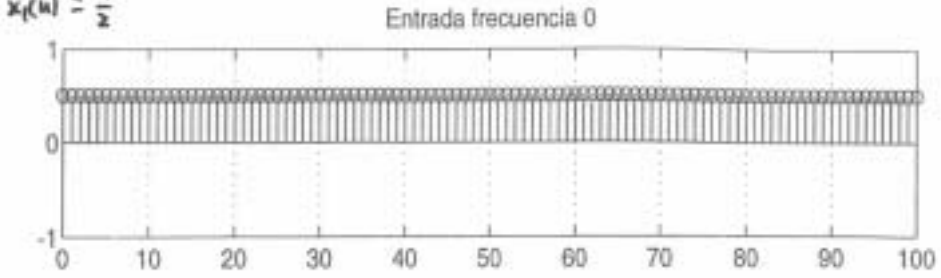
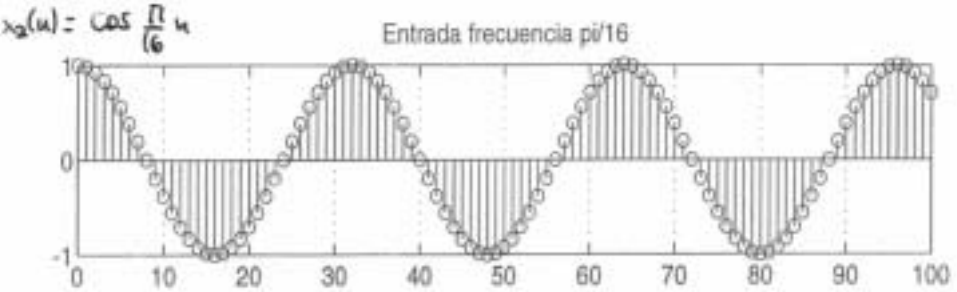
Tratamiento Digital de la Señal

