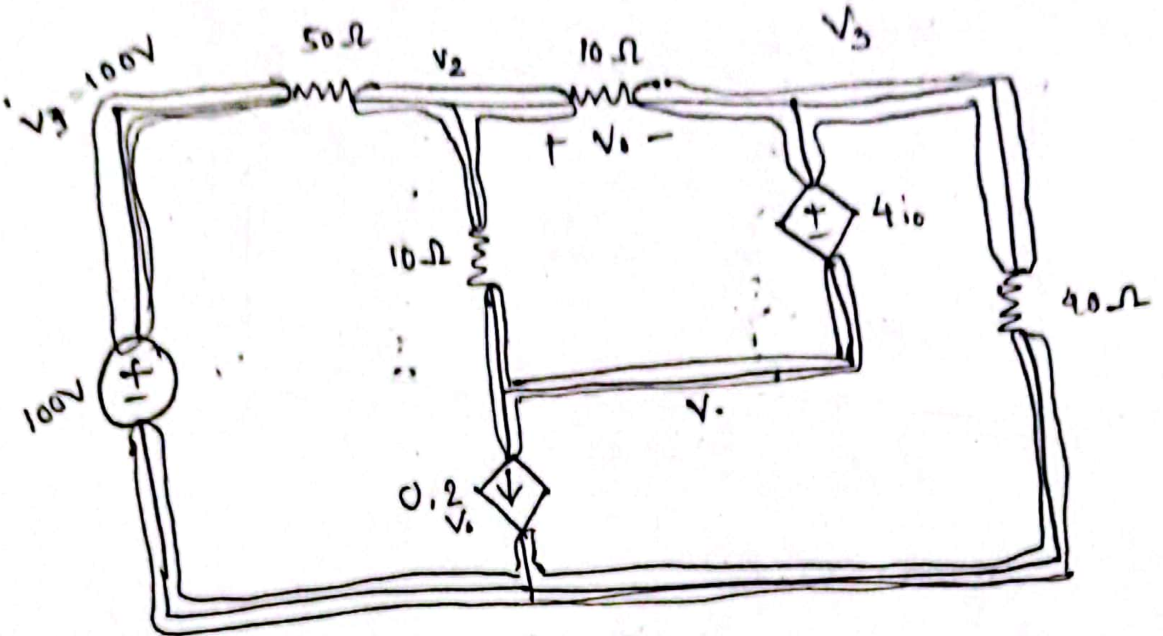
Answer no-1 (Superposition)

Superposition principle: The principle states that, if there's more than one voltage or current source in a circuit, then each sorce are to act independent & then to add current to it so ~~the~~ to find the voltage drops across each components. Each sub circuit has only one independent source. The principle is not applicable to power, because it is non-linear quantity

Answer no- 2

'For the superposition method, some sources have to on and some have to be OFF while performing nodal analysis' While applying superposition principle each sub circuit has only one independent source. the other independent sources are suppressed. So that some sources have to ON and some have to be OFF while performing nodal analysis.

(c) Keeping V = 100V alive,



$V_0 = V_2 - V_3$ — (i)

$V_1 = 100V$ — (ii)

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

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

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

$\Rightarrow 10V_3 - 10V_4 - 4V_2 + 4V_4 = 0$

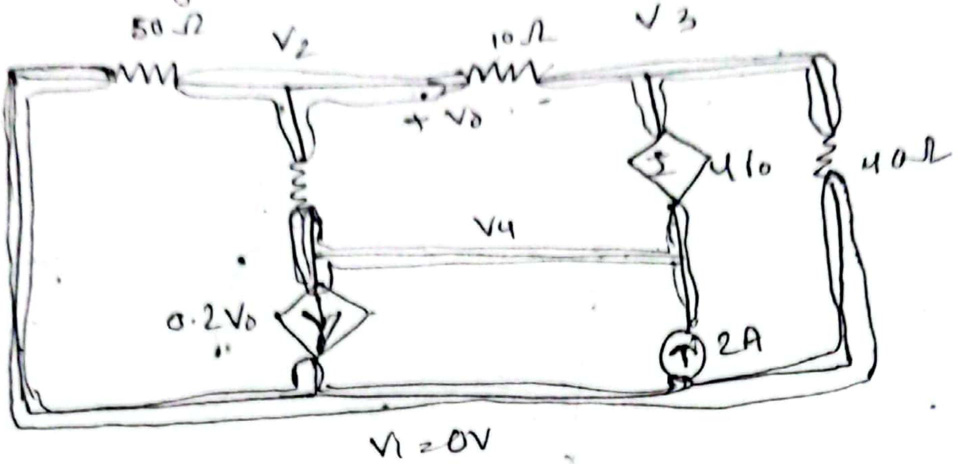
$\Rightarrow 10V_3 - 6V_4 - 4V_2 = 0$ — (v)

