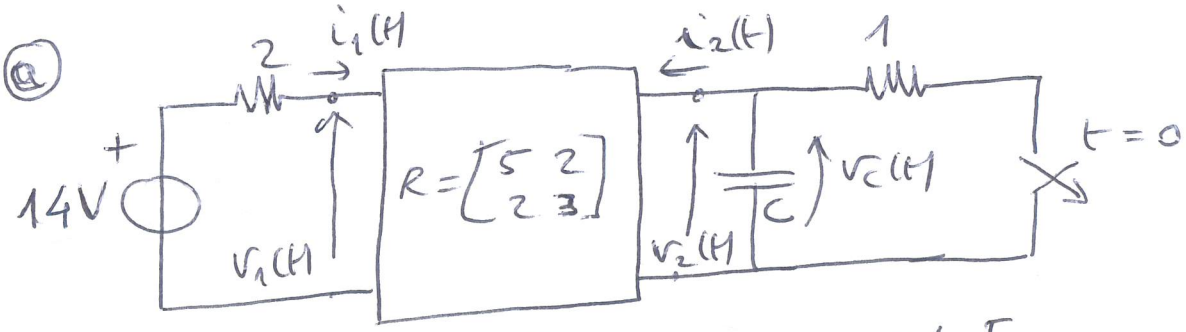
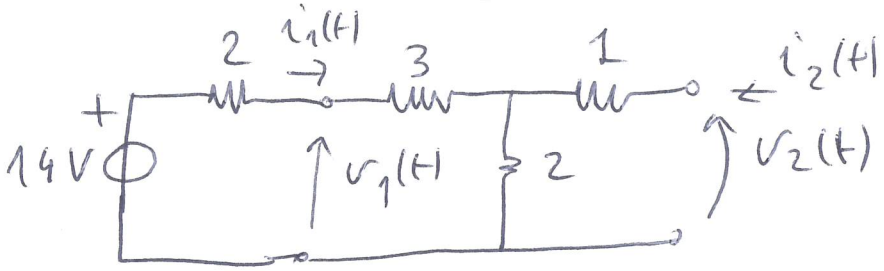
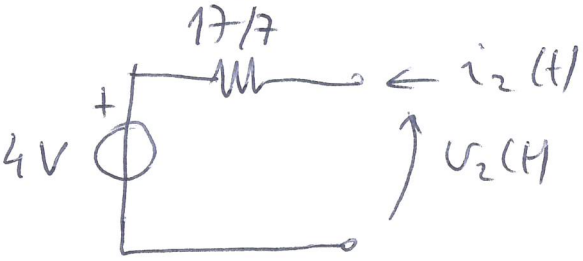
TRANSITORI I ORDINE (TEMPO)

2) (a)



$v_c(t)$? $C = 1\mu F$

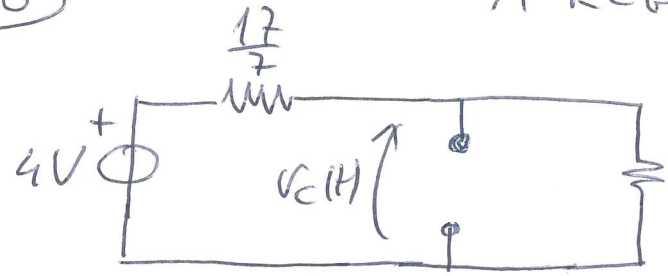




$$\begin{cases} v_1(t) = 5 i_1(t) + 2 i_2(t) \\ v_2(t) = 2 i_1(t) + 3 i_2(t) \\ v_1(t) = -2 i_1(t) + 14 \end{cases}$$

$$v_2(t) = \frac{17}{7} i_2(t) + 4$$

$t<0$ A REGIME



$R_{eq} = \frac{17}{7} /\!/ 1\ \Omega$

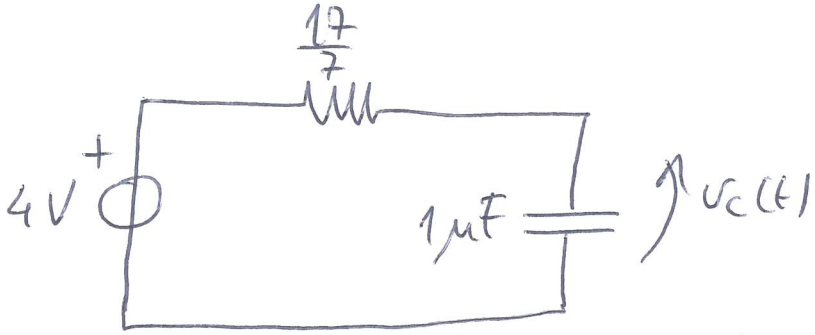
$$v_{eq}(t) = v_c(t) = \frac{1}{1+\frac{17}{7}} 4 = \frac{7}{6} V \quad \text{(REGIME)}$$

TRANSITORI I ORDINE (TEMPO)

2) (B)