Tema 2

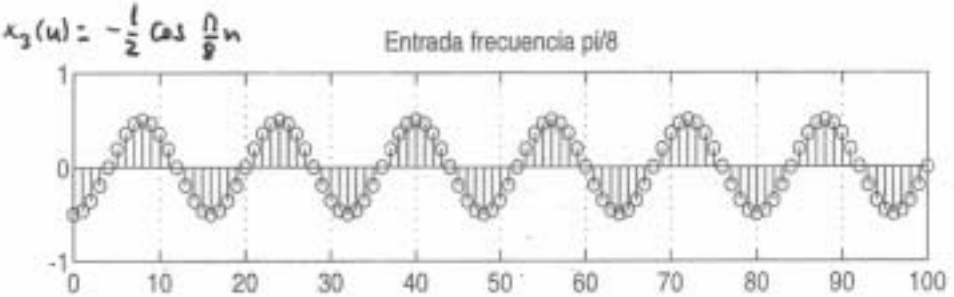
$x_1(n) = \frac{1}{2}$



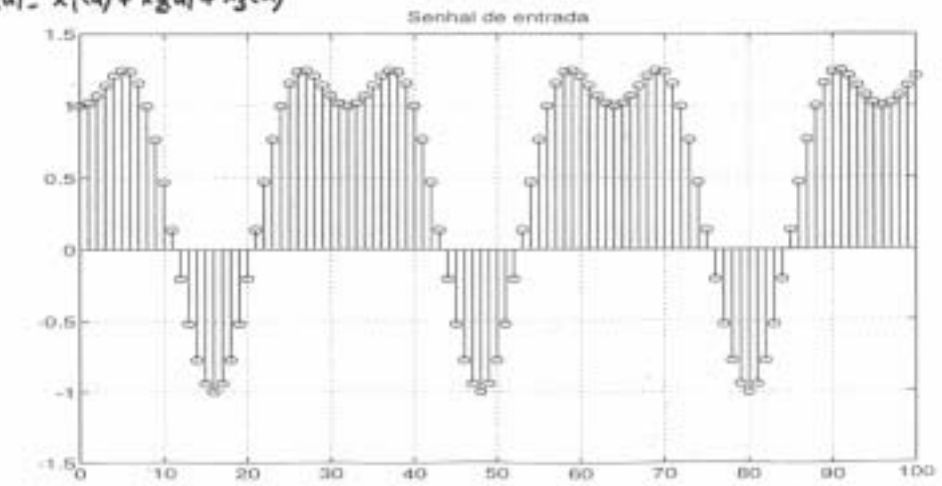
$x_2(n) = \cos \frac{\pi}{16} n$



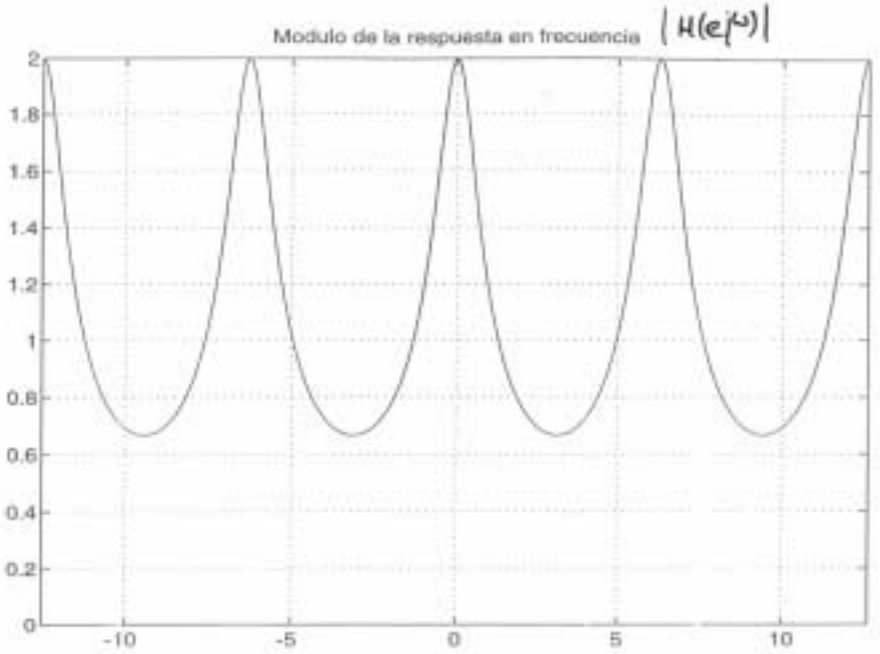
$x_3(n) = -\frac{1}{2} \cos \frac{\pi}{8} n$

