

$$\textcircled{1} \frac{V_1 - V_2}{-j8} + \frac{V_1 - 20 \angle 90^\circ}{-j4} = 5$$

$$\Rightarrow j3V_1 + V_2(-j) = 0 \quad \textcircled{1}$$

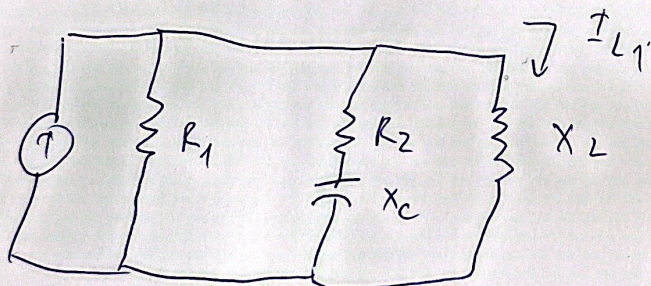
$$\text{node 2: } \frac{V_2 - V_1}{-j8} + \frac{V_2}{j4} + \frac{V_2 - 20 \angle 90^\circ}{12} = 0$$

$$\Rightarrow -j3V_1 + (2 - j3)V_2 = j40 \quad \textcircled{2}$$

$$\textcircled{1} \textcircled{2} \Rightarrow \begin{cases} V_1 = -8/3 + 4/3j \\ V_2 = -8 + j4 \end{cases}$$

$$\Rightarrow V_{\text{out}} = V = V_1 - 20 \angle 90^\circ = (-8/3 + 4/3j) - 20j \\ = -8/3 + (-j56/3)$$

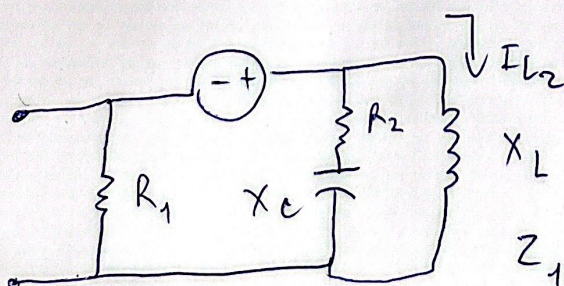
②



$$Z_1 = R_2 + Z_c \\ = 5k + j5k$$

$$Z_2 = Z_1 \parallel R_1 = 4k - j2k$$

$$\rightarrow I_{L1} = I \frac{Z_2}{Z_1 + Z_2} \\ = 5 \times 10^{-3} \times \frac{4k - j2k}{j5k + 4k - j2k} \\ = \frac{1}{500} - j \frac{1}{250}$$



$$Z_1 = 5k - j5k$$

$$Z_2 = Z_1 \parallel 2L = 5k + j5k$$

$$Z_{in} = Z_1 + R_1 = 15k + j5k$$

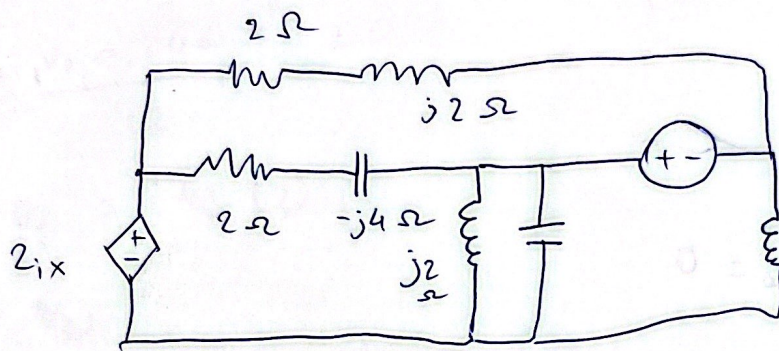
$$I_{L2} = \frac{20 \angle 0}{15k + j5k} = \frac{3}{2500} - \frac{1}{2500}j \text{ (A)}$$

$$I_L = I_{L1} + I_{L2} =$$

$$6.3 \text{ mA } \angle -63.45^\circ$$

$$= \left(9.80 \times 10^{-3} \angle -168.69^\circ \right)$$

$$R_{Th} = \frac{V_{Th}}{I_N} = \frac{-50 \angle 0^\circ}{9.80 \times 10^{-3} \angle -168.69^\circ} = \boxed{-5099.023 \angle 168.69^\circ}$$



