

Homework # 1
Due February 3, 2010

1. Express the following complex numbers in both standard cartesian form $z = x + jy$ and polar form $z = re^{j\theta}$. (Do this by hand for the practice, but you're encouraged to check your answers with a calculator or in Matlab!)

(a) $(1 + j2) - (2 + 3j)$

(b) $(1 + j)(2j)$

(c) $(1 - j1)(2 + 2j)$

(d) $(1 - j1)/(2 + 2j)$

(e) $e^{j\frac{\pi}{2}} + e^{j\pi} + e^{j\frac{3\pi}{2}} - j$

(f) $j \exp(j\pi/4)$

(g) $\frac{e^{j\frac{\pi}{4}}}{j}$

2. Simplify the following signal in complex exponential form to the corresponding real-valued signal $x(t) = e^{j\pi/4} + e^{-j\pi/4} + e^{j3(t-1)} + e^{-j3(t-1)} + je^{j\pi t} - je^{-j\pi t}$

3. Write the following signal in complex exponential form: $x(t) = \cos(6\pi t) + \sin(6\pi t)$

4. Calculate the Fourier series coefficients $a_0, a_k, b_k, k = 1, 2, 3, \dots$ for the periodic signal $x(t) = x(t + 2)$:

$$x(t) = \begin{cases} 1, & 0 \leq t < \frac{1}{2} \\ 0, & \frac{1}{2} < t < 2 \end{cases}$$

5. Calculate the complex exponential Fourier series coefficients $d_k, k = -\infty$ to ∞ for the above signal.
6. Sketch the signal $x(t) = 1 + \cos(2\pi t) + \sin(3\pi t)$ over at least the interval $0 < t < 5$ sec. What is the period T of $x(t)$? What are the Fourier series coefficients $a_0, a_k, b_k, k = 1, 2, 3, \dots$ of this periodic signal?