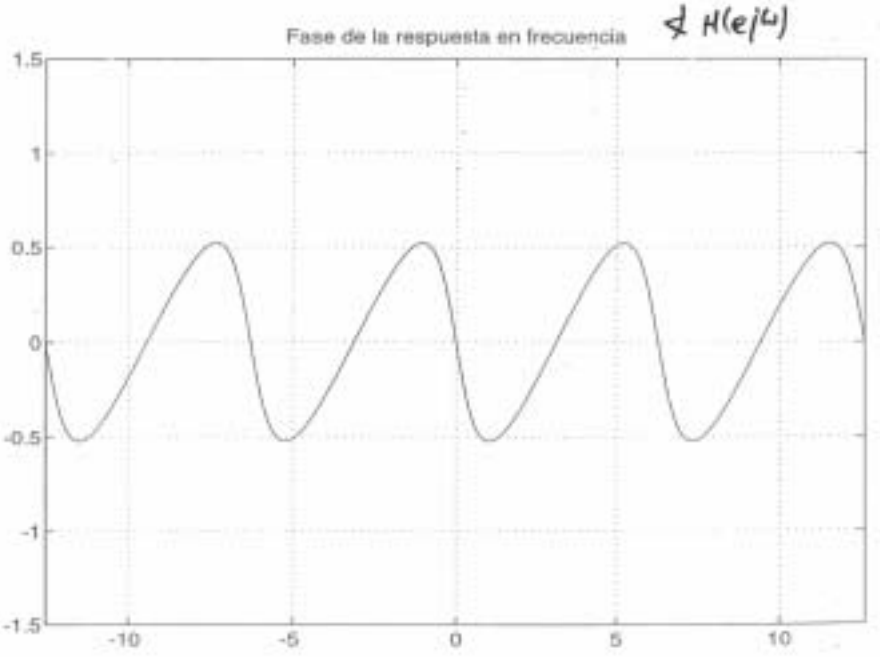


$x(n) = x_1(n) + x_2(n) + x_3(n)$

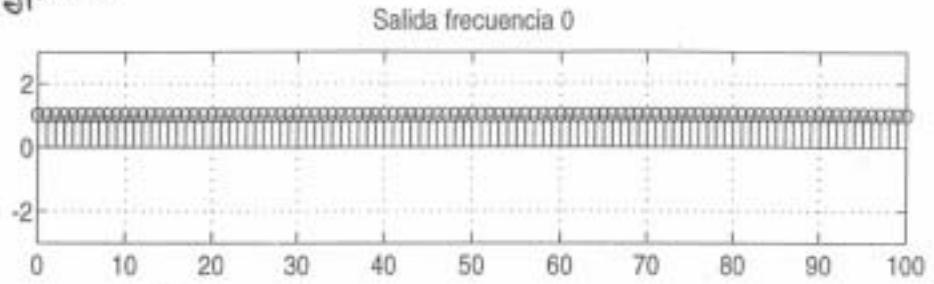


$$H(e^{j\omega}) = \frac{1}{1 - \frac{1}{2}e^{-j\omega}}$$

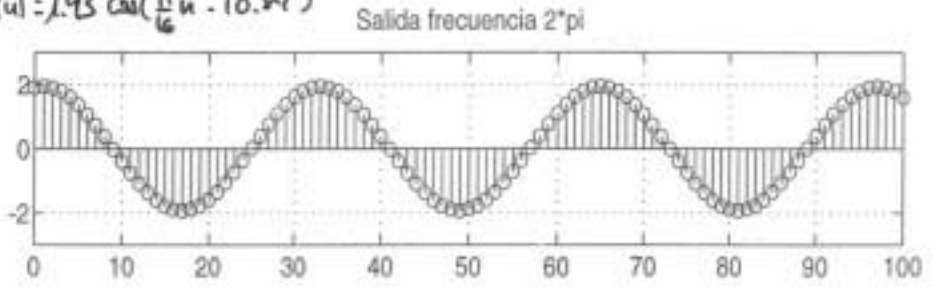




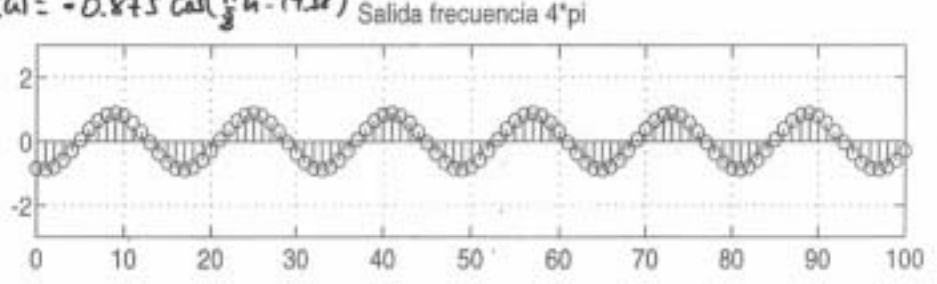
$y_1(n) = 1$



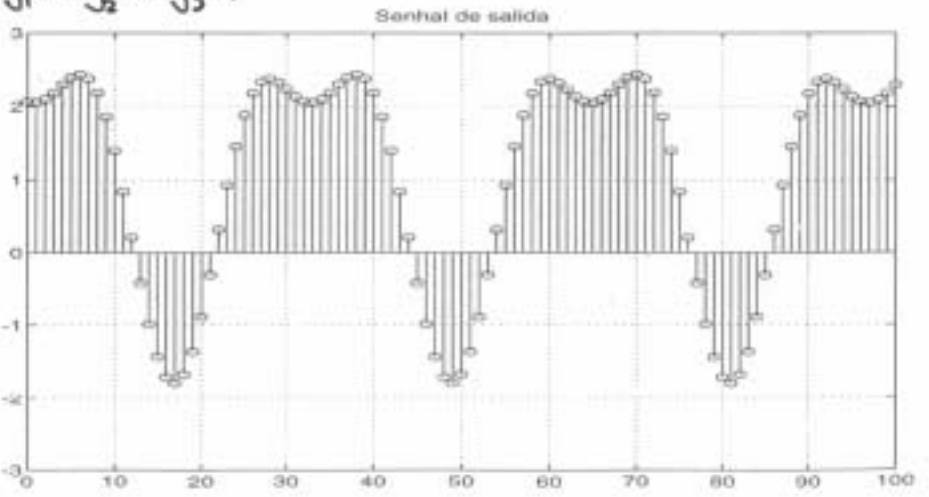
$y_2(n) = 1.93 \cos\left(\frac{\pi}{16} n - 10.8°\right)$

