9.13

a) $\omega = 2\pi f = 2\pi (5\times10^4) = 314.1593$ K rad/s.

b) $\bar{Z}_c = \dfrac{1}{j\omega C} = \dfrac{1}{j(3.141593\times10^5)(628.32\times10^{-6})} = -j15.92\ \Omega$

$\bar{I} = \dfrac{\bar{V}}{\bar{Z}_c} = \dfrac{10\times10^{-3}\angle 0^\circ}{15.92\angle -90^\circ} = 0.628\angle 90^\circ$ mA

$\therefore \theta = 90^\circ$

c) $\bar{Z}_c = R + jX = -j15.92 \Rightarrow X = -15.92\ \Omega$

d) $\dfrac{1}{\omega C} = 15.92 \Rightarrow \dfrac{1}{3.141593\times10^5 C} = 15.92$

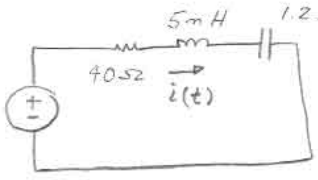
$C = 0.2\ \mu F$

e) $\bar{Z}_c = -j15.92\ \Omega$

9.15

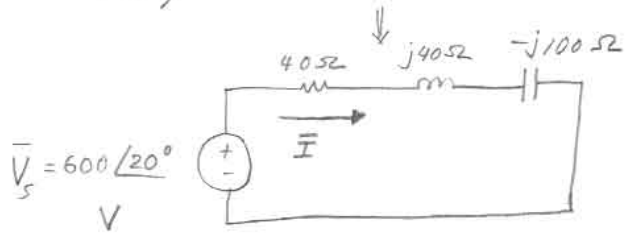
a)

$v_s(t) = 600\cos(8000t + 20°)$




$\bar{Z}_L = j\omega L$

$\bar{Z}_C = \frac{1}{j\omega C} = -j\frac{1}{\omega C}$



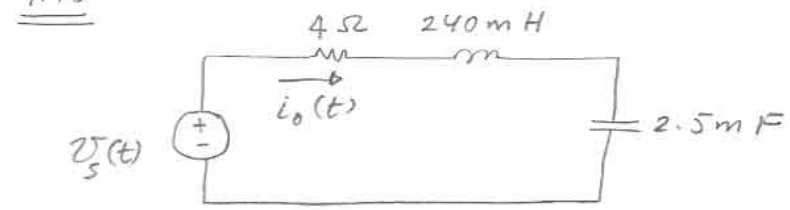

$\bar{V}_s = 600\angle 20°$ V

b) $\bar{I} = \frac{\bar{V}_s}{\bar{Z}_t} = \frac{600\angle 20°}{40 + j40 - j100} = \frac{600\angle 20°}{40 - j60}$

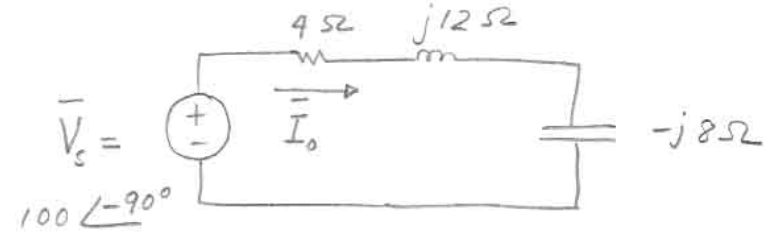
$= \frac{600\angle 20°}{72.111\angle -56.31°} = 8.321\angle 76.31°$ A

c) $i(t) = 8.321\cos(8000t + 76.31°)$ A

9.16




$= 100 \sin 50t$, mV




$100 \angle -90°$ mV

$$\bar{I}_o = \frac{\bar{V}_s}{\bar{Z}_t} = \frac{100 \times 10^{-3} \angle -90°}{4 + j12 - j8}$$

$$= \frac{100 \times 10^{-3} \angle -90°}{4 + j4} = \frac{10^{-1} \angle -90°}{4\sqrt{2} \angle 45°}$$

$$= 0.0177 \angle -135° = 17.7 \angle -135° \text{ mA}$$

$$\therefore i_o(t) = 17.7 \cos(50t - 135°) \text{ mA}$$

9.23

$$\bar{Z}_1 = R_1 + j\omega L_1$$

$$\bar{Z}_2 = R_2 /\!/ j\omega L_2 = \frac{jR_2\omega L_2}{R_2 + j\omega L_2}$$

$$= \frac{jR_2\omega L_2(R_2 - j\omega L_2)}{R_2^2 + \omega^2 L_2^2} = \frac{R_2\omega^2 L_2^2 + jR_2^2\omega L_2}{R_2^2 + \omega^2 L_2^2}$$

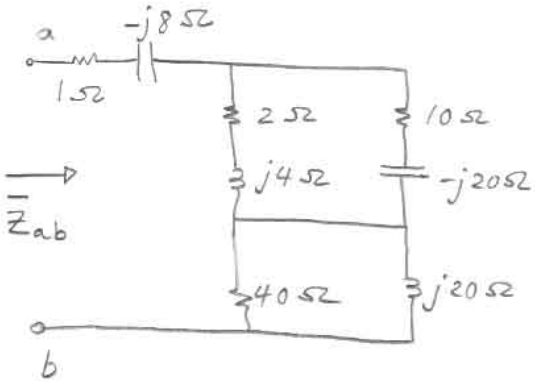
$$\bar{Z}_1 = \bar{Z}_2 \Rightarrow R_1 + j\omega L_1 = \frac{R_2\omega^2 L_2^2 + jR_2^2\omega L_2}{R_2^2 + \omega^2 L_2^2}$$

$$Re = Re \;\&\; Im = Im \Rightarrow$$

$$\therefore R_1 = \frac{R_2\omega^2 L_2^2}{R_2^2 + \omega^2 L_2^2}$$

$$\therefore L_1 = \frac{R_2^2 L_2}{R_2^2 + \omega^2 L_2^2}$$

9.33




$$\bar{Z}_{ab} = 1 + (-j8) + \left[(2+j4) /\!/ (10-j20)\right] + (40 /\!/ j20)$$

$$= 1 - j8 + \frac{(2+j4)(10-j20)}{(2+j4)+(10-j20)} + \frac{40(j20)}{40+j20}$$

$$= 1 - j8 + \frac{(4.472\angle 63.43^\circ)(22.361\angle -63.43^\circ)}{12 - j16} + \frac{800\angle 90}{44.72\angle 26.57^\circ}$$

$$= 1 - j8 + \frac{100\angle 0^\circ}{20\angle -53.13^\circ} + 17.889\angle 63.43^\circ$$

$$= 1 - j8 + 5\angle 53.13^\circ + 17.889\angle 63.43^\circ$$

$$= 1 - j8 + (3 + j4) + (8 + j16) = 12 + j12$$

$$= 16.971\angle 45^\circ \ \Omega$$