$t \geq 0$

$$v_c(0) = \frac{7}{6} V$$



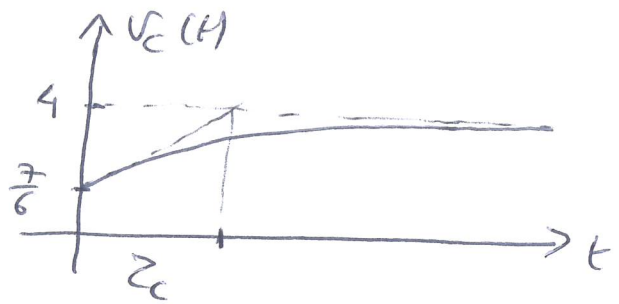
$$v_c(t) = [V_0 - v_c^p(0)]\, e^{-t/\tau_c} + v_c^p(t)$$
$t \geq 0$

$$V_0 = v_c(0) = \frac{7}{6} V$$

$$\tau_c = R\,C = \frac{17}{7} \times 10^{-6} = \frac{17}{7}\,\mu s$$

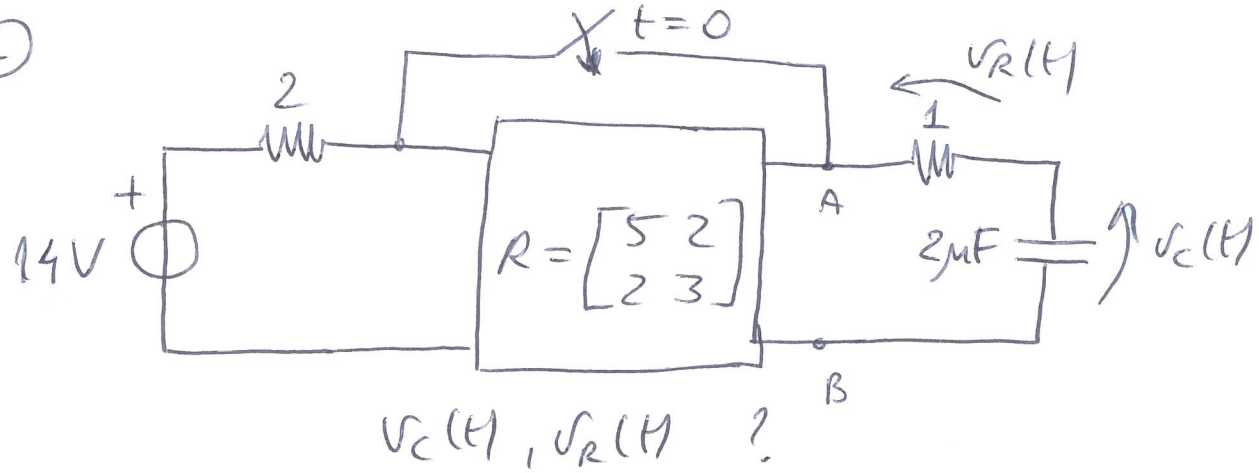
$$v_c^p(t) = 4\,V$$

$$v_c(t) = \underbrace{\left[\frac{7}{6} - 4\right]}_{-\frac{17}{6}} e^{-t/\tau_c} + 4 \quad V$$
$t \geq 0$



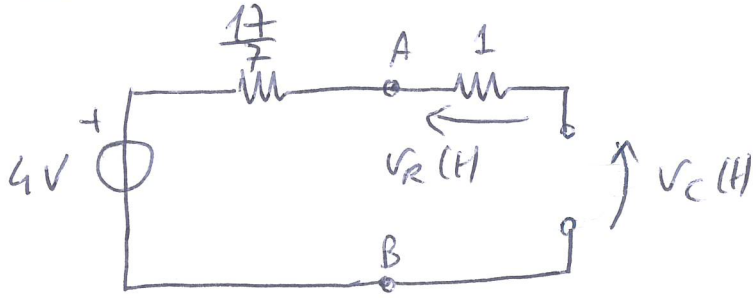
TRANSITORI I ORDINE (TEMPO)

4) (e)



$v_c(t)$, $v_R(t)$?