Solving the above eqn we get,

$V_2 = 21.5686\ V$ $\qquad V_4 = 11.7647\ V$

$V_3 = 15.6863\ V$ $\qquad V_0 = V_2 - V_3 = 5.88235\ V$

(d) keeping $J = 2A$ alive



$V_0' = V_2 - V_3$ — (iv)

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

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

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

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

$V_1 = 0V$ — (v)

Solving we get,

$V_2 = 62.7451V$

$V_3 = 67.451V$

$V_4 = 70.5882V$

$V_0' = -4.70586V$

(e) we know according to superposition principle

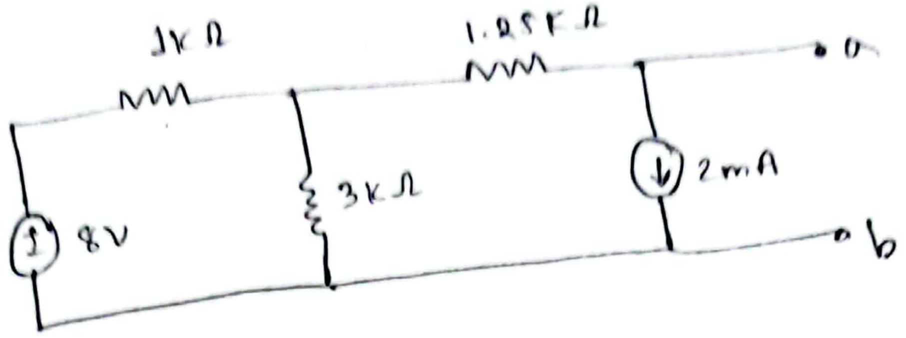
$$V_{total} = V_0 + V_0'$$

$$= 5.88235 - 4.70588$$

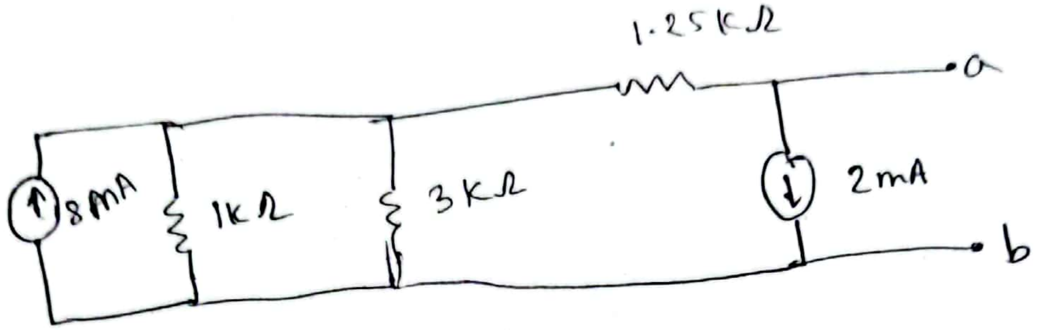
$$= 1.176V. \text{ (Ans).}$$

Transcient Analysis

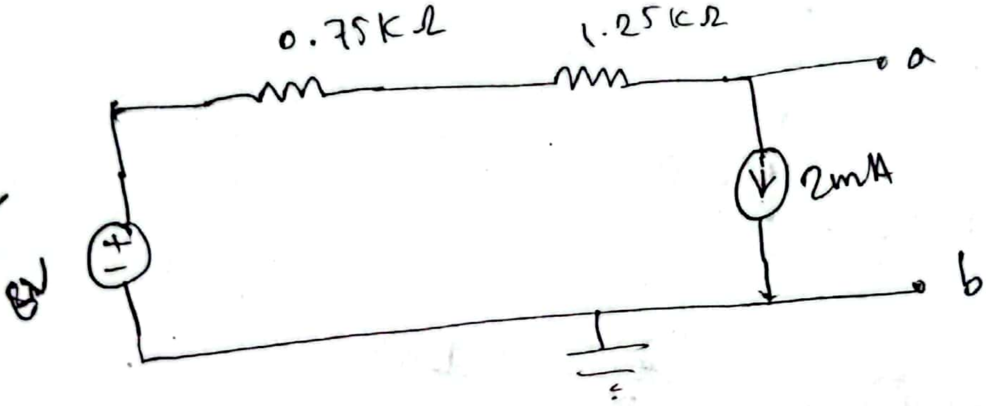
Answer no-1



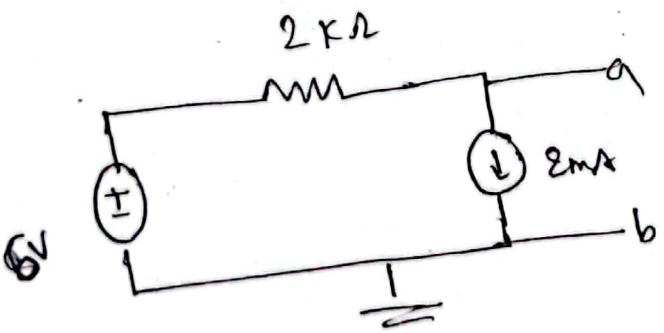
$I = \frac{V}{R}$

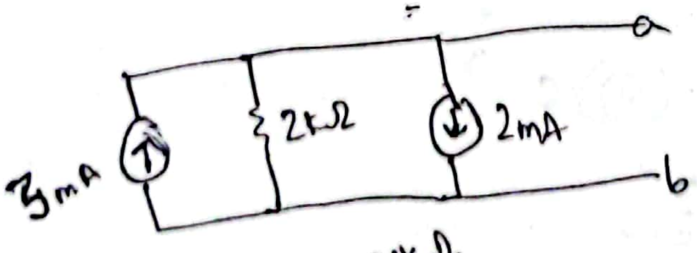


