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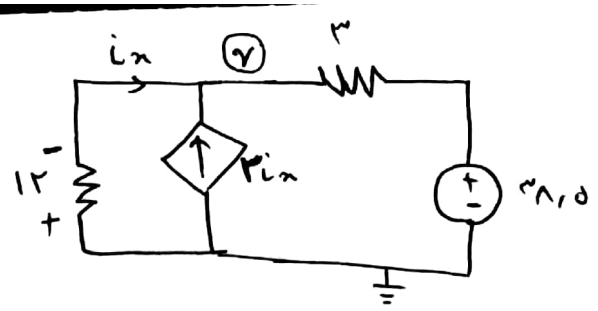
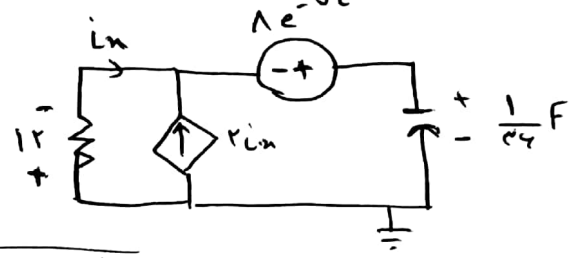
۲- $t<0$



$$\frac{v}{۱۲} = i_x \quad KCL: \frac{v}{۱۲} + \frac{v}{۳} = \frac{v - ۳۸,۵}{۳} \Rightarrow v = ۷,۲۲ V$$

$$\Rightarrow v_c(۰^-) = \frac{۲۲}{۳} V \overset{\text{پیوستگی}}{=} v_c(۰^+)$$

$t>۰$



$$Cv_c' = ۳i_x = \frac{v_c'}{۳۶}$$

$$KVL: ۸e^{-۵t} - ۳۶\left[۳i_x - ۱۲i_x = ۰\right]$$

$$v_c' + ۹v_c = ۷۲e^{-۵t} \qquad S+۹=۰ \Rightarrow S=-۹$$

$$v_{cn} = A e^{-۹t} \qquad v_{cf} = Ke^{-۵t} \overset{\text{صدق در معادله}}{=\!=} ۱۸e^{-۵t}$$

$$v_c = Ae^{-۹t} + ۱۸e^{-۵t}$$

$$v_c(۰) = A + ۱۸ = ۲۲ \Rightarrow A = ۴$$

$$\Rightarrow v_c = ۴e^{-۹t} + ۱۸e^{-۵t}$$

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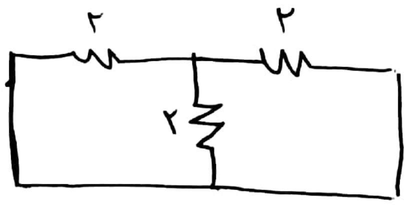
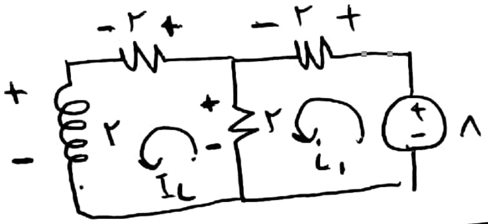
۳ـ $t<0$

$I_L(0^-) = I_L(0^+) = 0$



$0<t<\frac{2}{3}$



$KVL_1 : 8 - 2i_1 - 2(i_1 - I_L) = 0 \Rightarrow 8 - 4i_1 + 2I_L = 0$

$KVL_L : -2(I_L - i_1) - 2I_L - 2I_L' = 0$

$I_L' + 2I_L = i_1 \qquad i_1 = \frac{I_L + 4}{2}$

$\Rightarrow I_L' + 1.5 I_L = 2 \qquad s = -\frac{3}{2} \qquad I_{Ln} = Ae^{-\frac{3}{2}t}$

$I_{Lf} = K$ صرق $= \frac{4}{3}$

$I_L = Ae^{-\frac{3}{2}t} + \frac{4}{3}$

$I_L(0^+) = 0 \Rightarrow A = -\frac{4}{3} \qquad \Rightarrow I_L = \frac{4}{3}\left(1 - e^{-\frac{3}{2}t}\right)$

$t > \frac{2}{3}$

$-2(I_L + I) - 2(I_L + I - i_1) = 0$

$\Rightarrow i_1 = 0$

$2I_L' = 0 \Rightarrow I_L' = 0$

$4 - 2i_1 + I_L + I = 0 \Rightarrow I + I_L = -4$

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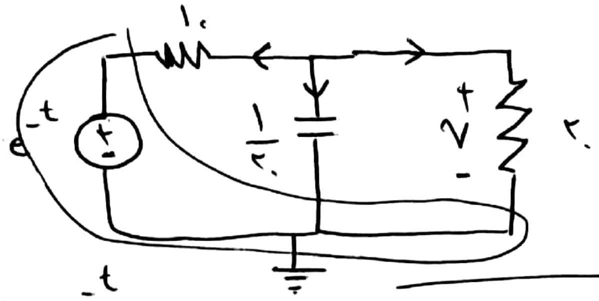
۴ -