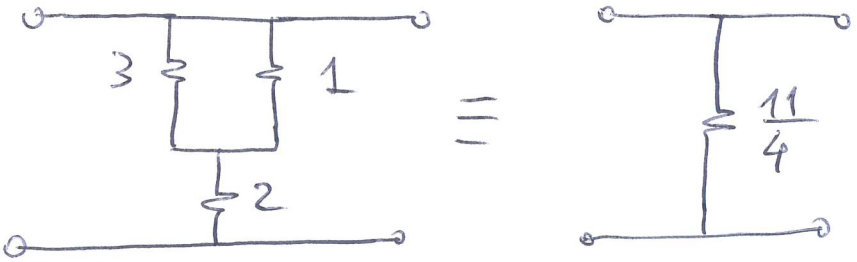
t<0

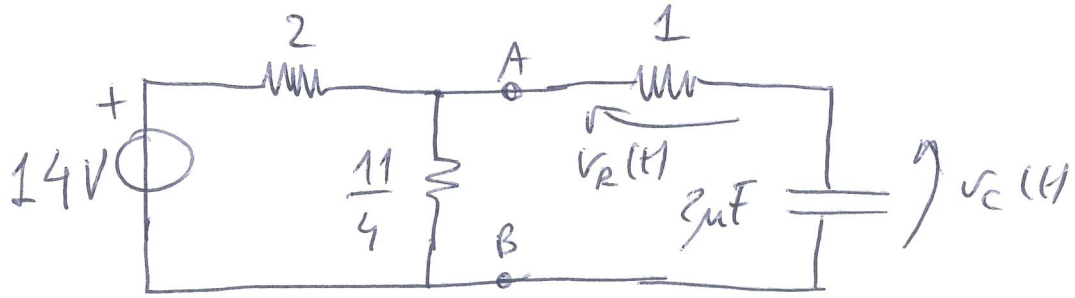


$v_R(t) = 0\ V$

$v_c(t) = 4\ V$

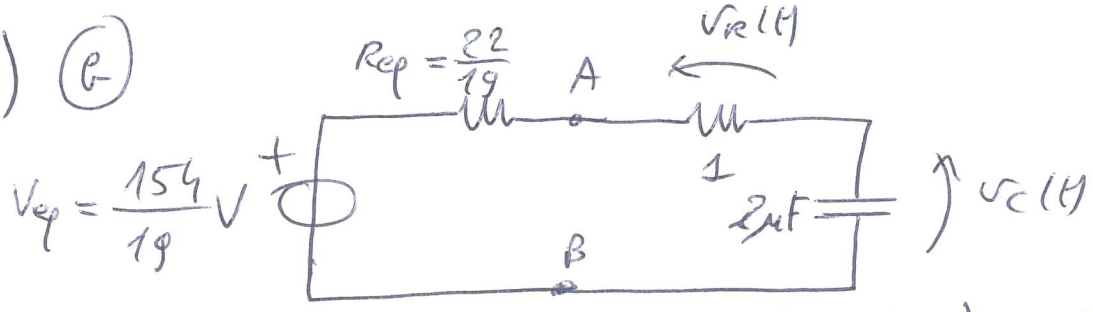
t≥0





TRANSITORI I ORDINE (TEMPO)

4) (C)



$v_C(0) = 4\,V \quad i \quad v_R(0^-) = 0\,V$

$$v_C(t) = [V_0 - v_C^p(0)]\, e^{-t/\tau_c} + v_C^p(t)$$

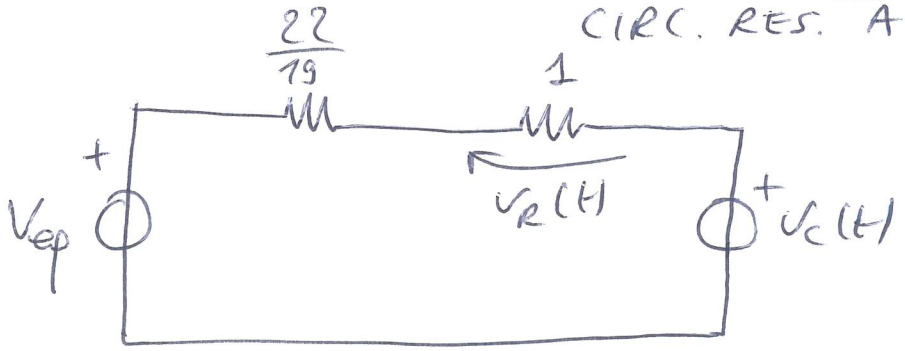
$V_0 = 4\,V$

$$\tau_c = R_{eq} C = \left(\frac{22}{19} + 1\right) \times 2 \times 10^{-6} = \frac{82}{19}\,\mu s$$

$$v_C^p(t) = \frac{154}{19}\,V$$

$$v_C(t) = \underbrace{\left[4 - \frac{154}{19}\right]}_{-\frac{78}{19}} e^{-t/\tau_c} + \frac{154}{19}\,V$$

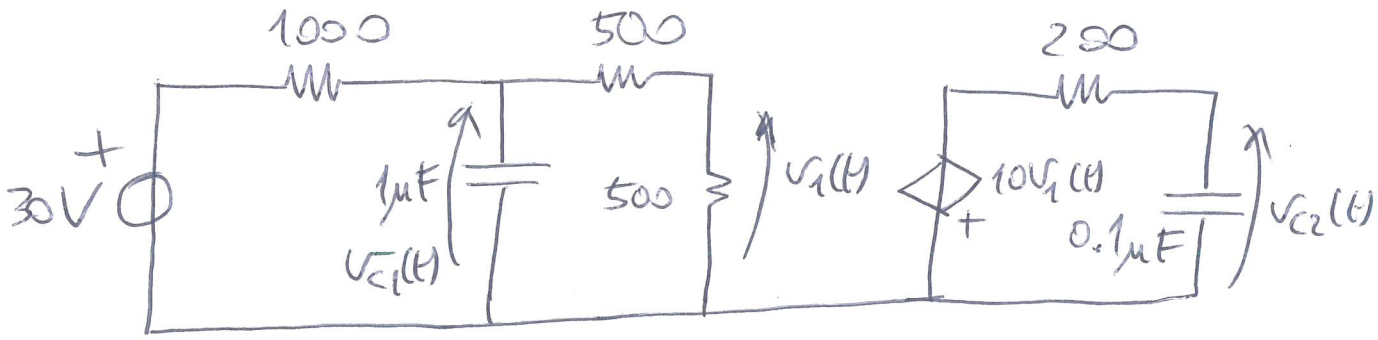
$$v_R(t) = 1 \times C\, \dot{v}_C(t) = \underbrace{[V_{eq} - v_C(t)] \frac{1}{1 + \frac{22}{19}}}_{\text{CIRC. RES. ASS.}}\,V$$



$$v_R(0^+) = \left(\frac{154}{19} - 4\right) \frac{19}{41} = \frac{78}{41}\,V$$

TRANSITORI I ORDINE (TEMPO)

