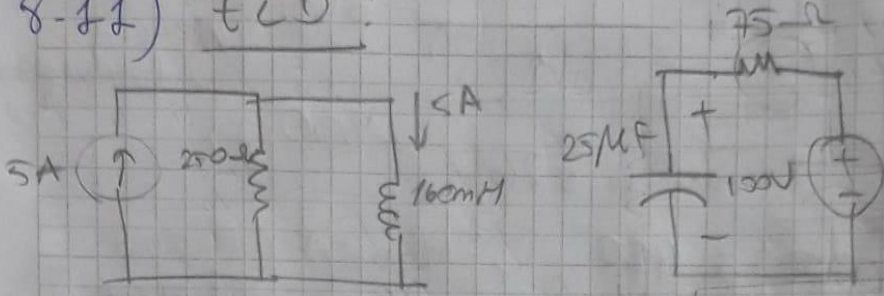
8-11) $t<0$:



After a very long time $\boxed{I_0 = 5A,\ V_0 = 100V}$

$$\alpha = \frac{1}{2RC} = \frac{1}{2.5^0(25.10^{-6})} = \frac{10^0}{10^2.25} = \frac{10^4}{25} = 400$$

$$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{160.10^{-3}.25.10^{-6}}} = \sqrt{\frac{10^9}{4.10^3}} = 500$$

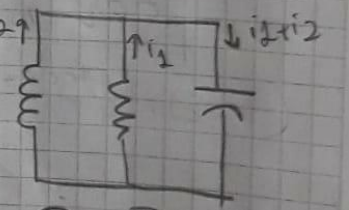
under damp.

$$\omega_d = \sqrt{\omega_0^2 - \alpha^2} = \sqrt{500^2 - 400^2} = 300$$

$$v(0^+) = B_1 \cdot e^{-400t} \cdot \cos(300t) + B_2 e^{-400t} \sin(300t)$$

$$v(0^+) = \boxed{B_1 = 300}$$

$$\frac{dv(0^+)}{dt} = -\alpha B_1 + \omega_d B_2 = \frac{1}{C} I_C$$



$I_C = I_R + I_L$

$$\frac{dv(0^+)}{dt} = -\alpha B_1 + \omega_d B_2 = \frac{1}{C}\left(-I_0 - \frac{V_0}{R}\right)$$

$$= -400.100 + 300 B_2 = \frac{1}{25\times10^{-6}}\left(-5 - 2\right)$$

$$\Rightarrow \boxed{B_2 = -800}$$

$$\boxed{v(t) = 100e^{-400t} \cdot \cos(300t) - 800e^{-400t} \cdot \sin(300t)\ V}$$

8.27) $\alpha = \frac{1}{2RC} = \frac{1}{2\cdot(12.5)(62.5)} = 640$

$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{25\times10^{-3}\cdot(62.5\times10^{-6})}} = 800$ } underdamped

$\omega_D = \sqrt{800^2 - 640^2} = 480$, If = 2A (Forced Response)

$i(t) = B_1' e^{-640t}\cos(480t) + B_2' e^{-640t}\sin(480t) + 2$

$i(0^+) = 2 + B_1' = 1 \Rightarrow \boxed{B_1' = -1}$

$\frac{di(0^+)}{dt} = -\alpha B_1' + \omega_d B_2' = \frac{V_0}{L}$

$= 640 + 480 B_2' = \frac{50}{25\times10^{-3}} = 2000$

$= 480 B_2' = 1360$

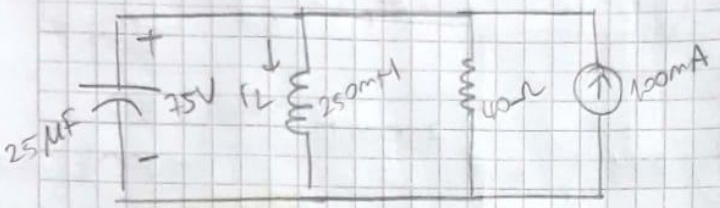
$\Rightarrow \boxed{B_2' = 2.83}$

$i(t) = -e^{-640t}\cos(480t) + 2.83 e^{-640t}\sin(480t) + 2$ A

↳ I_{forced}

8.35) $V_0 = 100 \cdot \frac{3}{4} = 75V$, $I_0 = 100mA$ (fig. 8

for $t > 0$:



