8.11) $t<0$;

$V_0 = 100V$

$I_0 = 5A$

$t>0$:

$$\alpha = \frac{1}{2RC} = \frac{1}{2.50.(25\times10^{-6})} = 400 \text{ rad/s}$$

$$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(160\times10^{-3}).(25\times10^{-6})}} = 500$$

$$\omega_d = \sqrt{500^2 - 400^2} = 900.100 = \underline{300 \text{ rad/s}}$$

$$V_0 = B_1 e^{-400t}\cos 300t + B_2 e^{-400t}\sin 300t$$

$$V_0(0) = B_1 = 100$$

$$\frac{dV_0}{dt} = -\alpha B_1 + \omega_d B_2 = \frac{1}{C}\left(-I_0 - \frac{V_0}{R}\right)$$

$$= -(400).(100) + 300 B_2 = \frac{1}{25\times10^{-6}}.\left(-5 - \frac{100}{50}\right)$$

$$= B_2 = -800$$

$$V_0 = 100 e^{-400t}\cos 300t - 800 e^{-400t}\sin 300t\ V \quad t>0.$$

8.27) $$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(25\times10^{-3}).(6,5\times10^{-6})}} = 800 \text{ rad/s}$$

$$\alpha = \frac{1}{2RC} = \frac{1}{2.(12,5).(62,5\times10^{-6})} = 640 \text{ rad/s}$$

$$\omega_d = \sqrt{800^2 - 640^2} = 480 \text{ rad/s}$$

$I_f = 2A$

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

$$i_L(0) = 2 + B_1' = 1$$

$$B_1' = -1$$

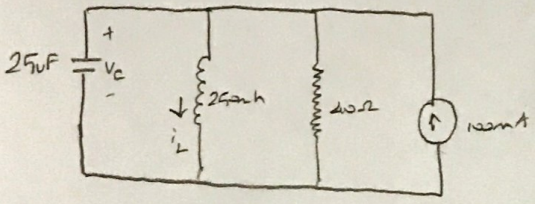
$$\frac{di_L}{dt}(0) = -\alpha B_1' + \omega_d B_2' = \frac{V_0}{L}$$

$B_2' = 2.83$

$$-640(-1) + 480 B_2' = \frac{50}{25\times10^{-3}}$$

$$i_L(t) = 2 - e^{-640t}\cos 480t + 2.83 e^{-640t}\sin 480t\,A \quad , \quad t \geq 0$$

8.35) $t>0$



$$\alpha = \frac{1}{2RC} = \frac{1}{2.40.(25\times10^{-6})} = 500\ rad/s$$

$$\omega_0 = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(250\times10^{-3}).(25\times10^{-6})}} = 400$$

$\alpha^2 > \omega_0^2$

↳ overdamped

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

a) $i_L = If + A_1 e^{-200t} + A_2 e^{-800t}$

$If = 100mA$

$i_L(0) = 0.1 + \underbrace{A_1 + A_2}_{0} = 0.1$

$$\frac{di_L}{dt}(0) = -200A_1 - 800A_2 = \frac{V_0}{L}$$

$$\frac{75}{0.25} = \frac{V_0}{L} = 300$$

$A_1 = 0.5 \quad A_2 = -0.5$

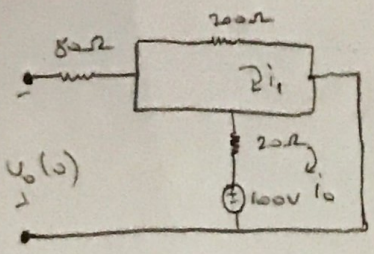
$i_L(t) = 0.1 + 0.5 e^{-200t} - 0.5 e^{-800t}\,A$

b) $V_c(t) = V_L(t)$

$$L.\frac{di_L}{dt} = 0.25.(-100e^{-200t} + 400e^{-800t})$$

$$= -25e^{-200t} + 100e^{-800t}\,V \quad , \quad t>0$$

847) $t<0$



$500i_1 - 100i_o = 0$

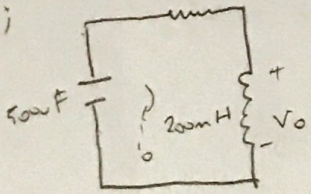
$-100i_1 + 120i_o = 100$

$i_1 = 0.2A$

$i_o = 1A$

$V_o = -100 + 20i_o + 100i_1 = -60V$

$t>0$;



