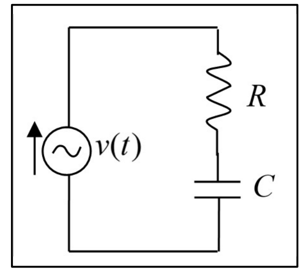
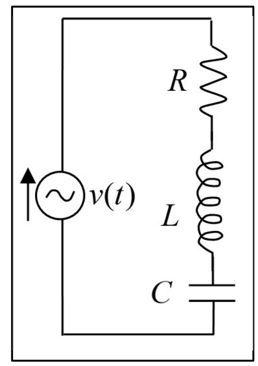
Elementary Engineering Mathematics
Exercises #5 – Application of Complex Numbers in Electrical Engineering

1. A voltage $v(t) = 110\cos\left(120\pi t + \frac{\pi}{3}\right)$ volts is applied to the RC series circuit with $R = 80\ \Omega$ and $C = 50\ \mu\text{f}$. Given that the total impedance is $Z = Z_R + Z_c$, find



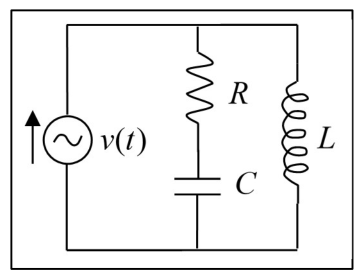
   a) Z in both rectangular and polar form
   b) I the complex current in both rectangular and polar form
   c) $i(t)$ the current as a function of time

2. A voltage $v(t) = 110\cos(120\pi t)$ volts is applied to the RLC series circuit with $R = 75\ \Omega$, $C = 40\ \mu\text{f}$, and $L = 300\text{ mh}$. Given that the total impedance is the sum $Z = Z_R + Z_c + Z_L$, find



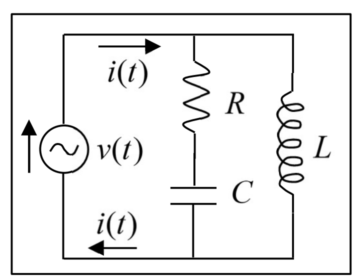
   a) Z in both rectangular and polar form
   b) I the complex current in both rectangular and polar form
   c) $i(t)$ the current as a function of time

3. A voltage $v(t) = 110\cos(120\pi t)$ volts is applied to the RLC parallel circuit with $R = 100\ (\Omega)$, $C = 35\ \mu\text{f}$, and $L = 500\text{ mh}$. Given that the equivalent impedance is given by the equation $\boxed{Z_{eq} = \dfrac{(Z_R + Z_c)Z_L}{(Z_R + Z_c) + Z_L}}$, find



   a) $(Z_R + Z_C)$ and Z_L in both rectangular and polar form
   a) Z_{eq} the equivalent impedance in polar form

4. A voltage $v(t) = 110\cos\left(120\pi t + \frac{\pi}{3}\right)$ volts is applied to the RLC parallel circuit with $R = 200\ (\Omega)$, $C = 25\ \mu\text{f}$, and $L = 800\text{ mh}$. Given that the equivalent impedance is $\boxed{Z_{eq} = \dfrac{(Z_R + Z_c)Z_L}{(Z_R + Z_c) + Z_L}}$, find



   a) Z_{eq} in polar form
   b) I the complex current in polar form
   c) $i(t)$ the total current as a function of time

Impedances for AC circuit elements: $\boxed{Z_R = R}$, $\boxed{Z_C = \dfrac{-j}{\omega C}}$, and $\boxed{Z_L = j\omega L}$

Complex form of Ohm's Law: $\boxed{V = IZ}$