$$V_0 = 2 \sin(2t) = 2 \angle -90^\circ$$

$$Z_1 = j\omega L + \frac{1}{j\omega C} = j \Omega$$

$$\rightarrow -2i_x + 2(i_a - i_b) - 4j(i_a - i_c) = 0$$

$$\Rightarrow (2 - 3j)i_a + (-4 + 4j)i_b - j i_c = 0 \quad (1)$$

$$\rightarrow 2i_b + j2i_b - V_0 - j4(i_b - i_c) + 2(i_b - i_a) = 0$$

$$\Rightarrow (-2 + j4)i_a + (4 - j2)i_b = V_0 \quad (2)$$

$$\rightarrow V_0 + j2(i_c) + j(i_c - i_a) = 0$$

$$\Rightarrow -j i_a + j3 i_c = -V_0 \quad (3)$$

$$\textcircled{1} \textcircled{2} \textcircled{3} \Rightarrow D = -20 + 28j = 4\sqrt{74} \angle 125.53^\circ$$

$$\cdot D_{ia} = 16 - 20j = 4\sqrt{41} \angle 125.53^\circ - 51.34^\circ$$

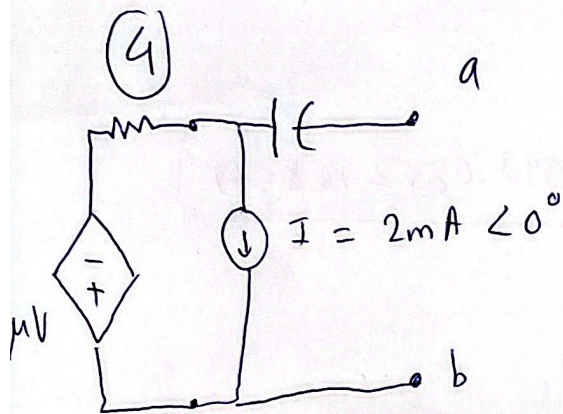
$$\cdot D_{ib} = 8 - 12j = 4\sqrt{13} \angle -96.31^\circ$$

$$\cdot D_{ic} = -8 + 12j = 4\sqrt{13} \angle 123.61^\circ$$

$$i_b = \frac{D_{ib}}{D} = \frac{4\sqrt{13} \angle -96.31^\circ}{4\sqrt{74} \angle 125.53^\circ} = 0.419 \angle 178.15^\circ = i_x$$

$$\Rightarrow i_x = i_b = 0.419 \sin(2t + 178^\circ)$$

$$= \boxed{0.419 \cos(2t + 88^\circ)}$$



$$V = 2 \angle 0^\circ$$

$$\mu = 20$$

Node Voltage:

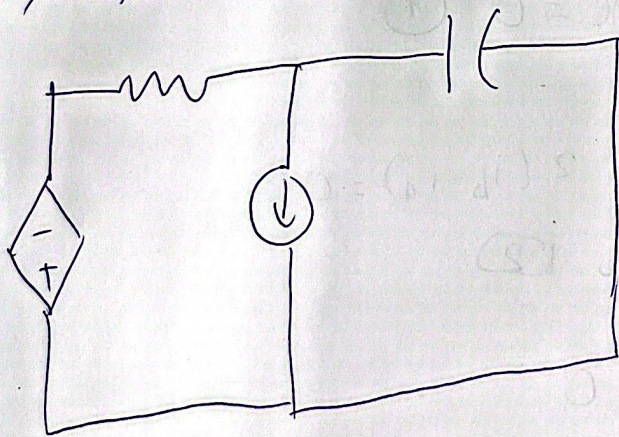
$$\frac{V_a + \cancel{\mu V}}{R_1} + 2 \times 10^{-3} \angle 0^\circ = 0$$

$$\Rightarrow V_a = -2 \times 10^{-3} \angle 0^\circ \times R_1 - \mu V$$

$$= -2 \times 10^{-3} \angle 0^\circ \times 5k - 20 \times 2 \angle 0^\circ$$

$$= -50 \angle 0^\circ V$$

$$\Rightarrow V_{Th} = V_a = -50 \angle 0^\circ V$$



Node voltage:

$$\frac{V_a + \mu V}{R_1} + 2mA \angle 0^\circ + \frac{V_a}{-X_{ej}} = 0$$

$$\Rightarrow \left(\frac{1}{R_1} + \frac{1}{-X_{ej}} \right) V_a = -2 \times 10^{-3} \angle 0^\circ - \frac{\mu V}{R_1}$$

$$\Rightarrow V_a = \frac{-25}{13} + \frac{125}{13}j \quad \Bigg| \quad I_N = i_{sc} = \frac{V_a}{-X_{ej}} = -\frac{1}{104} - \frac{1}{520}j$$