CENG 384 - Signals and Systems for Computer Engineers
Spring 2018-2019
Written Assignment 1

Sen, Ali
e2264661@ceng.metu.edu.tr

Sahin, Ismail
e2264653@ceng.metu.edu.tr

March 1, 2019

---

1. (a) (i) $|z|^2 = z * \overline{z} = x^2 + y^2$
   (ii) $3x + 3yj + 4 = 2j - x + yj$
   $4(x+1) + j(2y-2) = 0$
   $x = -1 \quad y = 1$

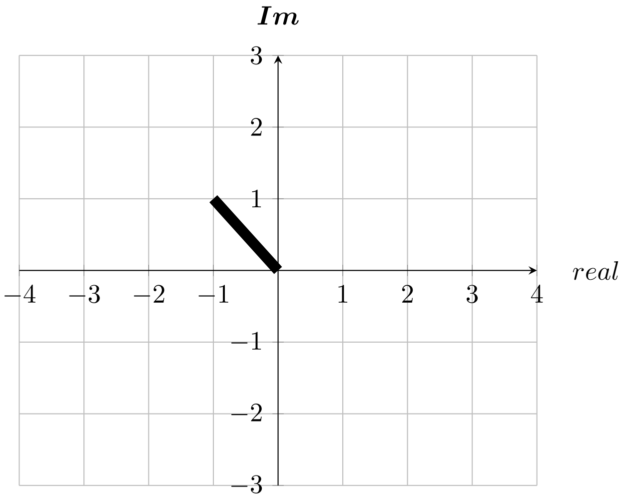

Figure 1: z is on complex plane.

   (b) $r^3 e^{j(3\theta)} = r^3 cos(3\theta) + jr^3 sin(3\theta) = 64j$
   $sin(3\theta) = 1 \;\; cos(3\theta) = 0$
   $\theta = \Pi/6 \; z = 4e^{j((\Pi/6)+(k2\Pi/3))}$ where k will be integer number.

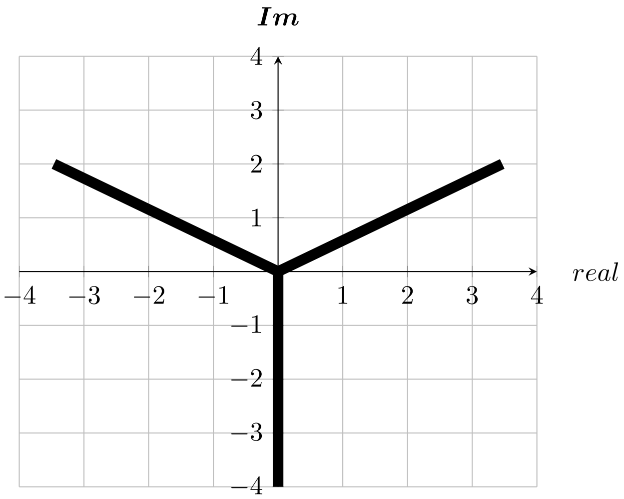

Figure 2: z is on complex plane.

(c) We multiply the denominator with its conjugate
$(1-j)^2 * (1+\sqrt{3}j)/2 = -j + \sqrt{3}$
$r = \sqrt{j^2 + 3}$
$r = \sqrt{2}$
$tan^{-1}(-1/\sqrt{3}) = -30$

(d) okey

2. t is 0 if $4 <= t <= 2$
2-t $0 <= t <= 2$
1 $-4 <= t <= 0$
2+t $-6 <= t <= -4$
0 $-8 <= t <= -6$

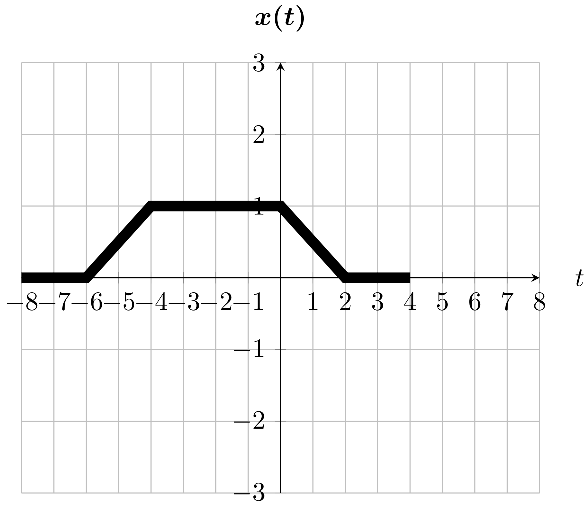

Figure 3: t vs. $x(t)$.

