EE103: Homework 1
Due Wednesday April 9, 2015: in class

1. Let $z^*$ denote the complex conjugate of $z$ (i.e. if $z = x + jy$ then $z^* = x - jy$).
   (a) Express the following in polar form:
      (i) $-1 + 1j$
      (ii) $2 - 3j$
   (b) Express the following in Cartesian form:
      (i) $4e^{-j\pi/2}$
      (ii) $6e^{+j\pi/3}$
      (iii) $5e^{j53.1^\circ}$
   (c) Compute the following (you can express the answer in Cartesian or polar form):
      (i) $5e^{j\pi/2} + 3e^{-j\pi/4}$
      (ii) $5e^{j\pi/2} \cdot 3e^{-j\pi/4}$
      (iii) $5e^{j\pi/4} + 3e^{-j\pi/8}$
      (iv) $(5 + 6j)/(3 - 4j)$
      (v) $5e^{j\pi/4}/3e^{-j\pi/4}$
      (vi) $(8e^{j\pi/8})^{1/3}$
      (vii) $(-4e^{j\pi/3})^2$
      (viii) $1/z^2$ where $z = 8e^{j\pi/4}$

2. Evaluate the real & imaginary parts of the following complex functions
   (a) $x(t) = 1/(3 \sin t + j \cos t)$
   (b) $x(t) = (\cos 3t + 4j \sin t)^2$
   (c) $x(t) = (2j + \cos t)^3$
   (d) $x(t) = \sqrt[3]{64}$
   (e) $x(t) = \sqrt{-8}$

3. Are the following signals periodic? If so, find the period.
   (a) $\sin(8\pi t)$
   (b) $\cos(7t)$
   (c) $e^{j3\pi t/2}$
   (d) $e^{\pi t/4}$
   (e) $\cos(16\pi t) + \sin(3\pi t/2)$
4. Let
\[ x(t) = \cos(3\pi t) + \sin(6\pi t) + 8t^3, \]
\[ y(t) = e^{3j\pi t} + e^{-3j\pi t}, \]
\[ z(t) = -4j - \sin(\pi t/2). \]

(a) Find \( x_e(t) \) and \( x_o(t) \).
(b) Find \( y(-t) \). Is \( y(t) \) odd or even?
(c) Is \( x_o(t)y(t) \) odd or even? Why?
(d) Is \( x_e(t) + y(t) \) odd or even? Why?
(e) Find \( z^*(-t) \). Is \( z(t) \) conjugate symmetric or anti-symmetric?
(f) Is \( x_o(t)z(t) \) conjugate symmetric or anti-symmetric? Why?

5. Find \( x \) and \( y \), given that

(a) \( 4x + 6y = 10, \ x - 2y = -4 \)
(b) \( z = Aw \) where
\[
A = \begin{bmatrix} 3 & 2 \\ 1 & -2 \end{bmatrix}, \quad z = \begin{bmatrix} 5 \\ 3 \end{bmatrix}, \quad w = \begin{bmatrix} x \\ y \end{bmatrix}.
\]
(c) Find \( A^{-1} \) for the matrix \( A \) in part (b).

6. Let \( x(t) \) be as shown in Fig. 1.

![Figure 1: x(t) for Problem 6.](image)

(a) Plot \( x(-t) \)
(b) Plot \( x(t-2) \)
(c) Plot \( x(t+2) \)
(d) Plot \( x(2t+4) \)