$\rightarrow I_f = 100mA$

$$\alpha = \frac{1}{2RC} = \frac{1}{2 \cdot 40 \cdot (25 \times 10^{-6})} = 500$$

$$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{250 \times 10^{-3} \cdot 25 \times 10^{-6}}} = 400$$

} overdamped

$$s_{1,2} = -\alpha \mp \sqrt{\alpha^2 - \omega_0^2} \Rightarrow s_{1,2} = -500 \mp \sqrt{500^2 - 400^2}$$

$s_1 = -200$

$s_2 = -800$

a) $i(t) = A_1 e^{-200t} + A_2 e^{-800t} + I_f$

$i(0) = A_1 + A_2 + 0.1 = 0.1 \Rightarrow \boxed{A_1 + A_2 = 0}$

$$\frac{di(0^+)}{dt} = -200A_1 - 800A_2 = \frac{V_0}{L} = \frac{75}{0.25} = 300$$

$$\left.\begin{array}{l} -2A_1 - 8A_2 = 3 \\ 2A_1 + 2A_2 = 0 \end{array}\right\} -6A_2 = 3$$

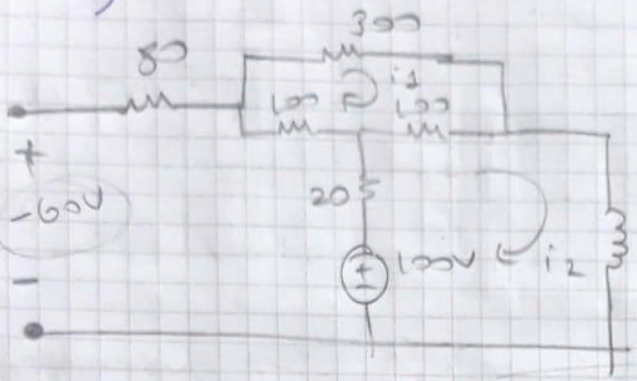
$\boxed{A_2 = -1/2}$ $\boxed{A_1 = 1/2}$

$i(t) = 0.5 e^{-200t} - 0.5 e^{-800t} + 0.1$ A

b) $V_c(t) = V_L(t) = L \frac{di_L}{dt} = (0.25)\left[-100 e^{-200t} + 400 e^{-800t}\right]$

$= -25 e^{-200t} + 100 e^{-800t}$ V

8.47) $t<0$, capacitor acts like an open circuit

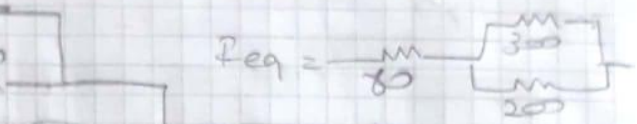


$500i_1 - 100i_2 = 0$ $\quad -100 + 120i_2 - 100i_1 = 0$

$5i_1 = i_2$ $\quad \Rightarrow i_1 = 0.2A,\ i_2 = 1A$

$v_0 = -100 + 20i_2 + 100i_1$

$v_0 = -60V$



$R_{eq} = 80 + 300 \| 200$

$R_{eq} = 200$

$A_1 + A_2 = 1 \quad |200$

$-200A_1 - 800A_2 = -700$

$-600A_2 = -500$

$A_2 = \frac{5}{6}, \quad A_1 = \frac{1}{6}$

$\alpha = \frac{R}{2L} = \frac{200}{0.4} = 500$

$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(0.2)(31.25\times10^{-6})}}$