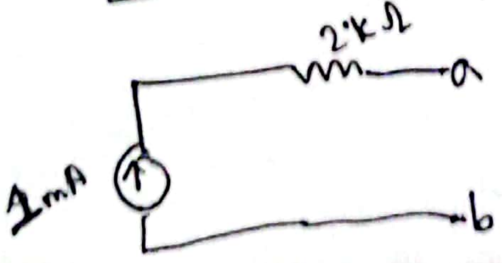
$V = \frac{8 \times 3}{3+1}$

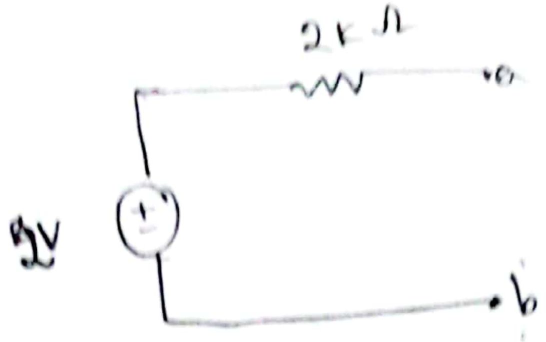


$V = \frac{8 \times 3}{3+1}$





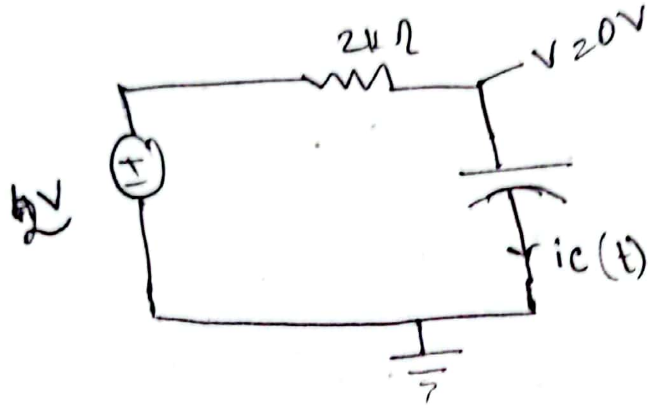




$V_1 = 2V$

$R_1 = 2k\Omega$

at $t = 0$

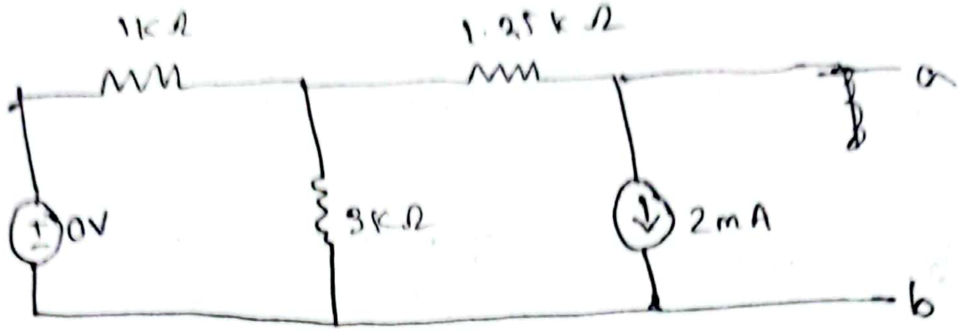


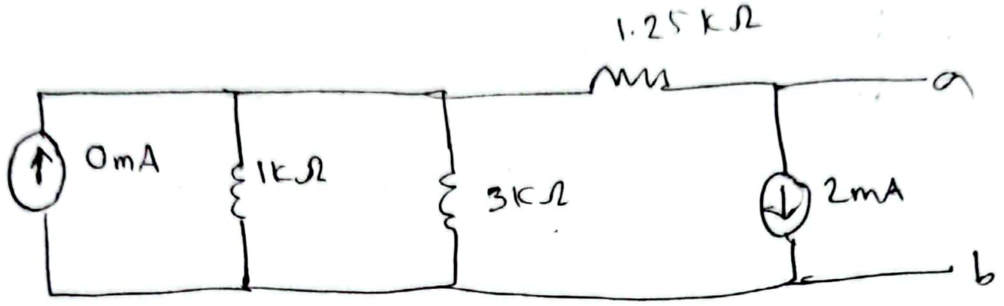
$$i_c(t) \,|\, i_c(0^+) = \frac{2}{2} = 1mA$$

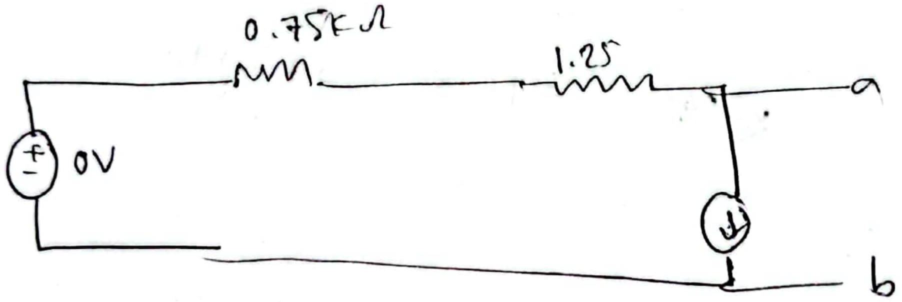
$$\tau = R \times C$$
$$= 2 \times 1\mu$$
$$= 2\times10^{-3} \text{ sec}$$

