ECE 310: Problem Set 1

Due: 5pm, Friday September 7, 2018

1. Evaluate and represent your final answer in both Cartesian and polar forms. Try to simplify your answers as far as you can by hand, without using a calculator or computer.

   (a) $10\angle 135° + 6\angle - 120°$

   (b) $\dfrac{(1-j)^2}{1+j}$

   (c) $\left(\dfrac{-1+j3}{1-j} + \dfrac{3+j}{1+j2}\right)^n$

2. Derive close-form expressions for the magnitude and phase of the function $G(\omega) = 1 - e^{-2j\omega}$ of the real variable ω. Sketch (*by hand*) the magnitude and phase over the interval $\omega \in [-\pi, \pi]$. Label your plots.

3. Sketch the following sequences ($u[n]$ is the unit step function in the discrete time variable n).

   (a) $n(u[n+1] - u[n-6])$

   (b) $\cos\left(\frac{n\pi}{3}\right) u[-n+3]u[n+4]$

4. Consider the sequence $\{x[n]\}_{n=-3}^{4} = \{1, 0, 3, 5, 0, -2, 0, 4\}$.

   (a) Sketch the sequence $y[n]$ defined by $y[n] = x[n-2]$.

   (b) Sketch the sequence $w[n]$ defined by $w[n] = x[n] + 2x[n-2] + 3x[n-3]$.

   (c) Sketch the sequence $v[n]$ defined by $v[n] = x[-n+2]$

   (d) Express $x[n]$ in terms of the unit pulse function (the Kronecker delta) $\delta[n]$.

5. Draw a block diagram of a system with input $x[n]$ and output $y[n]$, for each of the following cases

   (a) $y[n] = x[n] + 2x[n-2] + 3x[n-3]$.

   (b) $y[n] = -0.5y[n-1] + 2x[n]$