

6.003: Signals and Systems — Spring 2004

TUTORIAL 3 SOLUTIONS

Tuesday, February 23, 2004

Problem 3.1

(a) $a_1 = a_{-1}^* = \frac{1}{2j}$
 $a_2 = a_{-2}^* = \frac{1}{2}$

(b) $a_1 = 1/2, a_{-1} = -1/2$
 $a_2 = a_{-2}^* = -\pi/2$

(c) $a_1 = a_{-1}^* = \frac{1}{2}$
 $a_2 = a_{-2}^* = \frac{1}{2j}$
 $a_4 = a_{-4}^* = \frac{1}{2}$

(d) $a_0 = 1/2$
 $a_1 = a_{-1}^* = 1/2 + j\sqrt{3}/4$

(e) $a_k = 1/5, k = 0$
 $a_k = \frac{\sin(k\pi/5)}{k\pi}, k \neq 0$

Problem 3.2

(a) $(-2 + j)a_k$

(b) $e^{-jk\omega_0}a_k$

(c) $jk\omega_0a_k$

(d) $a_k + 1, k = 0$
 $a_{-k}, k \neq 0$

(e) $e^{-jk\omega_0}a_{-k}$

(f) $a_k * a_k$

Problem 3.3

$$x(t) = 2 \cos\left(\frac{\pi}{4}t + \frac{\pi}{2}\right) + 4 \cos\left(\frac{\pi}{2}t + \frac{\pi}{3}\right) - 6 \cos\left(\frac{5\pi}{4}t\right)$$

Problem 3.4

Problem 3.5

Problem 3.6

(a) $a_0 = 3$
 $a_1 = a_{-1}^* = 1$
($T = 8$)

(b) $a_0 = 1$
 $a_1 = a_{-1}^* = \frac{1}{2j}$
 $a_5 = a_{-5}^* = 1$
($T = 10$)

(c) $a_0 = 1$
 $a_1 = 1$
 $a_2 = a_{-2} = -\frac{1}{2}$
($T = 2$)

Problem 3.7

$$A = 1/100$$

$$T_0 = 10$$