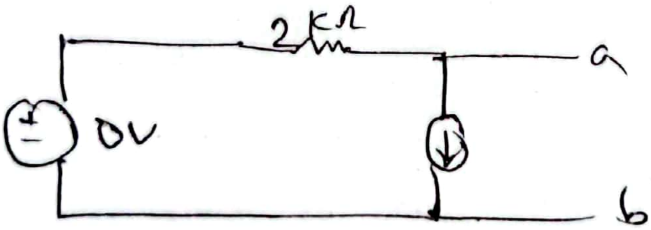
$$i(t) = i(\infty) + (i(0^+) - i(\infty))\, e^{-\frac{t}{\tau}}$$
$$= 0 + (1 - 0)\, e^{\frac{-t}{2\times10^{-3}}}$$
$$= 1 \times e^{(-t\times500)}$$
$$= 1e^{-500t}$$

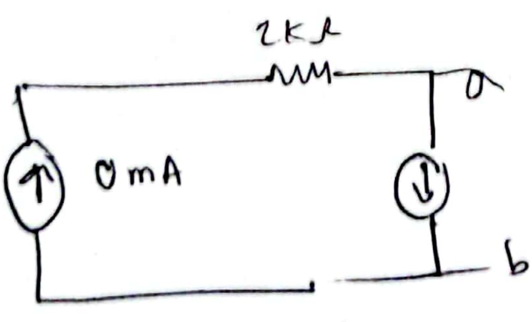
2

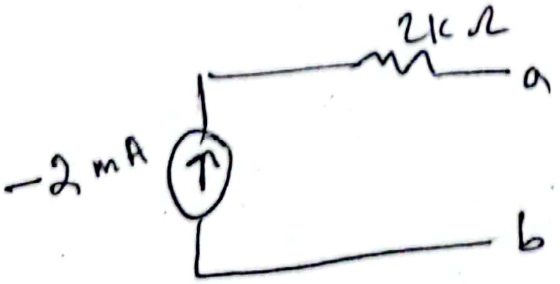

1KΩ
1.25KΩ
a
b
0V
3KΩ
2mA

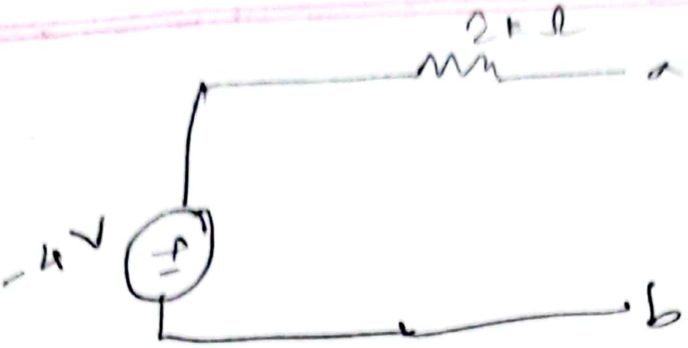

1.25KΩ
a
0mA
1KΩ
3KΩ
2mA
b


0.75KΩ
1.25
a
0V
b


2KΩ
a
0V
b


2KΩ
a
0mA
b


2KΩ
a
−2mA
b



at $t = 0$

$$i_c(0^+)/i_{c_1}(t) = \frac{-4}{2} = -2\ mA$$

$$\tau = R \times C$$

$$= 2 \times 1\mu = 2 \times 10^{-3}\ sec$$

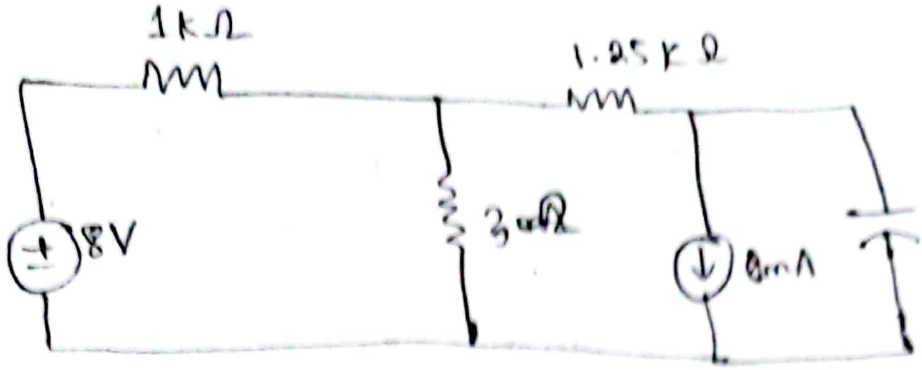
$$i_{c_1}(t) = i(\infty) + \left(i(0^+) - i(\infty)\right) \cdot e^{-t/\tau}$$

