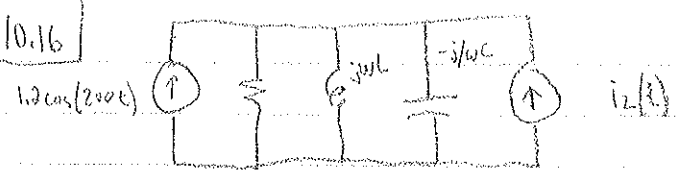
# HW #26 Solution

$v_o = 40\sin(200t)$

10.16




$\frac{1}{.05s}$ $\quad j(200)(.1)$ $\quad -j/4(200)$

$= j20 \quad = -j12.5$

a) $I_1 = 1.2\cos(200t) = \boxed{1.2\angle 0^\circ \text{ Amps}}$

$V_o = 40\sin(200t) = \boxed{40\angle 90^\circ \text{ volts}} = j40 \text{ v}$

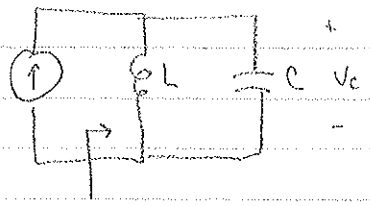
b) KCL: $1.2\angle 0^\circ + V_o(.05) + \frac{V_o}{j20} + \frac{V_o}{-j12.5} + I_2 = 0$

$I_2 = -1.2 - (j40)(.05) - \frac{j40}{j20} - \frac{j40}{-j12.5}$

$= -j1.2 = \boxed{1.2\angle -90^\circ}$

$\boxed{\rightarrow \quad i_2(t) = 1.2\cos(200t - 90^\circ) \text{ Amps}}$

10.20




a) $C = 0.01F$

$$Z_{in} = Z_L // Z_C = j\omega L // 1/j\omega C = \frac{(j\omega L)(1/j\omega C)}{j\omega L + 1/j\omega C}$$

$$= \frac{L/C \; j\omega C}{-\omega^2 LC + 1} = \frac{j\omega L}{1 - \omega^2 LC}$$

For $C = .01$ and $\omega = 100 \rightarrow$ $L = 50mH$

$$Z_{in} = \frac{j(100)(0.05)}{1 - 100^2(0.05)(.01)} = \frac{j100L}{1 - 100L} \frac{j5}{1-5}$$

$$= -j1.25$$

~~→ to get the answer in the book, $Z_{in} = -j1.25 = \frac{j100L}{1-100L}$~~

~~$L = 100L$~~

~~$= (1 - 100L)1.25 = 100L$~~

~~$1.25 = 100 + 125L \rightarrow L = 0.05$ H~~

b) $Z_{in}(j100) = j25 = \frac{j(100)(.05)}{1 - 100^2(.05)C} \rightarrow 25(1 - 100^2(.05)C) = 100(.05)$

$\rightarrow$ $C = 1.6$ mF

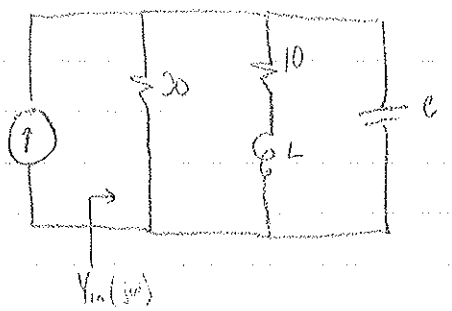
c) $i_{in} = 100\cos(100t + 45°) = 100\angle 45°$

$$V_c = I_{in} Z_{in} = \left(\frac{100}{1000}\angle 45°\right)(j25) = 2.5\angle 135° \text{ Volts.}$$

mA → 1000

$$v_c(t) = 2.5\cos(100t + 135°)$$

10.23




$\omega = 500$

$L = 20\,mH = j\omega L = j10$

$C = .3\,mF = 1/j\omega C = -j/.15$

a) $Y_{in}(j\omega) = 1/Z_{in}(j\omega) = 1/20 + 1/(10+j10) + \underbrace{1/-j/.15}_{j.15}$

$= 0.1 - j0.1 \ S$

b) $Y(j500) = Real$, find C.

$Y = 1/20 + \frac{1}{10+j10} + j500C$

$= 0.1 + j(500C - .05)$

Need $500C - .05 = 0 \rightarrow$ $C = 100\,\mu F$

c) $C = .3\,mF$, $i_{in} = 100\cos(500t)\,mA = .1\angle 0°\ A$.

By current division, $I_R = I_{in}\frac{Y_R}{Y_{in}} = \frac{1/20}{.1-j.1} = .025 - j.025 = .035\angle -45°$

$= .0353\cos(500t - 45°)$ Amps

$I_C = I_{in}\frac{Y_C}{Y_{in}} = .1\left(\frac{j.15}{.1-j.1}\right) = -.075 + j.075 = .106\angle 135°$ Amps

$= .106\cos(500t + 135°)$ Amps