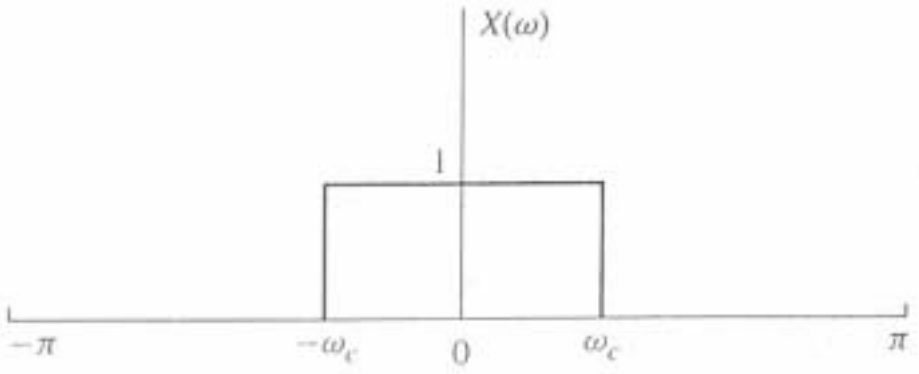


$y_3(n) = -0.875 \cos\left(\frac{\pi}{8} n - 19.8°\right)$

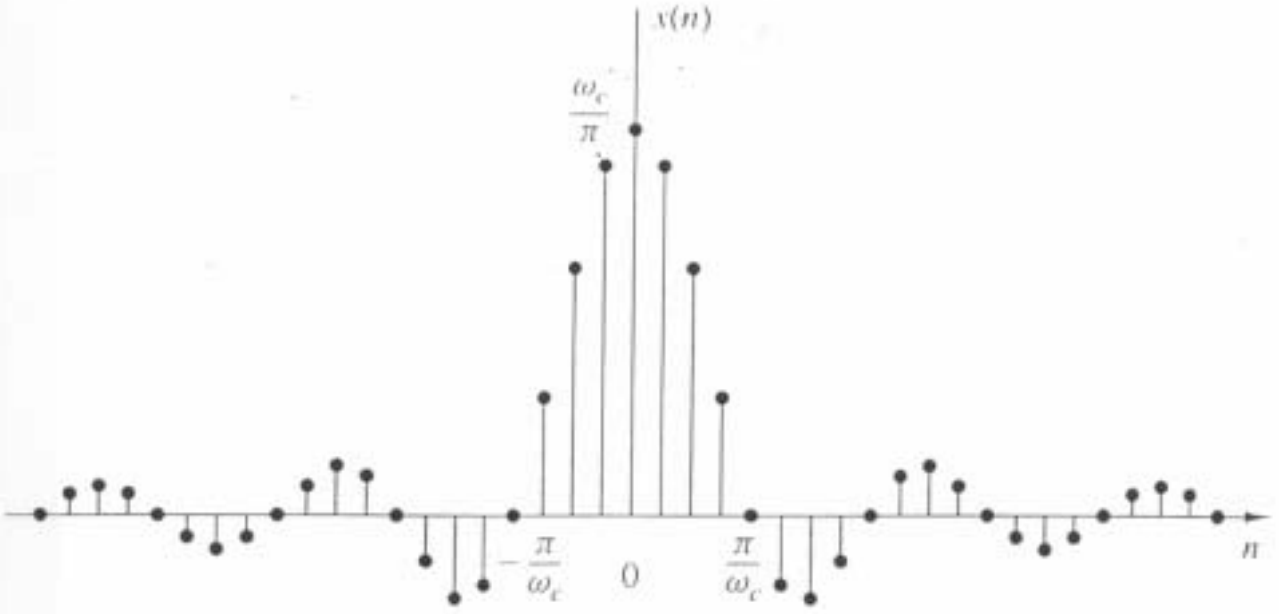


$y(n) = y_1(n) + y_2(n) + y_3(n)$

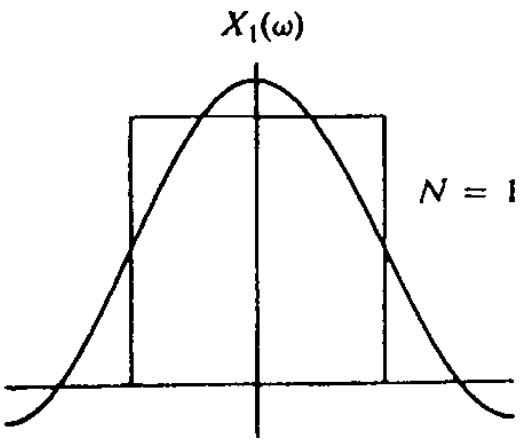


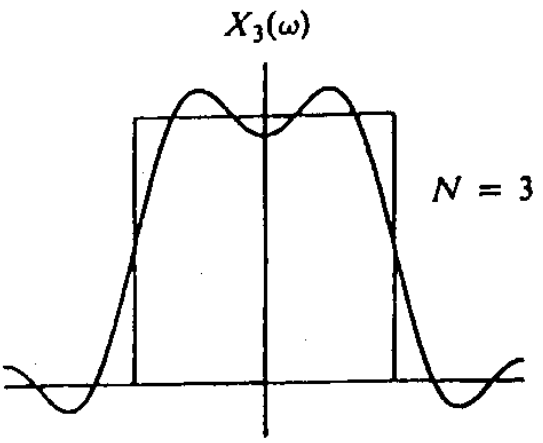

$X(\omega)$
1
$-\pi$
$-\omega_c$
0
ω_c
π

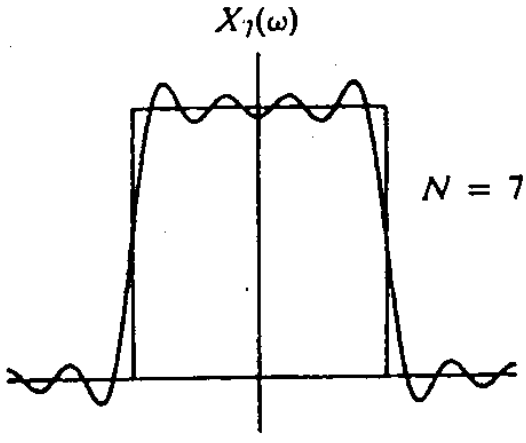
(b)

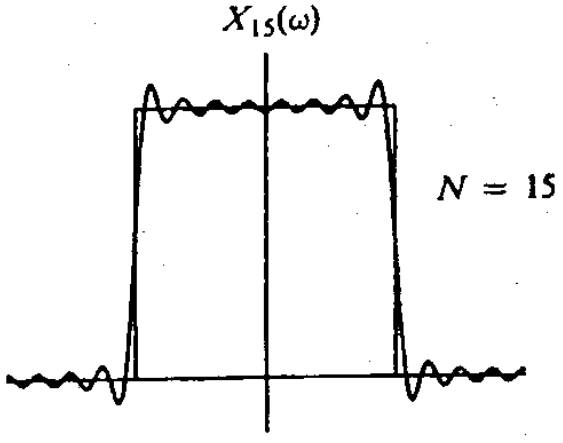

$x(n)$
$\frac{\omega_c}{\pi}$
$-\frac{\pi}{\omega_c}$
0
$\frac{\pi}{\omega_c}$
n

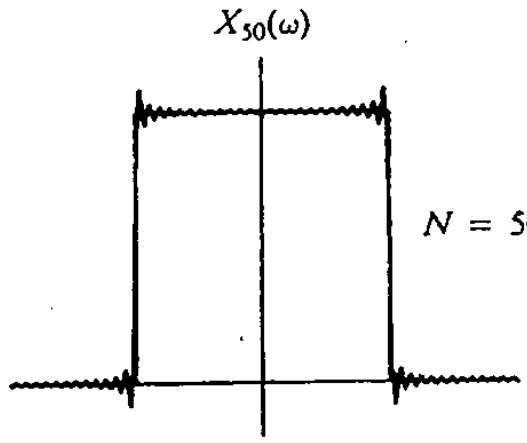
(a)