$\omega_0 = 400$

overdamped

$s_{1,2} = -100 \mp \sqrt{500^2 - 400^2} = -200, -800$

$i(0) = A_1 + A_2 = 1, \quad \frac{di(0^+)}{dt} = -200A_1 - 800A_2$

$= -\frac{1}{L}(-v_0 - Ri_0)$

$= -700$

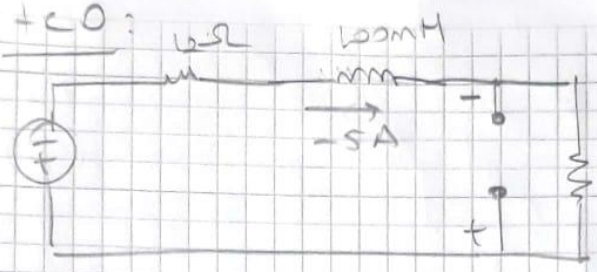
$\Rightarrow A_1 = 0.167$

$A_2 = 0.833$

$i(t) = 0.167e^{-200t} + 0.833e^{-800t}$ mA

$v(t) = L\frac{di}{dt} \Rightarrow -6.67e^{-200t} - 133.28e^{-800t}$ V

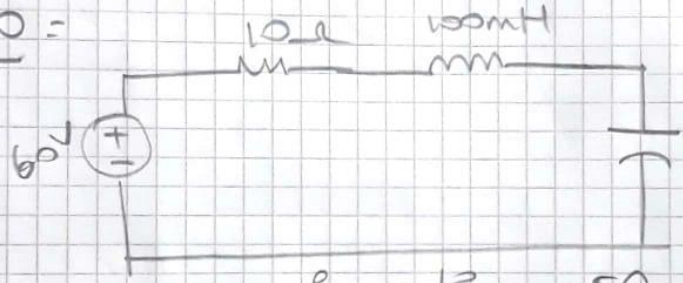
8-54) $t<0$:



$R_{eq} = 30\Omega$

$I_0 = \frac{V}{R} = \frac{-150}{30} = -5A \qquad V_0 = -90V$

$t>0$:



underdamped

In serial form →

$\alpha = \frac{R}{2L} = \frac{12}{2(0.1)} = 50$

$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(0.1)(2\times10^{-3})}} = 70.7$

$v(t) = 60 + B_1' e^{-50t}\cdot\cos(50t) + B_2' e^{-50t}\sin(50t)$

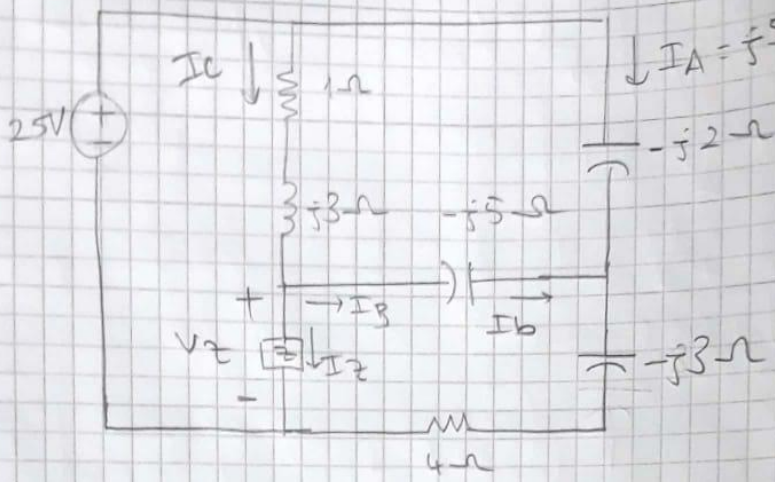
$v(0^+) = 60 + B_2' = -90 \Rightarrow B_2' = -150$

$\frac{dv}{dt} = \frac{I}{C} = \frac{-5}{2\times10^{-3}} = -2500$

$\frac{dv}{dt}(0^+) = -50B_1' + 50B_2' = -2500 \Rightarrow B_2' = -200$

$$v(t) = 60 - 150e^{-50t}\cos(50t) - 200e^{-50t}\sin(50t)\ V$$

9.32)