3. (a) .

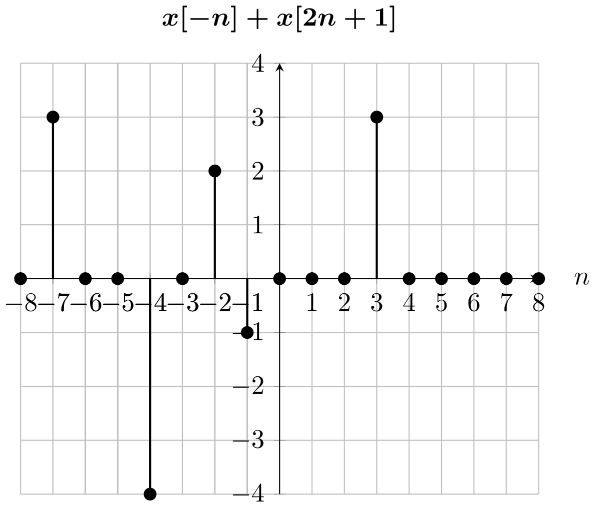

Figure 4: n vs. $x[-n] + x[2n+1]$.

(b) $x[n] = \sum_{k=-\infty}^{\infty} x[k]\delta[n-k]$

4. (a) for cosinus part:
$N1 = 2\Pi * m/(13\Pi/10)$ from this equation we get m = 13 and N1 = 20 both are integer numbers.
for sinus part:
$N2 = 2\Pi * m/(7\Pi/3)$ from this equation we get m = 7 and N2 = 6 again both are integer numbers.
So this signal is periodic.
LCM of N1 and N2 is the fundamantal period = 60

(b) $N = 2\Pi * m/3$ from this equation we can't get both m and N as integer values ,for discerete case we need to find values as integer in order signal to be periodic so this signal is not periodic.

(c) since this is a continues signal
$N = 2\Pi/3\Pi$ we get N = 2/3
this signal is periodic and fundemantal period is 2/3

(d) this signal is continues
$-j(e^{j5t}) = -j(cos5t + isin5t)$ from both cos and sin parts we get the same N = 2Π/5 so this signal is continues and the fundamental period is 2Π/5

5. .

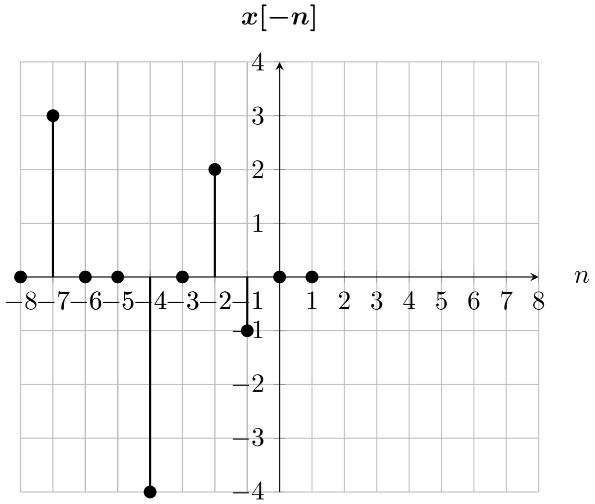

Figure 5: n vs. $x[-n]$.