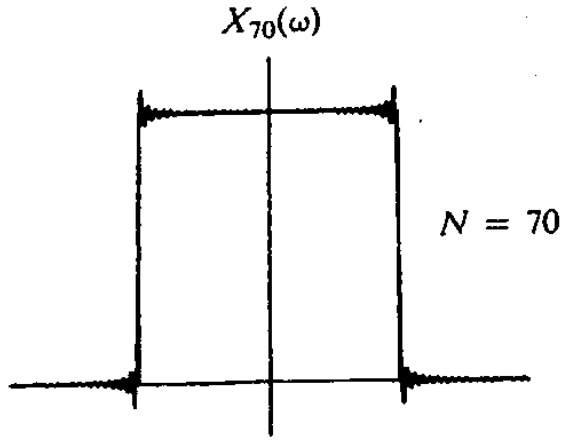

$X_1(\omega)$
$N = 1$

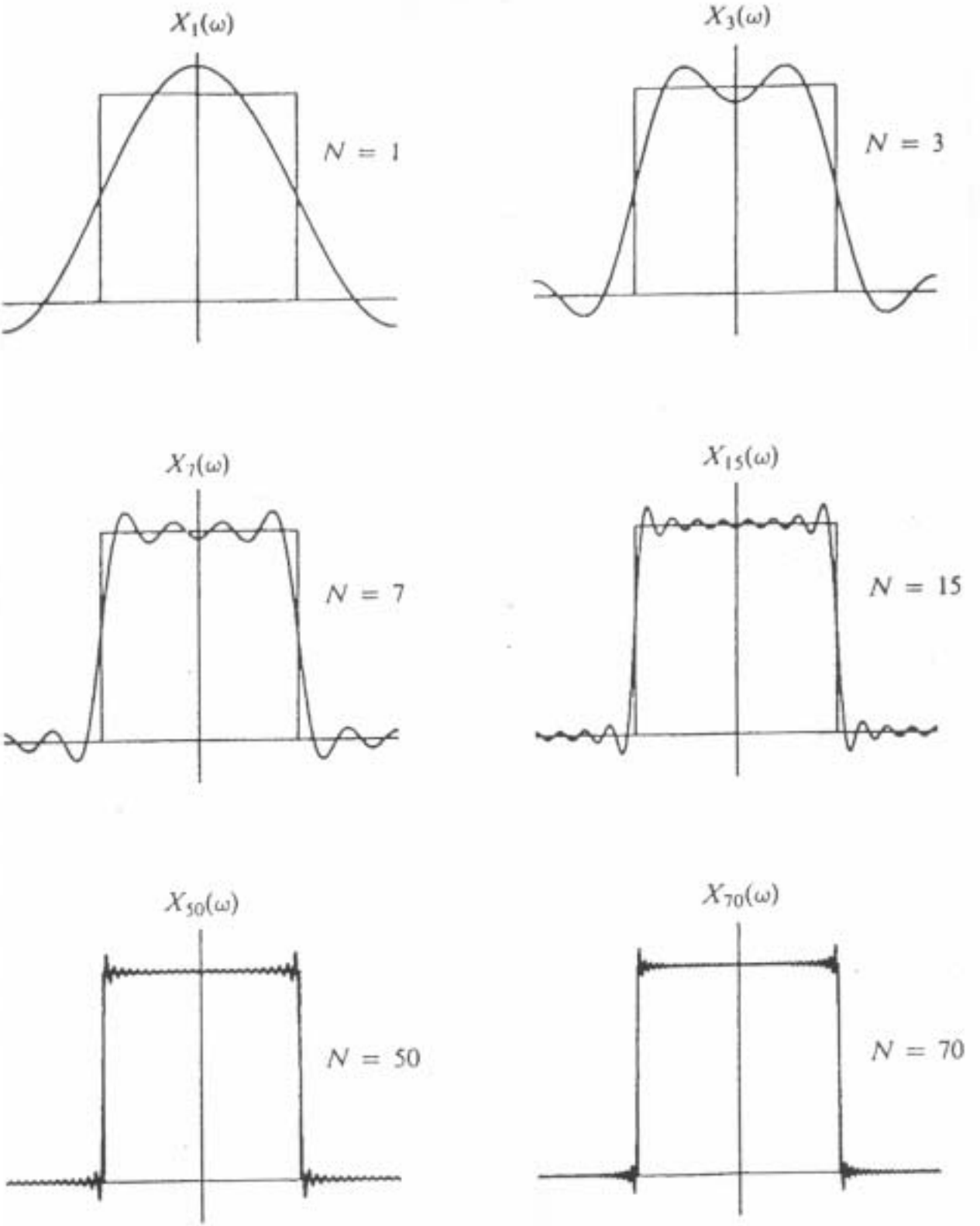

$X_3(\omega)$
$N = 3$


$X_7(\omega)$
$N = 7$


$X_{15}(\omega)$
$N = 15$


$X_{50}(\omega)$
$N = 50$

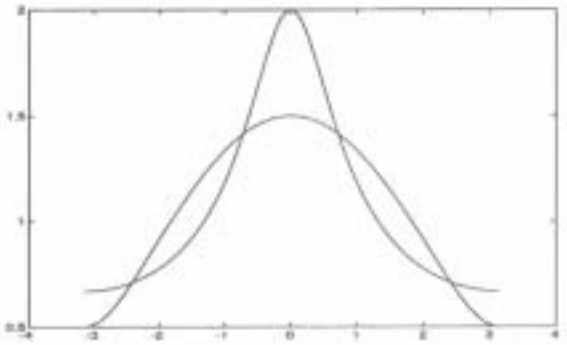

$X_{70}(\omega)$
$N = 70$


$X_1(\omega)$
$N = 1$
$X_3(\omega)$
$N = 3$
$X_7(\omega)$
$N = 7$
$X_{15}(\omega)$
$N = 15$
$X_{50}(\omega)$
$N = 50$
$X_{70}(\omega)$
$N = 70$

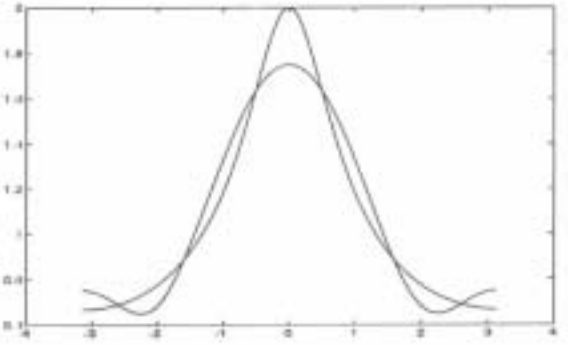
Convergencia Transformada de Fourier de $x(n) = (0.5)^n u(n)$

$$X_N(e^{j\omega}) = \sum_{n=-N}^{N} (0.5)^n u(n) e^{-j\omega n} \qquad X(e^{j\omega}) = \frac{1}{1 - 0.5e^{-j\omega}}$$

