EECS 361
Homework #7

1. Section 4.1 Participation Activities
4.1.1: Time to phasor domain transform examples.
4.1.3: Phasor technique to solve differential equations having sinusoidal inputs.

2. Challenge activity
4.1.1: Phasor-domain technique.

3. Find the output, y(t), for a system is characterized by the differential equation

$$c_1\, dy(t)/dt + c_2 y(t) = 5\cos\left(300t - \frac{\pi}{6}\right) - 10\cos\left(600t - \frac{\pi}{4}\right)$$

$$c_1 = 5\times10^{-3} \text{ and } c_2 = 2$$

4. Section 4.2 participation activity
4.2.1: Fourier series analysis technique.

5. Section 4.3 participation activity
4.3.1: Fourier series harmonics

6. Section 4.4 participation activity
4.4.2: Sine/cosine Fourier series for sawtooth wave.
4.4.3: Line spectra of triangle wave.
4.4.4: Amplitude/phase Fourier series for sawtooth wave.
4.4.5: Fourier series coefficients. .
4.4.8: Effect of number of Fourier terms used to represent a signal.

7. For x(t) = 8cos(300t)-3sin(600t) find

a. sinc/cosine Fourier series representation of x(t), a_0, a_n and b_n
b. amplitude/phase Fourier series representation of x(t), c_0, c_n, ϕ_n
c. complex exponential Fourier series representation of x(t), x_n

Hint: $\sin(\theta) = \cos\left(\theta - \frac{\pi}{2}\right)$ and $-\sin(\theta) = \sin(\theta+\pi) = \cos\left(\theta + \frac{\pi}{2}\right)$

8. For $x(t) = \sum_{k=-\infty}^{\infty} \text{tri}\left(\frac{t-kT_o}{\tau}\right)$ were $T_o = 6$ and $\tau = 2$.

a. Plot x(t).
b. Find x_0.
c. In the cosine/sine Fourier series find the b_n's.
d. In the complex exponential Fourier series find the x_n's.
(recommend you find the x_n's. using T_o and τ as parameters, see problem 9).
e. Given the x_n's found in part d, plot $\sum_{n=-10}^{10} x_n e^{jn\omega_0 t}$ and compare to the plot obtained in part a.

9. For $x(t) = \sum_{k=-\infty}^{\infty} \text{tri}\left(\frac{t-kT_o}{\tau}\right)$

Plot the magnitude spectrum (label the x-axis in frequency) for

a. $T_o = 6$ and $\tau = 2$.

b. $T_o = 6$ and $\tau = 1$.

c. $T_o = 12$ and $\tau = 2$.

d. Comment on the how fixing T_o and adjusting τ changes the magnitude spectrum. And comment on the how fixing τ and adjusting T_o changes the magnitude spectrum.

10. Find the amplitude/phase Fourier Series for $x(t) = \cos(2\pi 100t) + 2\cos^2(2\pi 100t)$ and plot the one sided line spectra.