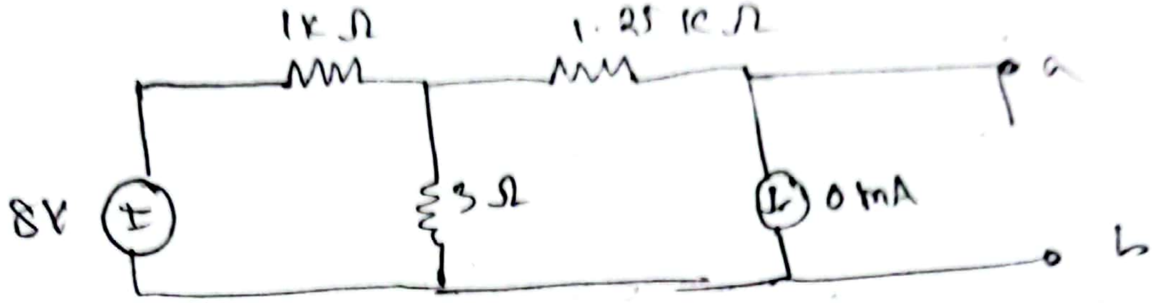
$$= 0 + (-2-0)\, e^{\frac{-t}{2\times10^{-3}}}$$

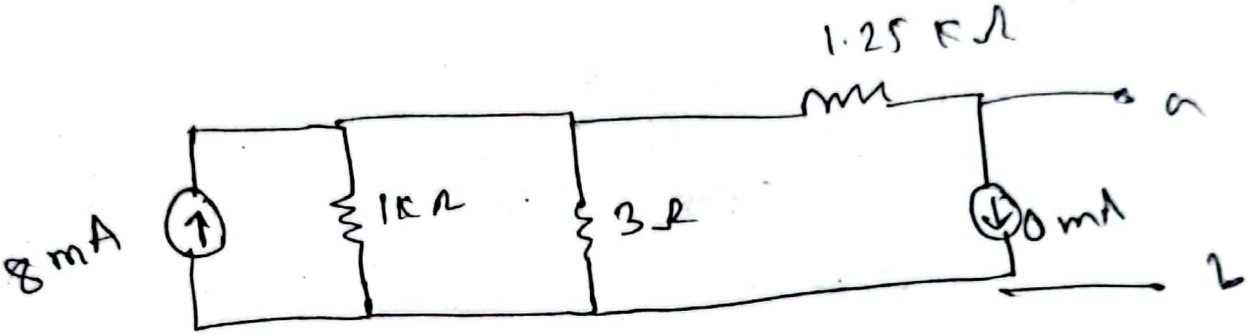
$$= -2 \times e^{\frac{-t}{2\times10^{-3}}}$$

