1051-716-20091 Homework Assignment #1 Due 9/14/2009 (M)

0. Review the concepts of complex numbers and their geometrical representation. Sources include text (Chapters 4,5), Gaskill (Chapter 2), Bracewell, (**Fourier Transform and its Applications**, Chapter 2). Any of several math books on complex analysis may also be useful.

1. Calculate all roots of the following equations and express them as both real/imaginary parts and as magnitude/phase.(20001-HW1-#1)

   (a) $z^5 - i = 0$

   (b) $z^3 + 1 = 0$

   (c) $z^2 + i = 4$

2. Determine the requirement that must be satisfied for the three complex numbers z_1, z_2, and z_3 to lie on a straight line in the complex plane. (20001-HW1-#2)

3. If $z_1 = 4 - 3i$ and $z_2 = -1 + 2i$, find the analytic and graphical solutions to: (20001-HW1-#4)

   (a) $|z_1 + z_2|$

   (b) $|z_1 - z_2| \setminus$

   (c) $z_1^* - z_2^*$

   (d) $|2z_1^* - 3z_2^* - 2|$

4. Describe the set of z that satisfy the constraint $z \cdot z^* = 4$ (20001-HW1-#5)

5. Find the complex numbers z that are complex conjugates of the values of $z^{-\frac{1}{2}}$.

6. Use complex analysis to demonstrate that:

   (a) $\cos[3\theta] = 4\cos^3[\theta] - 3\cos[\theta]$

   (b) $\sin[3\theta] = 3\sin[\theta] - 4\sin^3[\theta]$

7. Evaluate the integral

$$\int_{-\infty}^{+\infty} (A_0 + A_1 \sin[2\pi\xi_0\beta]) \cdot RECT[x - \beta] \; d\beta$$

   Since this is integrating over the "space" variable β, the answer is a function of x, A_0, A_1, and ξ_0.