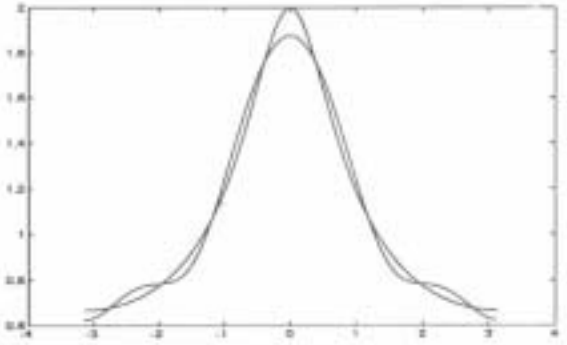
N=1



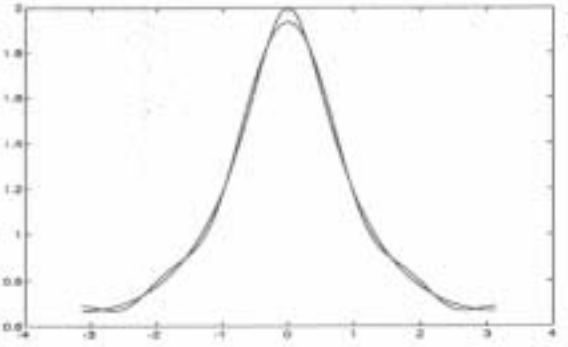
N=2



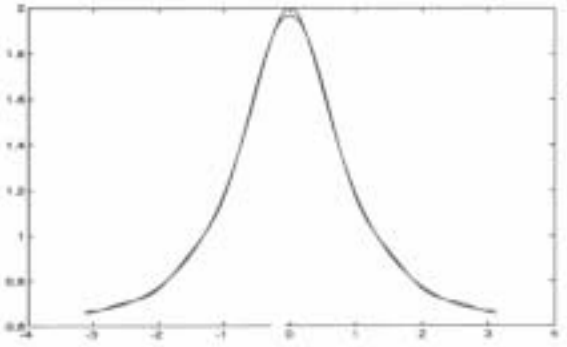
N=3



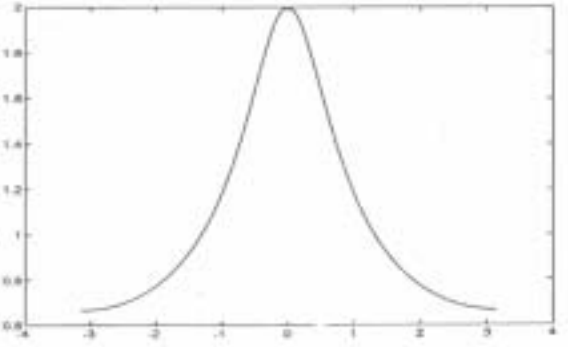