5) @

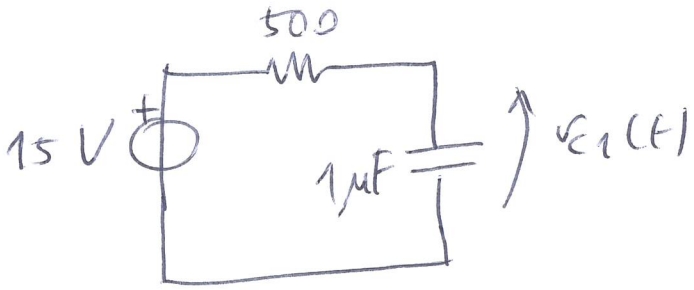


$v_{c1}(0) = 10\ V$

$v_{c2}(0) = 5\ V$

$v_{c1}(t)$, $v_{c2}(t)$? per $t \geq 0$

$$v_1(t) = \frac{v_{c1}(t)}{2}$$



$$v_{c1}(t) = [10 - 15]\, e^{-t/\tau_{c1}} + 15 \quad V$$

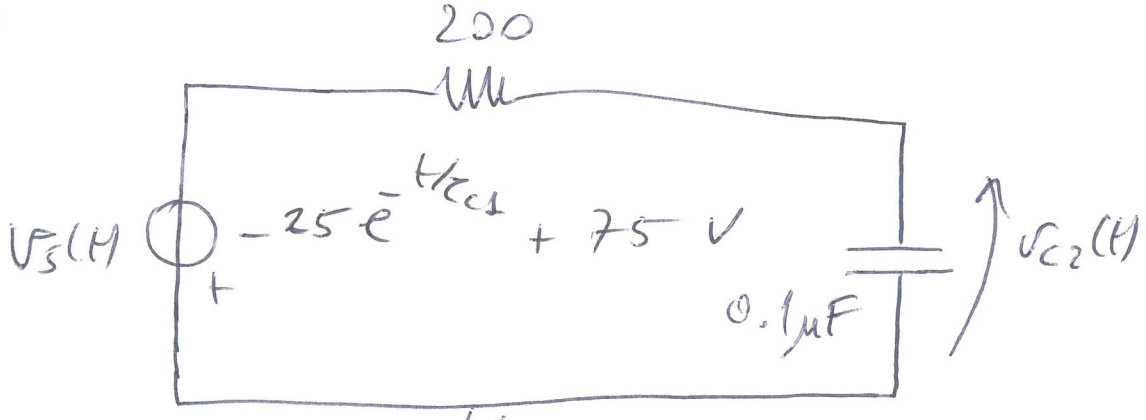
$t \geq 0$

$$\tau_{c1} = 500 \times 10^{-6} = 1 \times 10^{-4}\ s$$

$$v_1(t) = -\frac{5}{2} e^{-t/\tau_{c1}} + \frac{15}{2} \quad V$$

TRANSITORI I ORDINE (TEMPO)

5) (E)



$$v_s(t) = \underbrace{-25e^{-t/\tau_{c1}}}_{v_{s1}(t)} + \underbrace{75\ V}_{v_{s2}(t)}$$

$$v_{c2}(t) = [V_{02} - v_c^p(0)]\, e^{-t/\tau_{c2}} + v_c^p(t)$$

$t \geq 0$

$$V_{02} = 5\ V$$

$$\tau_{c2} = 200 \times 0.1 \times 10^{-6} = 20\ \mu s$$

$$v_c^{p2}(t) = 75\ V$$

$$\begin{cases} v_c^{\dot{p}1}(t) = -\dfrac{v_c^{p1}(t)}{\tau_{c2}} + \dfrac{v_{s1}(t)}{\tau_{c2}} \\ v_c^{p1}(t) = V_p e^{-t/\tau_{c1}} \end{cases}$$

$$-\frac{V_p}{\tau_{c1}} e^{-t/\tau_{c1}} = -\frac{V_p}{\tau_{c2}} e^{-t/\tau_{c1}} + \frac{(-25)e^{-t/\tau_{c1}}}{\tau_{c2}}$$

$$V_p = \frac{-25}{\tau_{c2}\left(\frac{1}{\tau_{c2}} - \frac{1}{\tau_{c1}}\right)} = \frac{-25}{1 - 0.2} = -31.25\ V$$

TRANSITORI I ORDINE (TEMPO)

5) (c)

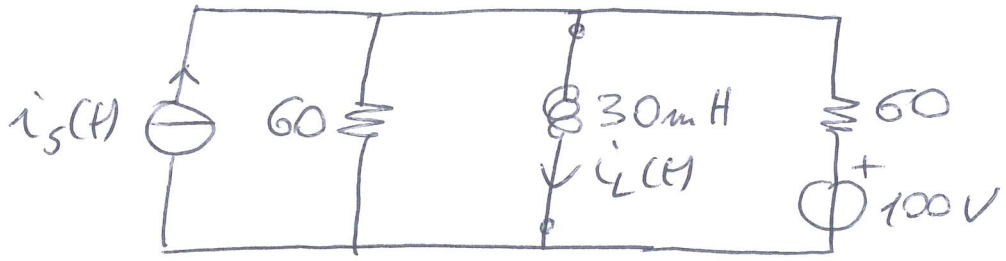
$$v_c^p(t) = 75 - 31.25\, e^{-t/\tau_1} \quad V$$

$$v_c^p(0) = 75 - 31.25 = 43.75 \quad V$$

$$v_c(t) = \underbrace{[5 - 43.75]}_{-38.75} e^{-t/\tau_2} + 75 - 31.25\, e^{-t/\tau_1} \quad V \qquad t \geq 0$$