$$-25 - (-j2 \cdot j5) + (4 - j3)(j5 + I_B) = 0$$

$$-25 + 10 + (4 - j3)(j5 + I_B) = 0$$

$$\Rightarrow I_B = (2.4 - j3.2)\ A$$

$$V_z = -j5(2.4 - j3.2) + (4 - j3)\underbrace{(2.4 + j1.8)}_{I_1 + I_2} = 0$$

$$\Rightarrow V_z = (-1 - j12)\ V$$

$$-25 + (1 + j3) I_C + (-1 - j12) = 0$$

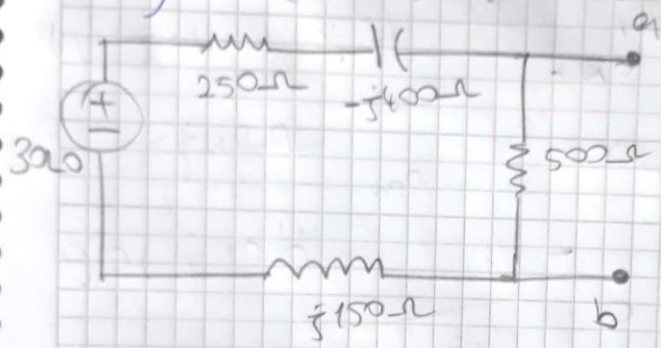
$$\Rightarrow I_C = (6.2 - j6.6)\ A$$

$$I_z = I_C - I_B \quad (6.2 - j6.6) - (2.4 - j3.2)$$

$$= (3.8 - j3.4)\ A$$

$$z = \frac{V_z}{I_z} = \frac{-1 - j12}{3.8 - j3.4} = (1.42 - j1.88)\ \Omega$$

9.45) $V = (120\angle 0)\cdot(2.5\angle 0) = 30\ V$



$Z_{eq} = (750 - j250)\ \Omega$

$Z_{eq} = (790.6\angle 341.2)\ \Omega$

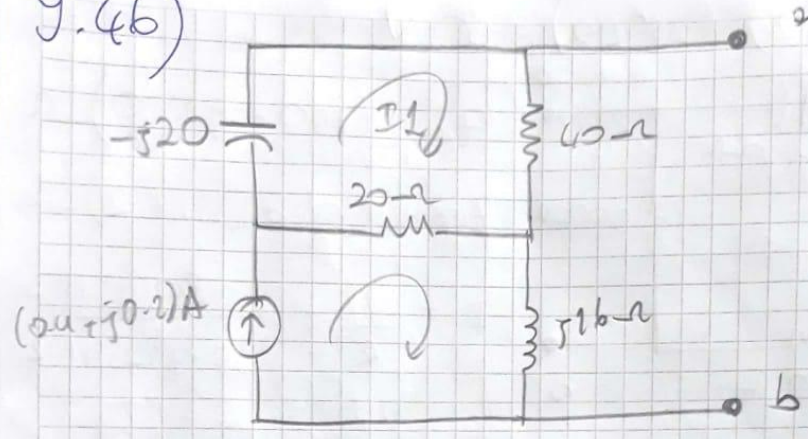
$I = \frac{V}{R} = \frac{30}{790.6\angle 341.2}$

$I = 0.038\angle -341.2$

$V_{ab} = 500\cdot(0.038\angle -341.2)$

$V_{ab} = 19\angle -341.2 = 18 - j6\ V$

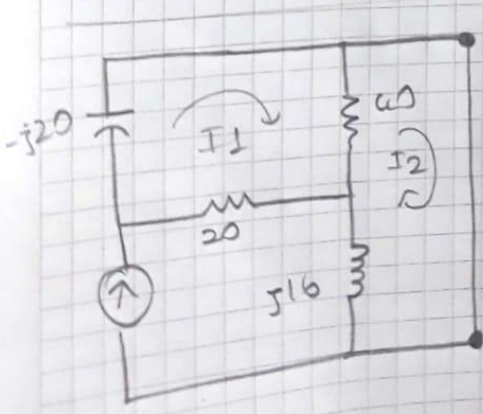
9.46)