N=4



N=5



N=9



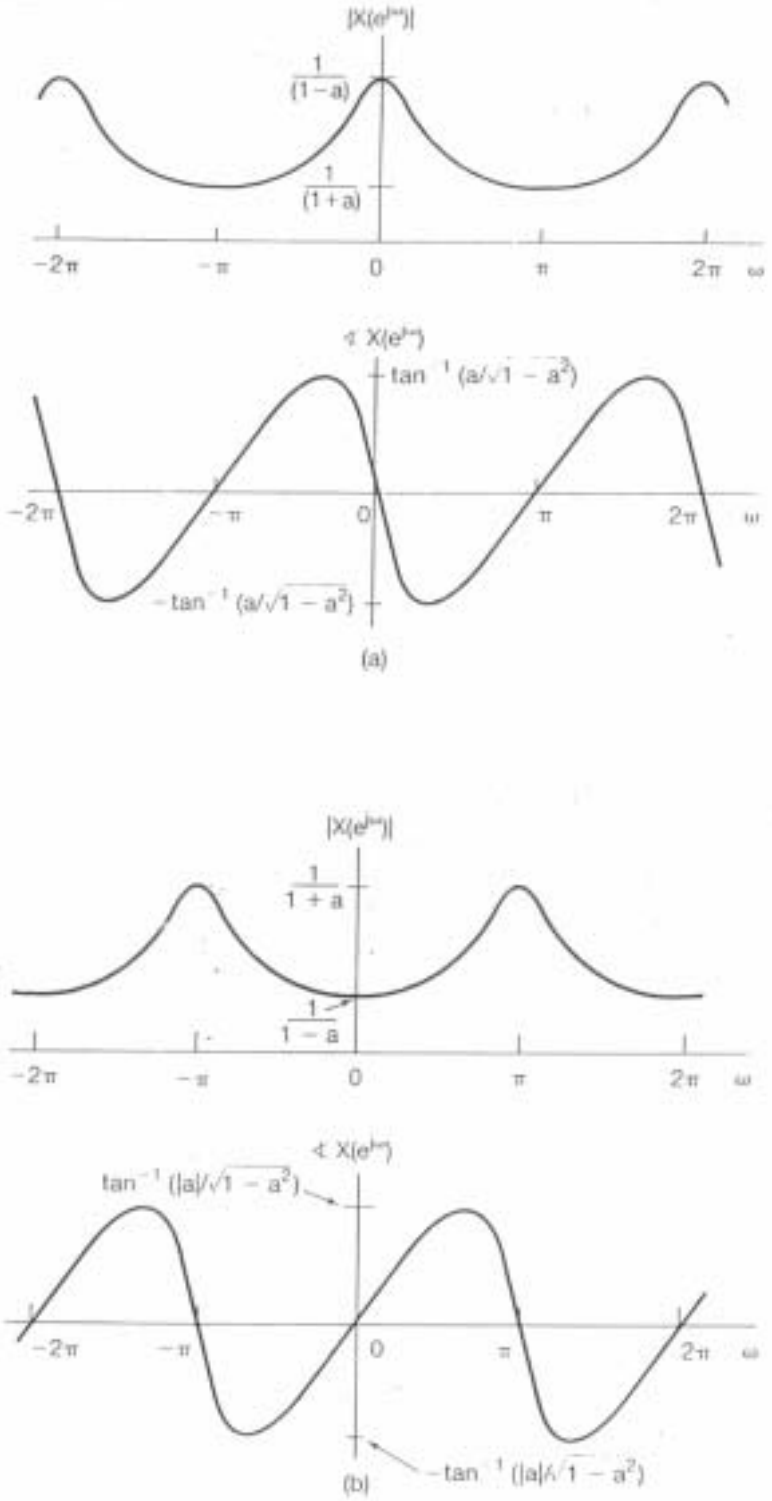
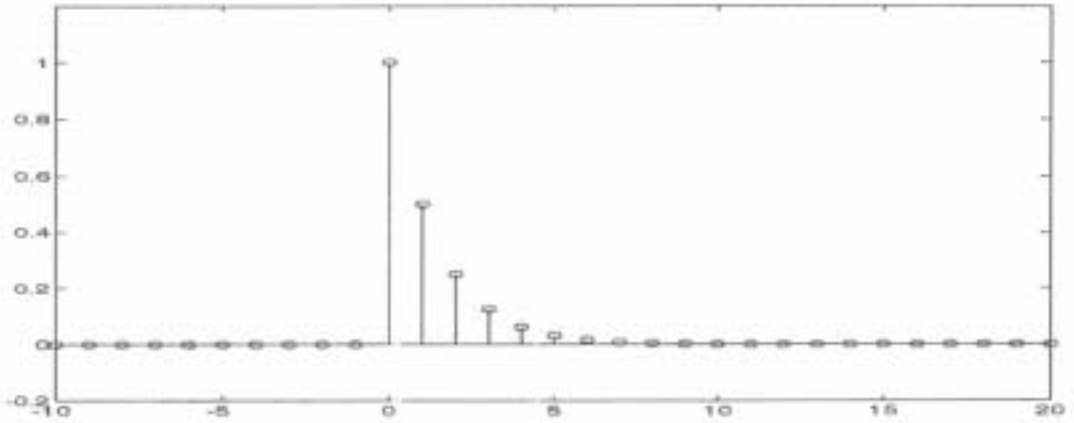
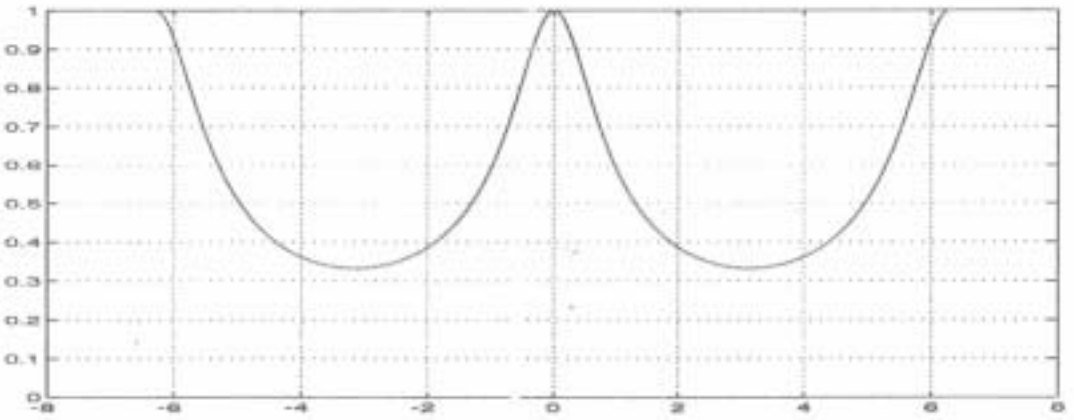