$$\alpha = \frac{R}{2L} = \frac{200}{2.(0.2)} = 500$$

$\alpha^2 > w_o^2$

overdamped

$$w_o = \sqrt{\frac{1}{LC}} = \sqrt{\frac{1}{(0.2)(36.25\times10^{-6})}} = 400$$

$$s_{1,2} = -100 \pm \sqrt{500^2 - 400^2} = -200, -800 \text{ rad/s}$$

$i_o = A_1 e^{-200t} + A_2 e^{-800t}$

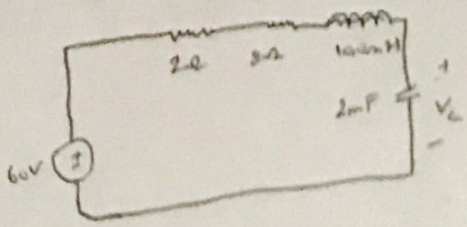
$i_o(0) = A_1 + A_2 = 1$

$$\frac{di_o}{dt}(0) = -200A_1 - 800A_2 = \frac{1}{L}(-V_o - RI_o) = -200$$

$A_1 = 166.67 mA$

$t \geq 0$ $A_2 = 833.33 mA$

8.54) $t<0$:



$\alpha = \frac{R}{2L} = \frac{10}{2.(0.1H)} = 50$ rad/s

$\omega_0^2 = \frac{1}{LC} = \frac{1}{(0.1).(2\times10^{-3})} = 5000$

$\omega_0 > \alpha^2$

Underdamped

$s_{1,2} = -50 \pm \sqrt{50^2 - 5000} = -50 \pm j50$

$V_c = 60 + B_1' e^{-50t}\cos 50t + B_2' e^{-50t}\sin 50t = -90$

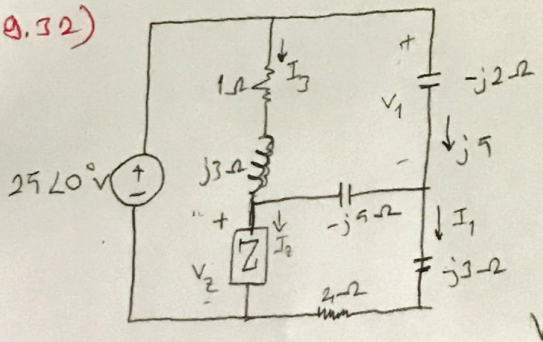
$B_1' = -150$

$C.\frac{dV_c}{dt}(0) = -5;$ $\quad \frac{dV_c}{dt}(0) = \frac{-5}{2\times10^{-3}} = -2500$

$\frac{dV_c}{dt}(0) = -50B_1' + 50B_2 = -2500$ $\quad B_2' = -200$

$V_c = 60 - 150e^{-50t}\cos 50t - 200e^{-50t}\sin 50t V, \quad t \geq 0$

9.32)



$V_1 = j5(-j2) = 10V$

$-25 + 10 + (4-j3)I_1 = 0$

$I_1 = \frac{15}{4-j3} = 2.4 + j1.8A$

$I_b = I_1 - j5 = (2.4 + j1.8) - j5 = 2.4 - j3.2\,A$

$V_2 = -j5I_2 + (4-j3)I_1 = -j5(2.4 - j3.2) + (4-j3).(2.4+j1.8) = -1 - j12V$

$-25 + (1+j3)I_3 + (-1-j12) = 0$

$I_3 = 6.2 - j6.6A$

$I_2 = I_3 - I_2 = 3.8 - j3.4A$

$Z = \frac{V_2}{I_2} = 1.42 - j1.88\Omega$

9.45) First step: $(0.12\angle 0^\circ)(250) = 30\angle 0^\circ V$

Second step: $250 - j400 + j150 = 250 - j250\ \Omega$

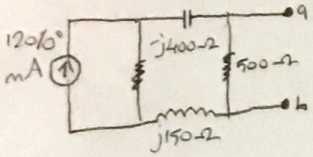
$\frac{30\angle 0^\circ}{250 - j250} = 60 - j60\ mA$

Third Step: to floor

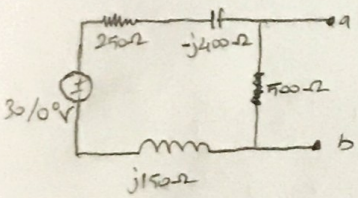
$(250 - j250) \| 500 = 200 - j100\ \Omega$

