Due Date: Sep. 9th, (Thursday)

1.1 Convert the following to polar form:
(a) \( z = 2\sqrt{3} + j2 \);
(b) \( z = (2, -5) \);

1.2 Convert the following to rectangular form:
(a) \( z = 3e^{j\pi} \);
(b) \( z = \frac{3}{4} \angle \left(\frac{4\pi}{3}\right) \);

1.3 Simplify the following complex-valued expressions:
(a) \( 10e^{j\pi/2} + 2e^{j4\pi} \)
(b) \( \text{Re}\left(\frac{(\sqrt{3} - j2)^2}{(1 - j\sqrt{2})^{1/2}}\right) \)

1.4 Evaluate the following by reducing the answer to rectangular form:
(a) \( z = j^{1/3} \); (find three answers)
(b) \( z = j^{5} \)
(c) \( z = j^{2m-1} \) (m an integer);
(d) \( z = e^{j(3\pi+2m)} \) (n an integer)

1.5 Evaluate each expression and give the answer in both rectangular and polar form. In all cases, assume that \( z_1 = 5e^{j2\pi/3}, z_2 = -2 - j2 \).
(a) \( z_1 + 3z_2 \)
(b) \( z_1 - z_2^2 \)
(c) \( z_1^* z_2 \)
(d) \( \frac{(z_1^*)^3}{z_2} \)

1.6 Simplify the following complex-valued sum:
\[ z = e^{-j9\pi/7} + e^{j4\pi/2} + e^{j2\pi/7} \]
Give the numerical answer for \( z \) in polar form. Draw a vector diagram for the three vectors and their sum (\( z \)).

1.7 Solve the following equation for \( z \):
\[ z^{5/2} = j3 \]
Be sure to find all possible answers, and express your answer(s) in polar form. Plot the results.
1.8 Signal Processing First, P-2.3. (Plot with Matlab or Mathcad)

1.9 Signal Processing First, P-2.4

1.10 Signal Processing First, P-2.14.

1.11 Solve the following equation for $\theta$: $\text{Im}\left\{\frac{1}{2} e^{j\theta} (2 - j\sqrt{3})\right\} = 1$.

Give the answers in radians. Make sure that you find all possible answers.

1.12 There is a time-related sinusoid as following:

$$x(t) = 3 \sin(2\pi\phi t + \phi) = 3 \sin(2\pi\phi (t + \tau)) ;$$

Assume the period of the sinusoid wave is $T_0 = 6 \text{ sec}$

(a) Calculate the value of the phase $\phi$, when $t_f = 2 \text{ sec}$ ;

(b) Calculate the value of the phase $\phi$, when $t_f = -\frac{5}{7} \text{ sec}$ ;

1.13 Let $x[n]$ be the complex exponential sequence: $x[n] = 6e^{j(0.25\pi t + 0.22\pi)}$, defined for $n = -\infty, \ldots, -1, 0, 1, 2, \ldots, \infty$.

If we define a new sequence $y[n]$, to be the second difference:

$$y[n] = x[n + 1] + x[n - 1] - 2x[n], \text{ for all } n;$$

It is possible to express $y[n]$ in the form $y[n] = Ae^{j(\omega n + \phi)}$

Determine the numerical values of $A$, $\phi$, and $\omega$. 
1.14 A continuous-time signal $x(t)$ is shown in Fig. 1.1, sketch and label clearly each of the following signals:

(a) $x(1-t)$;
(b) $x(2t-3)$;
(c) $x\left(1 - \frac{1}{2}t\right)$

1.15 A discrete-time signal $x[n]$ is shown in Fig. 1.2, sketch and label clearly each of the following signals:

(a) $x[2-2n]$;
(b) $x[3n+2]$;
(c) $x\left[-\frac{1}{2}n\right]$
1.16 Determine the sketch the even and odd parts of the signals depicted in Figure Fig 1.3, Label your sketches carefully.