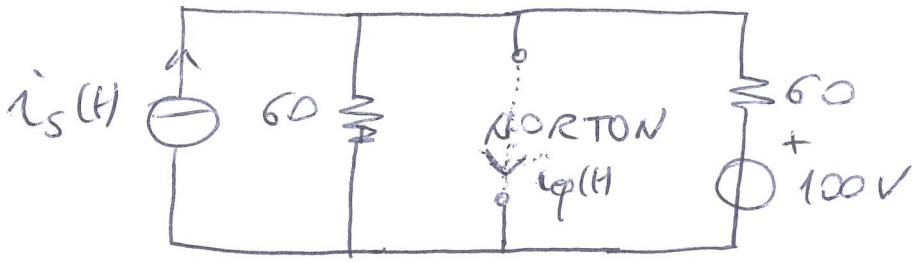
TRANSITORI I ORDINE (TEMPO)

6 (a)



$$i_s(t) = 10\cos(1000t)\ A$$

$$i_L(0) = -1\ A$$



$$R_{eq} = 60 // 60 = 30\ \Omega$$

$$i_{eq}(t) = \underbrace{i'_{eq}(t)}_{i_s(t)} + \underbrace{i''_{eq}(t)}_{V_s}$$

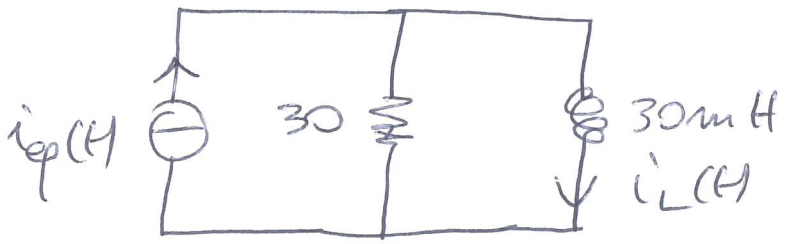
$$i'_{eq}(t) = i_s(t) = 10\cos(1000t)\ A$$

$$i''_{eq}(t) = \frac{100}{60} = \frac{5}{3}\ A$$

$$i_{eq}(t) = \frac{5}{3} + 10\cos(1000t)\ A$$

TRANSITORI I ORDINE (TEMPO)

6) (e)



$$i_{eq}(t) = \frac{5}{3} + 10\cos(1000t)\ A$$

$$i_L(0) = -1\ A$$

$$i_L(t) = [I_0 - i_L^p(0)]e^{-t/\tau_L} + i_L^p(t)$$

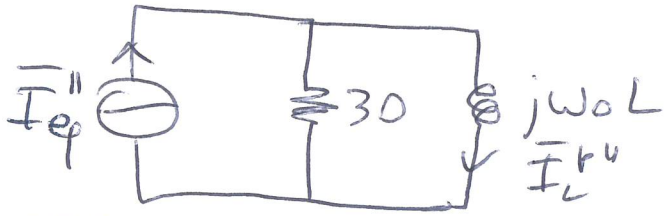
$t \geq 0$

$$I_0 = i_L(0) = -1\ A$$

$$\tau_L = G_{eq} L = \frac{30\,10^{-3}}{30} = 1\ ms$$

$$i_L^p(t) = i_L^{p'}(t) + i_L^{p''}(t)$$

$$i_L^{p'}(t) = \frac{5}{3}\ A$$



$$\bar{I}''_{eq} = 10\ A$$

$$\bar{I}_L^{p''} = \frac{30}{30 + j\omega L}\bar{I}''_{eq} =$$

$$= \frac{30}{30 + j30}10 = \frac{10}{1+j}$$

$$|\bar{I}_L^{p''}| = \frac{10}{\sqrt{2}}\ A \qquad \angle \bar{I}_L^{p''} = -\frac{\pi}{4} + 2k\pi\ rad$$

TRANSITORI I ORDINE (TEMPO)

6) (c)

$$i_L^{p4}(t) = \frac{10}{\sqrt{2}} \cos\left(1000t - \frac{\pi}{4}\right) A$$

$$i_L^{p}(t) = \frac{5}{3} + \frac{10}{\sqrt{2}} \cos\left(1000t - \frac{\pi}{4}\right) A$$

