EE 313 – Problem Set 1
Material to be covered on Quiz 1 scheduled September 12th

1. For the following pairs of signals, make a determination about which signal leads by a positive angle.

a. $v_1(t) = 4\cos(5t)$ Volts and $v_2(t) = 10\cos(5t-20°)$ Volts
b. $v_x(t) = -10\cos(100t+50°)$ Volts and $v_y(t) = 10\sin(100t+10°)$ Volts
c. $i_x(t) = -2\sin(t-130°)$ Amps and $i_y(t) = -5\cos(t+100°)$ Amps

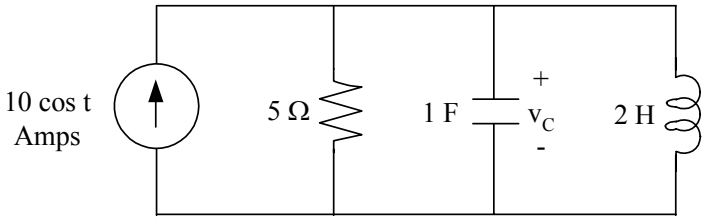
2. Transform the following sinusoidal time functions into the complex exponential form and then into the phasor form.

a. $v(t) = 10\cos(120t-225°)$ Volts
b. $i(t) = 5\sin(600t-125°)$ Amps
c. $v(t) = -3\sin(20t)$ Volts
d. $i(t) = -10\cos(2t+45°)$ Amps

3. Evaluate the following expressions and transform them into the sinusoidal time representation. Your final answer should be in the following form: $f(t) = A\cos(\omega t+\phi) + jB\sin(\omega t+\phi)$. For each answer below, the angular frequency is 5 rad/s.

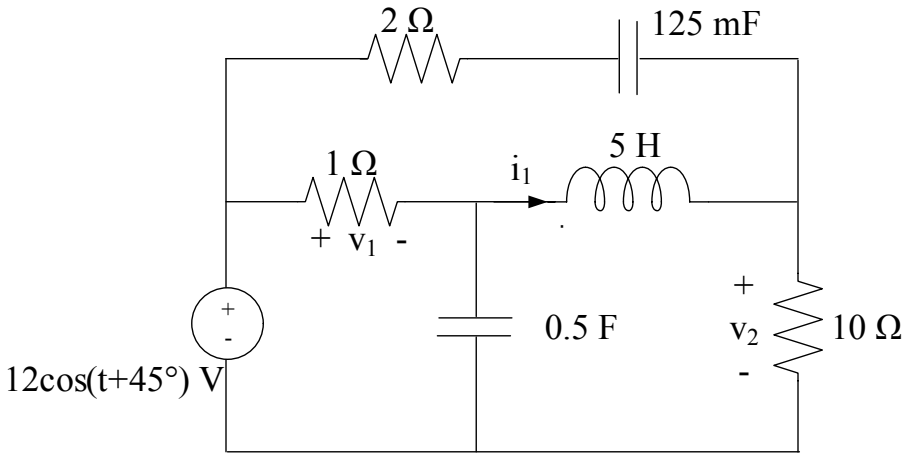
a. $6\angle 25° + 10\angle -40°$
b. $(5\angle 80°)(2+j4)$
c. $(-1-j8) + (6+j5)$
d. $(2\angle 140°) + (3-j6)$
e. $\dfrac{(-4+j3)}{2\angle 10^{o}}$
f. $\dfrac{10\angle -25^{o}}{-2+j10}$