$t > 0$



$$\frac{v}{20} + \frac{v'}{20} + \frac{v - e^{-t}}{10} = 0 \Rightarrow v' + 3v = 2e^{-t}$$

$$s + 3 = 0$$

$$v_h = Ae^{-3t}$$

$$v_f = Ke^{-t} \overset{\text{صدق}}{\Longrightarrow} K = 1 \Rightarrow e^{-t}$$

$$v = Ae^{-3t} + e^{-t}$$

$t < 0$ منبع وجود ندارد $\quad v(0^+) = v(0^-) = 0$

$$A = -1 \Rightarrow v = e^{-t} - e^{-3t}$$

$$\frac{dv}{dt} = 3e^{-3t} - e^{-t} \overset{(0^+)}{=} 2$$

$$\frac{d^2v}{dt^2} = e^{-t} - 9e^{-3t} \overset{(0^+)}{=} -8$$

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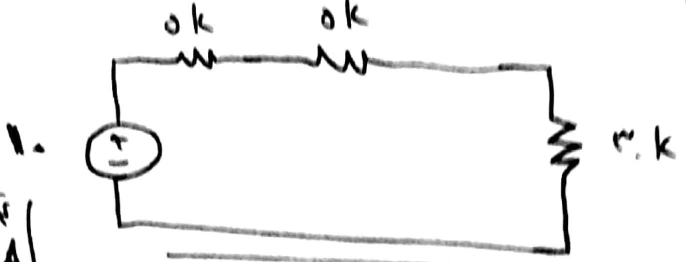
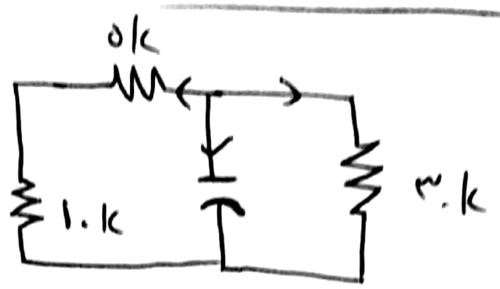
۵ - $t < 0$



$i = \frac{10}{4\times10^4} = 2.5\times10^{-4}\ A$

$v_c(0^-) = 7.5\ V = v_c(0^+)$

$0 < t < 0.2\ ms$

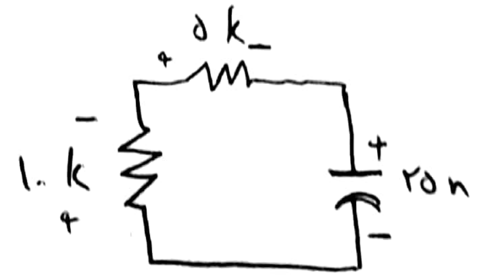


$\frac{v}{30k} + \frac{v}{15k} + 25n\, v' = 0 \Rightarrow 25v' + 10^5 v = 0 \qquad s = -4000$

$v_c = Ae^{-4000t}$, $v_c(0^+) = 7.5$ $\Rightarrow A = 7.5 \Rightarrow v_c = 7.5e^{-4000t}$

$v_c(0.2ms^-) = v_c(0.2ms^+) = 3.37\ V$

$0.2ms < t < 0.8ms$



$25n\, v_c' = i$

KVL: $v_c = -15k\, i$

$v_c + \frac{15}{4}\times10^{-4} v_c' = 0 \Rightarrow s = -\frac{8}{3}\times10^3$

$v_c = Ae^{-\frac{8000}{3}t}$, $v_c(0.2ms^+) = 3.37\ V$ $\Rightarrow A = 5.74 \Rightarrow v_c = 5.74e^{-\frac{8000}{3}t}$

$v_c(0.8ms^-) = v_c(0.8ms^+) = 0.68\ V$

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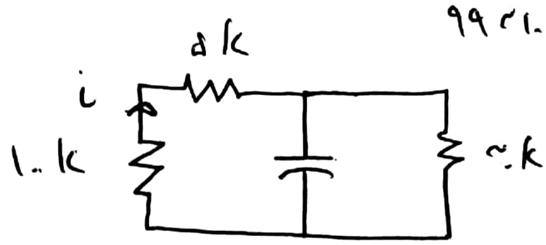
۵ - $t > ۰٫۸ms$

باشد حالت $۰٫۲ms < t < ۲$.



$v_c = Ae^{-۴۰۰۰t}$

$v_c(۰٫۸ms^+) = ۰٫۶۴۸$

$\Rightarrow A = ۱۴٫۶۸ \Rightarrow v_c = ۱۴٫۶۸e^{-۴۰۰۰t}$

$v_c = -۱۵ki \quad v_0 = ۱۰ki \Rightarrow v_0 = -۰٫۲۰۳۷$

$v_c(۵ms) = ۰/۳۰۵$