$$-j20I_1 + 40I_1 + 20(I_1 - 0.4 - j0.2) = 0$$

$$\Rightarrow I_1 = \frac{20(0.4+j0.2)}{60-j20} = 0.1 + j0.1\ A$$

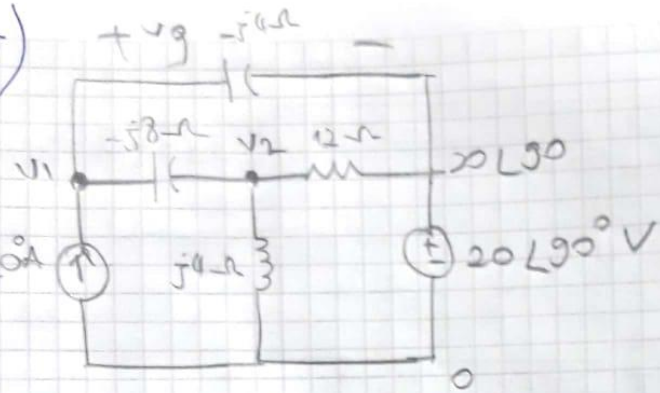
$$V_{ab} = 40I_1 + j16(0.4+j0.2) = 0.8 + j10.4\ V$$



$$40(I_2 - I_1) + j16(I_2 - 0.4 - j0.2) = 0$$

$$\Rightarrow I_2 = 0.3 + j0.5\ A$$

9.55)



$$V_1: \quad -5\angle 0 + \frac{V_1 - V_2}{-j8} + \frac{V_1 - 20\angle 90}{-j4} = 0$$

$$V_2: \quad \frac{V_2 - V_1}{-j8} + \frac{V_2}{j4} + \frac{V_2 - 20\angle 90^\circ}{12} = 0$$

$$V_1\left(\frac{1}{-j8} - \frac{1}{j4}\right) + V_2\left(\frac{1}{j8}\right) - 5\angle 0 + \frac{20\angle 90^\circ}{j4} = 0$$

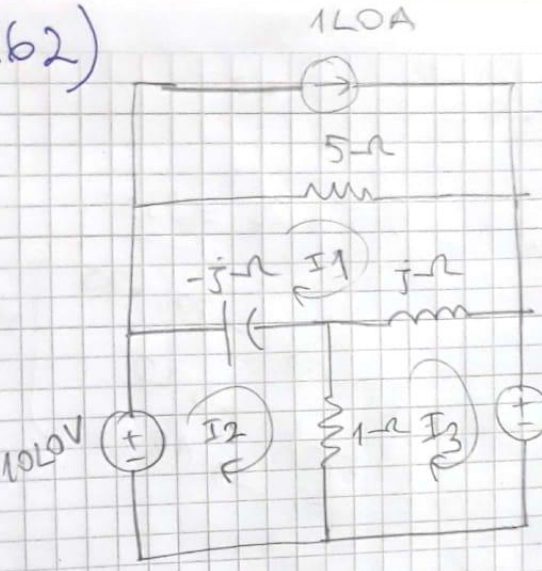
$$V_1\left(\frac{1}{j8}\right) + V_2\left(\frac{1}{j4} - \frac{1}{j8} + \frac{1}{12}\right) - \frac{20\angle 90^\circ}{12} = 0$$

$$\Rightarrow V_1 = -\frac{8}{3} + j\frac{4}{3}, \quad V_2 = -8 + j4$$

$$V_g = V_1 - 20\angle 90^\circ = \left(-\frac{8}{3} + j\frac{4}{3}\right) - \left(j20\right)$$

$$= \left(-\frac{8}{3} - j18.67\right) V$$

9.62)



$$\begin{bmatrix} j & -j+1 & -1 \\ -j & -1 & j+1 \\ 1 & -1 & -j \end{bmatrix} \begin{bmatrix} I_1 \\ I_2 \\ I_3 \end{bmatrix} = \begin{bmatrix} 10\angle 0 \\ -5\angle 0 \\ 1 \end{bmatrix}$$

$$-10\angle 0 + I_2(-j+1) - I_1(-j) - I_3(1) = 0$$

$$5\angle 0 + (1+j)I_3 - jI_1 - I_2 = 0$$

$$-1 - jI_2 - jI_3 + I_1 = 0$$

$$\Rightarrow I_1 = 6A \;,\; I_2 = 11+j10 \;,\; I_3 = 11+j5$$

$$I_a = I_1 - 1 = 5A$$

$$I_B = I_2 - I_1 = (5+j10)A$$

$$I_C = I_3 - I_1 = (5+j5)A$$

$$I_D = I_2 - I_3 = j5A$$