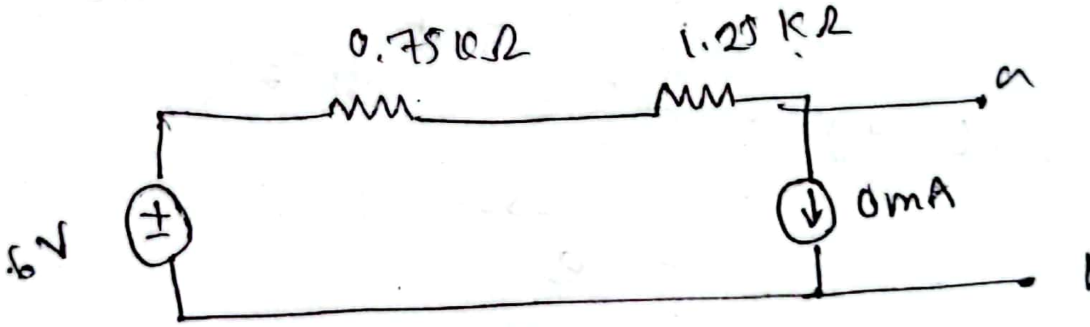
$$= -2e^{-500t}$$

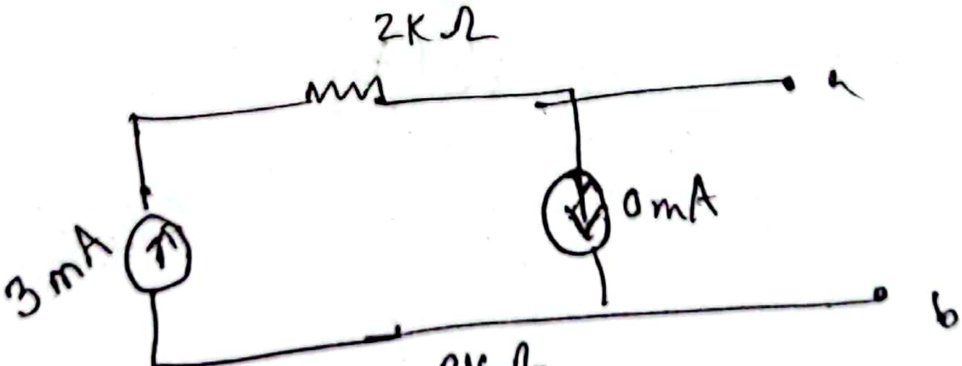
3

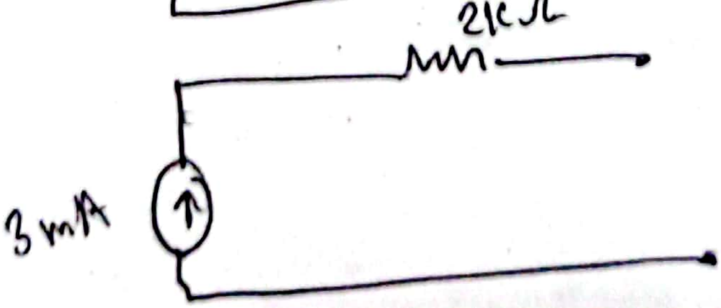

1KΩ
1.25KΩ
8V
3KΩ
0mA

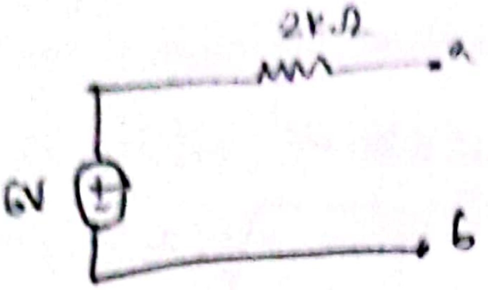

1KΩ
1.25KΩ
a
8V
3Ω
0mA
b


1.25KΩ
a
8mA
1KΩ
3Ω
0mA
b


0.75KΩ
1.25KΩ
a
6V
0mA
b


2KΩ
a
3mA
0mA
b


2KΩ
3mA



$v = 6V$

$R = 2k\Omega$

$$i(0^+) = \frac{6}{2} = 3mA$$

$$\tau = R \times C$$
$$= 2 \times 1\mu$$
$$= 2 \times 10^{-3} \sec$$

$$i_{C_2}(t) = i(\infty) + (i(0^+) - i(\infty))\, e^{-\frac{t}{\tau}}$$
$$= 0 + (3 - 0)\, e^{-\frac{t}{2\times10^{-3}}}$$
$$= 3e^{-500t}$$

④

$$i_{C_1}(t) + i_{C_2}(t) = -2e^{-500t} + 3e^{-500t}$$
$$= e^{-500t}$$
$$= i_C(t)$$

Yes, the superposition principle work in case of time varying current also.