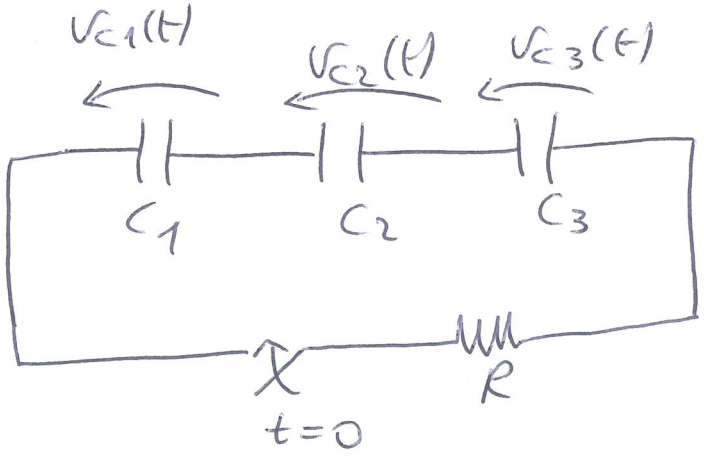
$$i_L^{p}(0) = \frac{5}{3} + \frac{10}{2} = \frac{20}{3} A$$

$$i_L(t) = \underbrace{\left[-1 - \frac{20}{3}\right]}_{-\frac{23}{3}} e^{-t/\tau_L} + \frac{5}{3} + \frac{10}{\sqrt{2}} \cos\left(1000t - \frac{\pi}{4}\right) A$$

$t > 0$

TRANSITORI I ORDINE (TEMPO)

11)



$v_{C1}(0)$, $v_{C2}(0)$, $v_{C3}(0)$ NOTI

v_{C1}^{∞}, v_{C2}^{∞}, v_{C3}^{∞} ?

$$v_{C1}^{\infty} + v_{C2}^{\infty} + v_{C3}^{\infty} = 0$$

$$\underbrace{C_1\left[v_{C1}^{\infty} - v_{C1}(0)\right]}_{\Delta Q_1} = \underbrace{C_2\left[v_{C2}^{\infty} - v_{C2}(0)\right]}_{\Delta Q_2} = \underbrace{C_3\left[v_{C3}^{\infty} - v_{C3}(0)\right]}_{\Delta Q_3}$$

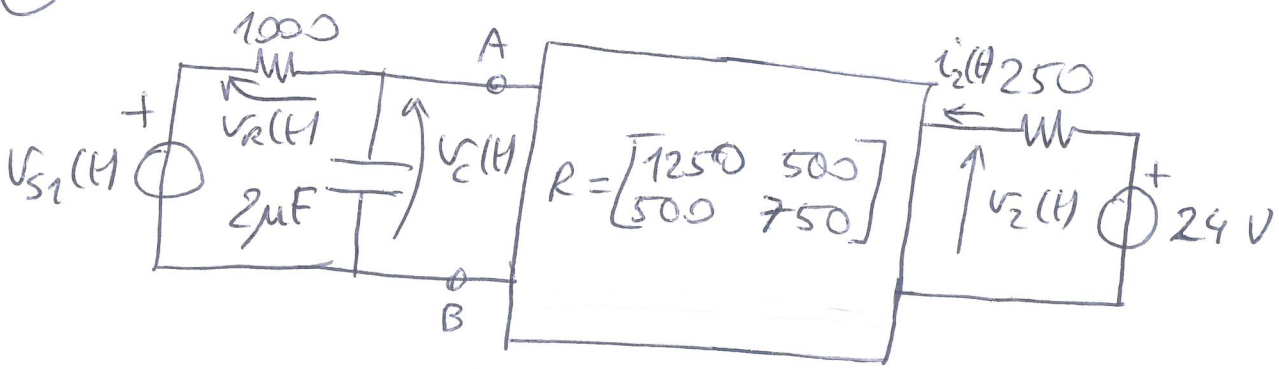
$$\begin{cases} v_1 + v_2 + v_3 = 0 \\ v_1 - 2v_2 = -1 \\ -2v_2 + 0.5v_3 = -3.5 \end{cases}$$

$v_{C1}^{\infty} = 1.2857\ V$; $v_{C2}^{\infty} = 1.1429\ V$; $v_{C3}^{\infty} = -2.4286\ V$

$\Delta Q_1 = \Delta Q_2 = \Delta Q_3 = 0.2857 \times 10^{-6}\ C$

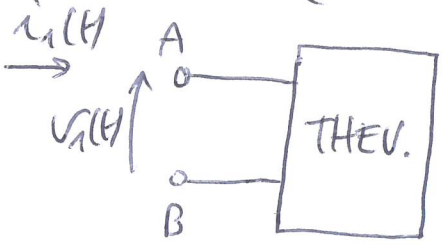
TRANSITORI I ORDINE (TEMPO)