xe : even signal
$xe(t) = x(t) + x(-t)/2$

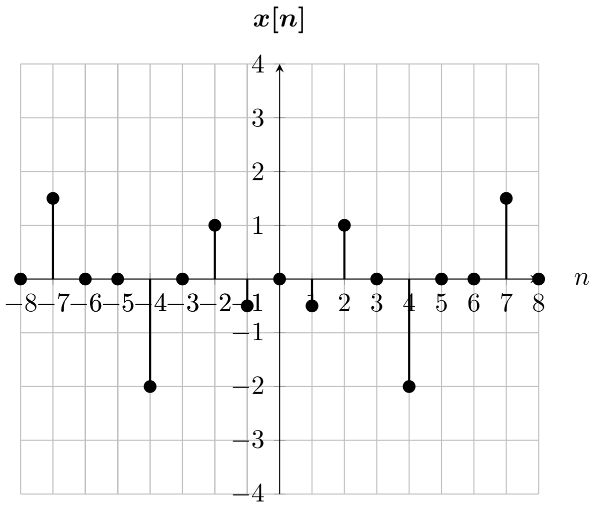

Figure 6: even signal

xo : odd signal
$xo(t) = x(t) - x(-t)/2$
.
.

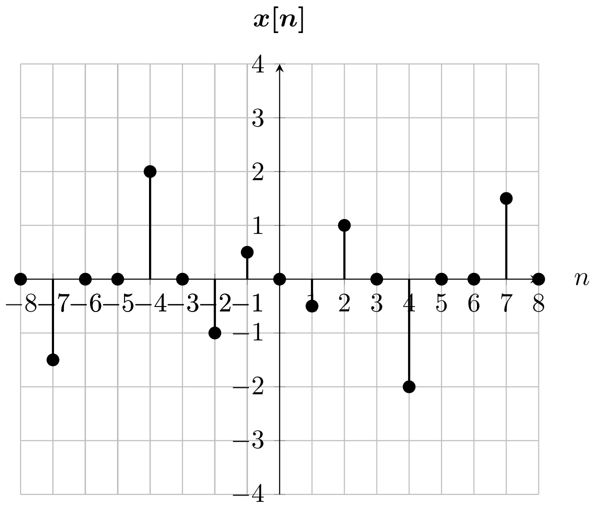

Figure 7: odd signal

6. (a) x(2t-3) has memory because it doesn't only depend on the current t
   it is not causal , it depends on future when we try to find t=5 we try to find x(7)
   stable because signal input and output is bounded.
   invertible cause we can get, for every t a different value so we can get the inverse of the signal.
   time invariant because when we put (t-t0) instead of t as input to the signal we get x(2(t-t0)-3) and to the signal output x(2t-3) we get x(2(t-t0)-3) which are the same results.
   linear

   (b) tx(t) is memoryless because it depends only the current value of t
   it is causal , it depends on present
   not stable because signal input is bounded but the output is unbounded.
   a1x1(t) −− > t −− > a1y1(t) = ta1x1(t)
   a2x2(t) −− > t −− > a2y2(t) = ta2x2(t)

   x3(t) = a1x1(t) + a2x2(t) −− > + −− > y3(t) = a1y1(t) + a2y2(t)
   y3 = t(a1x1(t) + a2x2(t)) = a1y1(t) + a2y2(t)
   so it is linear
   x(t) −− > system −− > y(t) = tx(t)
   x(t-t0) −− > system −− > y(t-t0)
   x(t-t0) not equal to tx(t-t0) so this signal is time variant.
   invertible, cause x(t) = 1/t(y(t))

   (c) x[2n-3] has memory has memory because it doesn't only depend on the current n
   it is not causal , it depends on future
   stable because signal input and output is bounded.
   not invertible cause some values for n will be lost and we won't be able to find them back.
   time invariant because when we put (n-n0) instead of n as input to the signal we get x(2(n-n0)-3) and to the signal output x(2n-3) we get x(2(n-n0)-3) which are the same results.
   linear

   (d) this signal has memory because it doesn't only depend on the current n
   it is not causal , it depends on future
   not stable because signal input is bounded but the output is unbounded.
   invertible cause we can find the values for every n value.
   time invariant because we get the same result x[(n-n0)-k] both as an input n -n0 instead of n and to the sum k=1 to the infinity n[(n-n0)-k]. linear.