$(200 - j100).(0.06 - j0.06) = 18 - j6\ V$

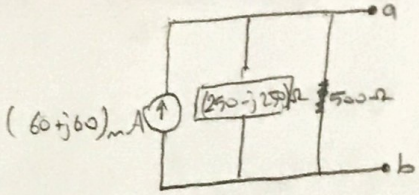
Step 1



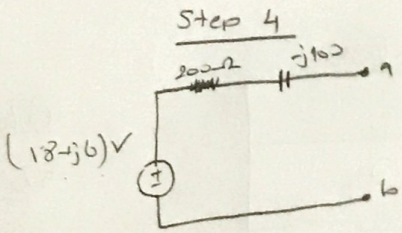
Step 2



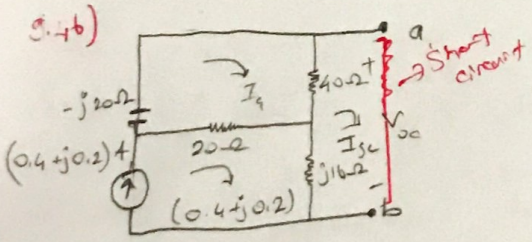
Step 3



Step 4



9.46)



Open circuit

$-j20 I_a + 40 I_a + 20(I_a - 0.4 - j0.2) = 0$

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

$V_{oc} = 40 I_a + j16(0.4 + j0.2) = 0.8 + j10.4 V$

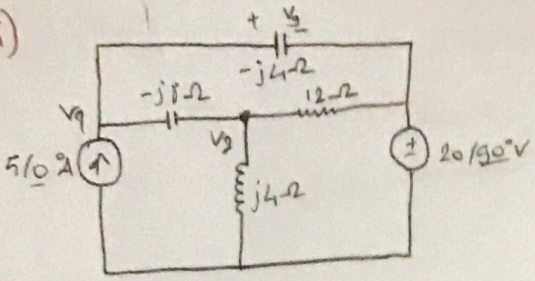
Short circuit:

$-j20 I_a + 40(I_a - I_{sc}) + 20(I_a - 0.4 - j0.2) = 0$

$40(I_{sc} - I_a) + j16(I_{sc} - 0.4 - j0.2) = 0$

$I_{sc} = 0.3 + j0.5 A$ / $Z_{Th} = \frac{V_{Th}}{I_{sc}} = \frac{0.8 + j10.4}{0.3 + j0.5} = 16 + j8\ \Omega$

9.55)



$$V_1 = -5\angle 0^\circ + \frac{V_1 - V_2}{-j8} + \frac{V_2 - 20\angle 90^\circ}{-j4} = 0 \quad , \quad V_2 = \frac{V_2 - V_1}{-j8} + \frac{V_2}{j4} + \frac{V_2 - 20\angle 90^\circ}{12} = 0$$

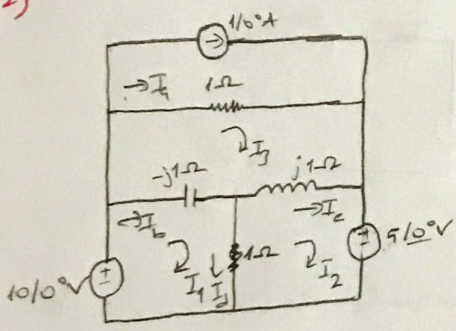
$$V_1\left(\frac{1}{-j8} + \frac{1}{-j4}\right) + V_2\left(-\frac{1}{-j8}\right) = 5\angle 0^\circ + \frac{20\angle 90^\circ}{-j4}$$

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

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

$$V_3 = V_1 - 20\angle 90^\circ = -\frac{8}{3} - j\frac{56}{3} V$$

9.62)



$$10\angle 0^\circ = (1-j1)I_1 - 1I_2 + j1I_3$$

$$-5\angle 0^\circ = -1I_1 + (1+j1)I_2 - j1I_3$$

$$j1I_1 - j1I_2 + I_3 = 1$$

$I_1 = 11 + j10A$

$I_2 = 11 + j5A$

$I_3 = 6A$

$I_a = I_3 - I_1 = 5A$

$I_b = I_1 - I_3 = 5 + j10A$

$I_c = I_2 - I_3 = 5 + j5A$

$I_d = I_1 - I_2 = j5A$

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