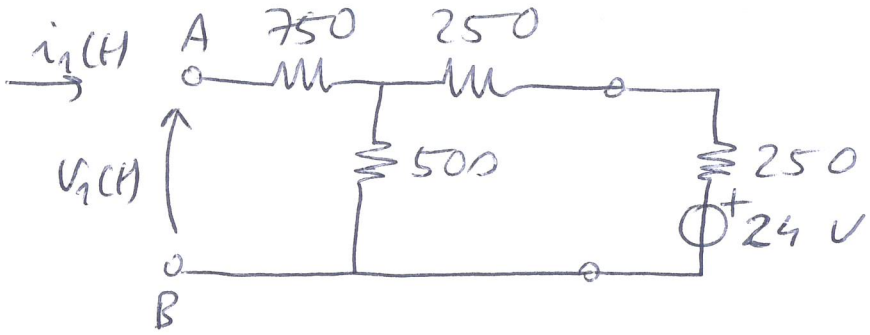
14) ⓐ

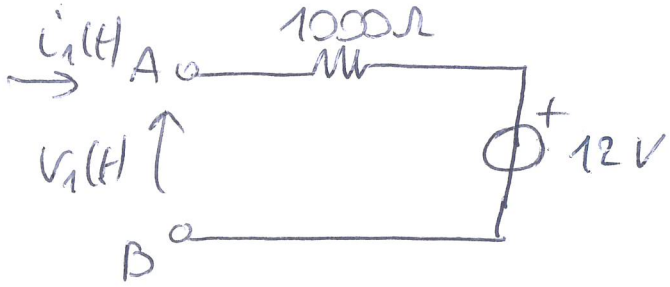


$v_{s1}(t) = 10 \cos(1000 t)$ V

$v_c(0) = -1$ V





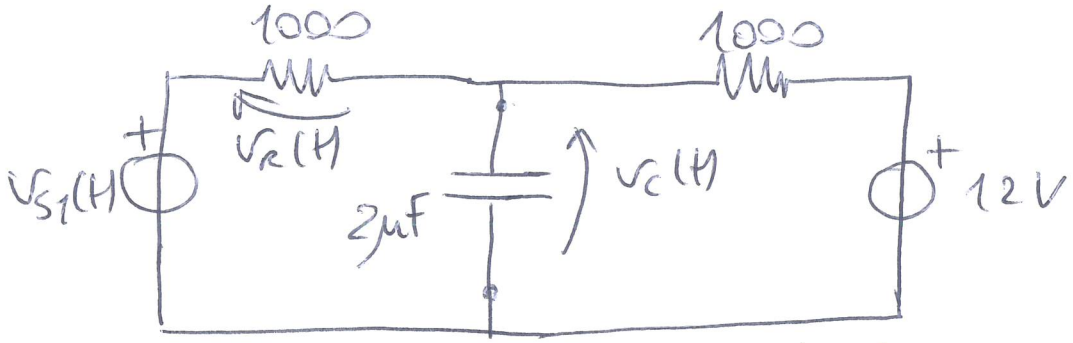


$$\begin{cases} v_1(t) = 1250\, i_1(t) + 500\, i_2(t) \\ v_2(t) = 500\, i_1(t) + 750\, i_2(t) \\ v_2(t) = -250\, i_2(t) + 24 \end{cases}$$

$$v_1(t) = 1000\, i_1(t) + 12$$

TRANSITORI I ORDINE (TEMPO)

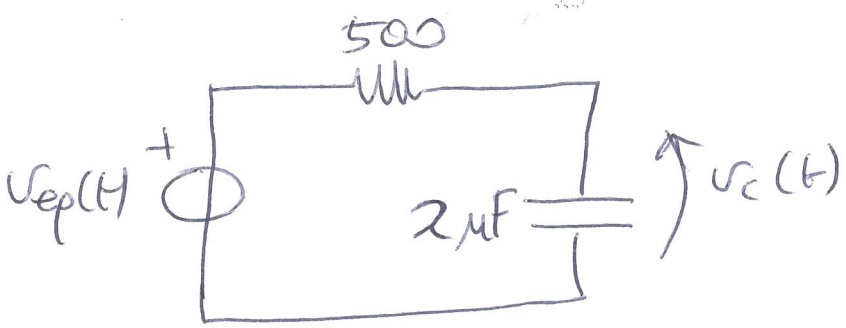
14) (B)



$v_{s1}(t) = 10\cos(1000t)$ V

$v_c(0) = -1$ V

$v_R(t) = v_{s1}(t) - v_c(t)$



$$v_{eq}(t) = \frac{\frac{v_{s1}(t)}{1000} + \frac{12}{1000}}{\frac{1}{1000} + \frac{1}{1000}} = \frac{v_{s1}(t) + 12}{1000} \cdot \frac{1000}{2} =$$

$$= \frac{v_{s1}(t)}{2} + 6 = 5\cos(1000t) + 6 \quad V$$

TRANSITORI I ORDINE (TEMPO)

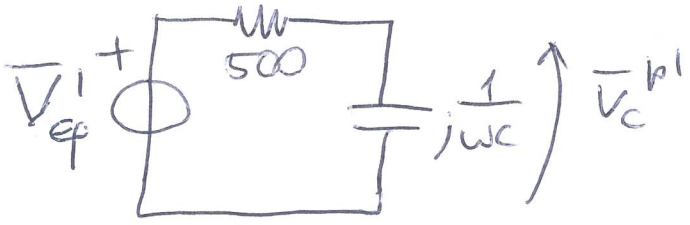
14) (c)

$$v_C(t) = [V_0 - v_C^p(0)]\, e^{-t/\tau_c} + v_C^p(t)$$

$$V_0 = -1\,V$$

$$\tau_c = R_{eq} C = 500 \times 2 \times 10^{-6} = 1\,ms$$

$$v_C^p(t) = \underbrace{v_C^{p'}(t)}_{\cos} + \underbrace{v_C^{p''}(t)}_{\text{COST.}}$$



$$\bar{V}'_{eq} = 5\,V$$

$$\bar{V}_C^{p'} = \frac{\frac{1}{j\omega C}}{500 + \frac{1}{j\omega C}} \bar{V}'_{eq} = \frac{5}{1+j}\,V$$

$$|\bar{V}_C^{p'}| = \frac{5}{\sqrt{2}}\,V \qquad \angle \bar{V}_C^{p'} = -\frac{\pi}{4} + 2k\pi \text{ rad}$$

