Homework Assignment #1

ECE 565, Spring 2009

(Emailed to students on Sun, 8 Feb; due in class on Fri, 13 Feb)

Problem 1 (10 pts. total): *Magnitudes of complex numbers*

Determine the magnitudes of the following complex numbers. Work in closed form, don't use an electronic calculator!

(a) $\frac{1}{1+5j}$; (b) $e^{j\varphi}$, where φ is real; (c) $e^{7j}/(4+j)$; (d) $e^{3+4j}(3+4j)$; (e) $(1-2j)^6$.

Problem 2 (10 pts. total, 2 pts. per subproblem): *Phases of complex numbers*

Determine the phases of the following complex numbers. Work in closed form, don't use an electronic calculator!

(a) $7e^{3j}$; (b) 8; (c) -13; (d) $(1+j)^5$; (e) $j^{1/3}$.

Problem 3 (4 pts. total, 2 pts. per subproblem): *Geometric series*

User the formula for the geometric series to expand the following complex numbers into a series of powers of a purely imaginary number.

(a) $1/(1+j/2)$; (b) $1/(3+2j)$.

Problem 4 (6 pts. total, 2 pts. per subproblem): *Unit circle*

Are the following complex numbers inside, outside, or on the unit circle? Justify your answer.

(a) $3e^{j/3}$; (b) $1/(1+e^{j/4})$; (c) $(1-j)/\sqrt{2}$.

Problem 5 (10 pts. total, 5 pts. per subproblem): *Complex-valued, continuous-time signal*

Consider the complex-valued, continuous-time signal $x_c(t) = \frac{t}{2}\exp\left(j\frac{\pi}{4}t\right)$.

(a) Plot the "complex-plane trajectory" of $x_c(t)$ for $0 \le t \le 24$;

(b) Plot the real part of $x_c(t)$ for $0 \le t \le 24$ as a function of time t.