4. Consider the following circuit.



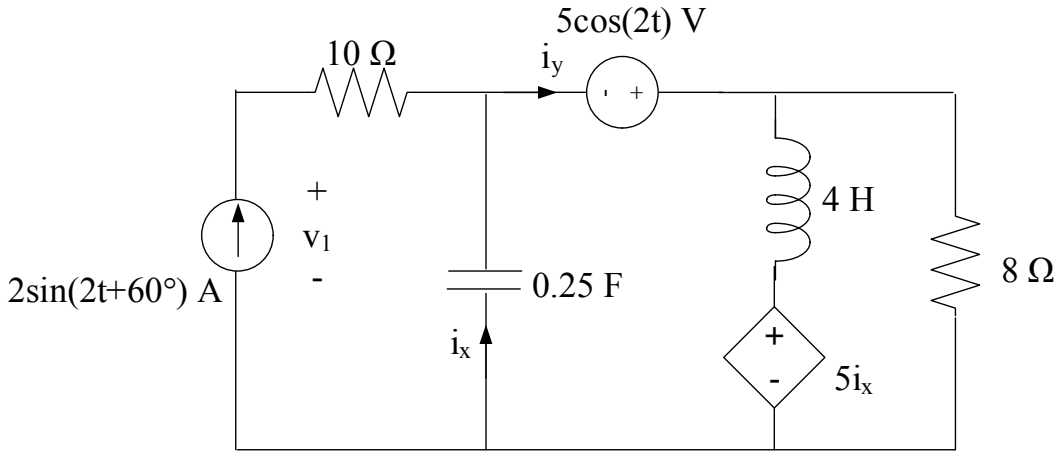
a. Find the forced response for $v_C(t)$. The solution guess is $v_C(t) = A\cos(t) + B\sin(t)$.
b. Find the forced response for $v_C(t)$. The solution guess is $v_C(t) = Ae^{jt}$.

5. The following circuit is given in the time domain and assumes steady-state conditions:



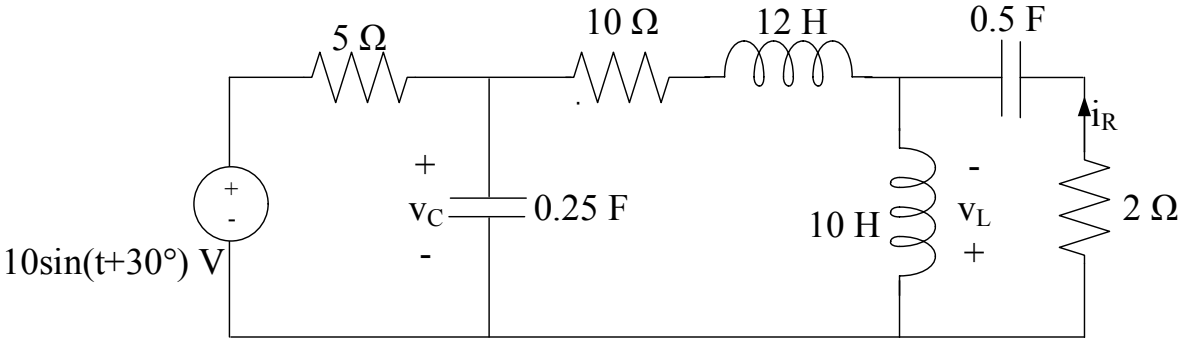
a) Transform the circuit to the frequency domain.
b) Use nodal analysis and mesh analysis to solve for the phasor voltages, $\mathbf{V}_1$ and $\mathbf{V}_2$ and the phasor current, $\mathbf{I}_1$. Show that your answers for each method match.
c) Transform the phasors to the time domain and give the real part of the sinusoidal representation.

6. The following circuit is given in the time domain and assumes steady-state conditions:



a) Transform the circuit to the frequency domain.
b) Using nodal analysis and mesh analysis, solve for the phasors $\mathbf{V}_1$ and $\mathbf{I}_x$ and $\mathbf{I}_y$.
c) Find $v_1(t)$ and $i_x(t)$ and $i_y(t)$ (only the real part of the signal is necessary).

7. Consider the following subcircuit.



a. Convert the circuit from the time domain to the frequency domain.

b. Find the equivalent impedance seen by the source. What is the reactance of the impedance? Is it capacitive or inductive?

c. Expand the circuit and find the labeled voltages and current in phasor form and then give the real part of time domain values.