$$v_C^{p'}(t) = \frac{5}{\sqrt{2}} \cos\left(1000t - \frac{\pi}{4}\right) V$$

$$v_C^{p'}(0) = \frac{5}{2}\,V$$

$$v_C^{p''}(t) = 6\,V$$

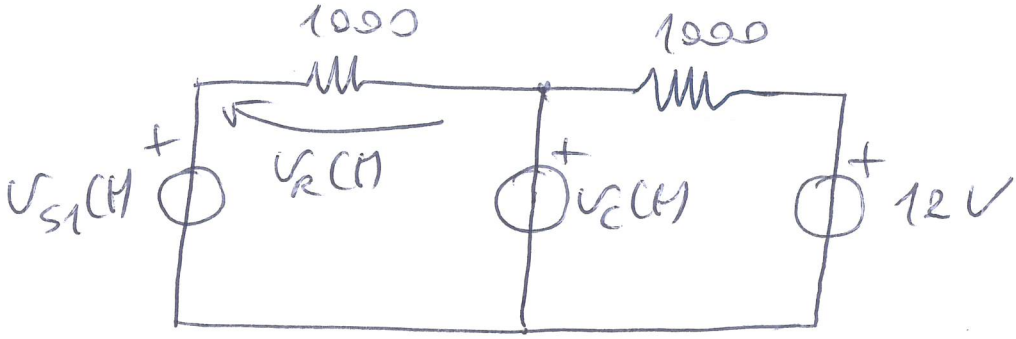
$$v_C^p(t) = 6 + \frac{5}{\sqrt{2}} \cos\left(1000t - \frac{\pi}{4}\right) V$$

TRANSITORI I ORDINE (TEMPO)

14) (d)

$$v_C(t) = \underbrace{\left[-1 - \frac{5}{2} - 6\right]}_{-9.5} e^{-t/\tau_c} + 6 + \frac{5}{\sqrt{2}}\cos\left(1000t - \frac{\pi}{4}\right) V \qquad t>0$$

CIRC. RES. ASS.

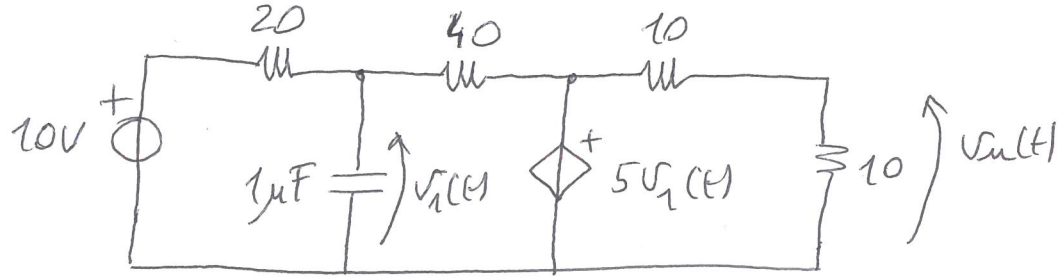


$$v_R(t) = v_{s1}(t) - v_C(t)$$

$$v_R(0) = v_{s1}(0) - v_C(0) = 10 - (-1) = 11\ V$$

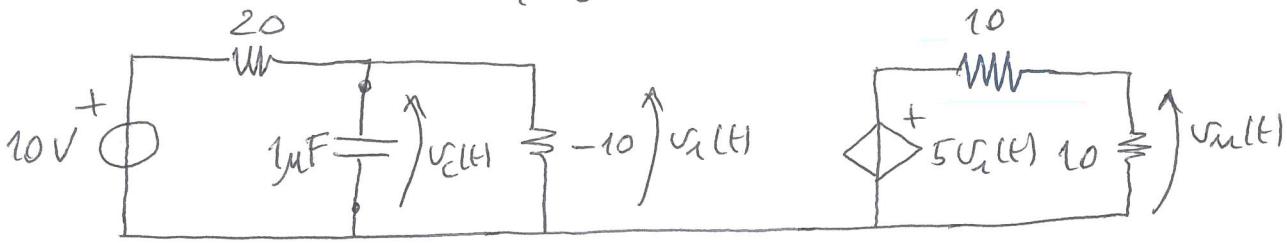
TRANSITORI I ORDINE (TEMPO)

15)



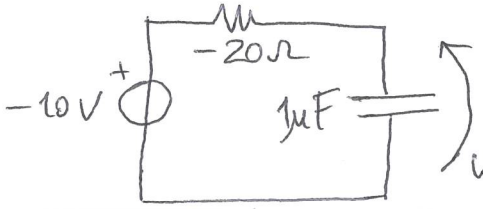
$v_1(0) = 1\,V$

MILLER I: $R_1 = \frac{40}{1-5} = -10\,\Omega$



$$R_{eq} = 20 // (-10) = \frac{20 \times (-10)}{20 - 10} = -20\,\Omega$$

$$V_{eq} = \frac{-10}{20 - 10}\,10 = -10\,V$$



$\tau_c = -20 \times 10^{-6} = -20\,\mu s$

$$v_c(t) = (1 - (-10))\,e^{-\frac{t}{\tau_c}} + (-10)\;V$$

$t > 0$

↑ INSTABILE

$$v_u(t) = \frac{5}{2}\,v_c(t)$$