HW #19

15-1

a.) $Z_R = R + 0 \cdot j$ $\quad Z_R = 6{,}8\,\Omega$ or $Z_R = 6{,}8 \angle 0^\circ$

b.) $Z_L = j X_L$ .. $X_L = \omega L = 377\ \text{rad/s} \cdot 1{,}2\,H = 452{,}4\,\Omega$

$Z_L = j452{,}4$ or $Z_L = 452{,}4 \angle 90^\circ$

c.) $X_L = \omega \cdot L = 2\pi f L = 2\pi\, 50\,Hz \cdot 4{,}7 \cdot 10^{-3} H = 1{,}48\,\Omega$

$Z_L = j \cdot 1{,}48$ or $Z_L = 1{,}48 \angle 90^\circ$

d.) $Z_C = -j X_C$ .. $X_C = \frac{1}{\omega C} = \frac{1}{100\ \text{rad/s} \cdot 10 \cdot 10^{-6} F} = 1\,K\Omega$

$Z_C = -j\,1\,K\Omega$ or $Z_C = 1\,K\Omega \angle -90^\circ$

e.) $Z_C = -j X_C$ .. $X_C = \frac{1}{\omega C} = \frac{1}{2\pi f C} = \frac{1}{2\pi\, 10\,KHz \cdot 0{,}47\,\mu F} = 33{,}86\,\Omega$

$Z_C = -j\,33{,}86\,\Omega$ or $Z_C = 33{,}86 \angle -90^\circ\,\Omega$

f.) $Z_R = R + 0j$ or $Z_R = R \angle 0^\circ$

$Z_R = 220\,\Omega$ or $Z_R = 220 \angle 0^\circ\,\Omega$

15-3

a.) $i = 4 \cdot 10^{-3} \sin 1000t \Rightarrow \vec{I} = \frac{4 \cdot 10^{-3}}{\sqrt{2}} \angle 0^\circ = 2{,}83\,mA \angle 0^\circ$

$Z = Z_R = 22 \angle 0^\circ\,\Omega$

$\bar{V} = \bar{I} \cdot \bar{Z} = 2{,}83\,mA \angle 0^\circ \cdot 22\,\Omega \angle 0 = 62{,}22\,mV \angle 0^\circ$

$V(t) = 62{,}22\,mV \cdot \sqrt{2} \sin 1000t + \phi = \boxed{0{,}088 \sin 1000t}$

b.) $i = 1{,}5 \sin \omega t + 60 \Rightarrow \bar{I} = \frac{1{,}5}{\sqrt{2}} \angle 60^\circ = 1{,}06\,A \angle 60^\circ$

$Z = Z_L = j \cdot 2\pi f L = j \cdot 15{,}08 = 15{,}08 \angle 90^\circ = Z_L$

$\bar{V} = \bar{I}\,\bar{Z} = 1{,}06\,A \angle 60^\circ \cdot 15{,}08 \angle 90^\circ = 16 \angle 150^\circ$

$\boxed{V(t) = 22{,}62 \sin(2\pi\, 200t + 150^\circ)}$

c.) $i = 0{,}002 \sin 157t + 40^\circ \Rightarrow \bar{I} = \frac{0{,}002}{\sqrt{2}} \angle 40 = 1{,}41\,mA \angle 40^\circ$

$Z_C = -j X_C \quad X_C = \frac{1}{\omega C} = \frac{1}{157 \cdot 0{,}047\,\mu F} = 135{,}52\,K\Omega$

$\bar{V} = \bar{I}\,\bar{Z} = 1{,}41\,mA \angle 40^\circ \cdot 135{,}52\,K\Omega \angle -90 = 191{,}63\,V \angle -50^\circ$

$\boxed{V(t) = 270{,}96 \sin 157t - 50^\circ}$