EE 301 Homework 1 Due 8/31/01

1. **Complex numbers.**

   (a) Express the following complex numbers in *polar* form

   i. $z_1 = 2 + j\sqrt{3}$ ii. $z_2 = \dfrac{1+j}{2+3j}$ iii. $z_3 = (1+j)^*$

   (b) Express the following complex numbers in *rectangular* form

   i. $z_1 = e^{2jp/3}$ ii. $z_2 = e^{jp/3} + 2e^{2jp/3}$ iii. $z_3 = \left(e^{-jp}\right)^{1/2}$

2. **Fundamental periods**. Determine if the following signals are periodic. For those that are periodic calculate the fundamental period.

   (a) $x(t) = \cos(2pt/3) + \sin(5t + p/3)$ (b) $x[n] = e^{j2n}$

   (c) $x(t) = \sin(pt/3) - 3\cos(5pt/2 + p/4) + 2e^{j(3p/4+5)}$ (d) $x[n] = e^{j(p/4)n}\, e^{j(p/8)n}$

3. **Energy and Power.** Calculate the energy and power for the following signals.

   (a) $x(t) = e^{-2jt}$ (b) $x(t) = \cos(3t)$

   (c) $x(t) = e^{-5t}\sin(2t)u(t)$ (d) $x[n] = e^{2n}u[n]$ (Use the formula $\sum_{n=0}^{N} a^n = \dfrac{1-a^{N+1}}{1-a}$)

4. **Properties of periodic functions.** State whether each of the following statements is true or false. If the statement is true, prove your assertion with a brief argument. If it is false, provide a counter example.

   1. If $x(t)$ is periodic then so is $x(-t)$.
   2. The sum of two periodic signals is always periodic.
   3. The signal $x(t) = \sum_{k=-\infty}^{\infty} y(t - kT)$ where $y(t)$ is any function such that $\int_{-\infty}^{\infty} |y(t)|dt < \infty$.
   4. The signal $x(t) = 0$

MATLAB Exercises

1. Plot the following discrete-time signal for $-10 \le n \le 10$, using the *stem* function. Make sure both axes are properly labeled.

$$x[n] = (0.8)^n \sin\left(\frac{2pn}{3}\right)$$

2. Plot the following continuous-time signal for $0 \le t \le 10$ using the *plot* function. Make sure both axes are properly labeled.

$$x(t) = \sin\left(\frac{3pt}{5}\right) + \cos\left(\frac{2t}{3}\right)$$