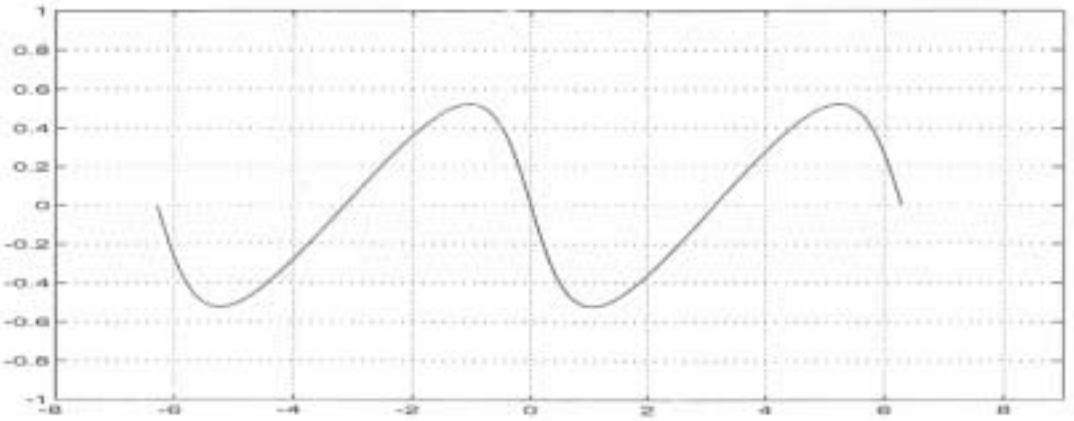
Figure 5.4 Magnitude and phase of the Fourier transform of Example 5.1 for (a) $a > 0$ and (b) $a < 0$.

Tansformada de Fourier de una exponencial

$$x(n) = (0.5)^n u(n)$$

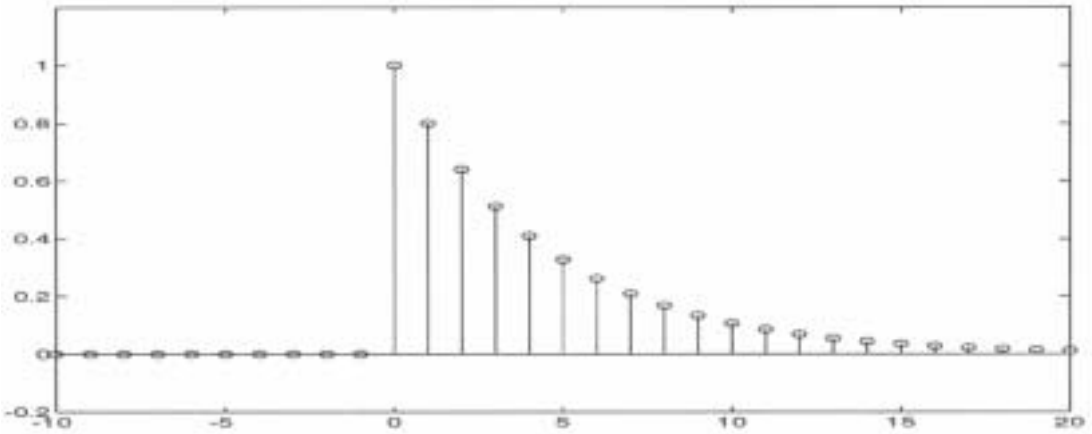


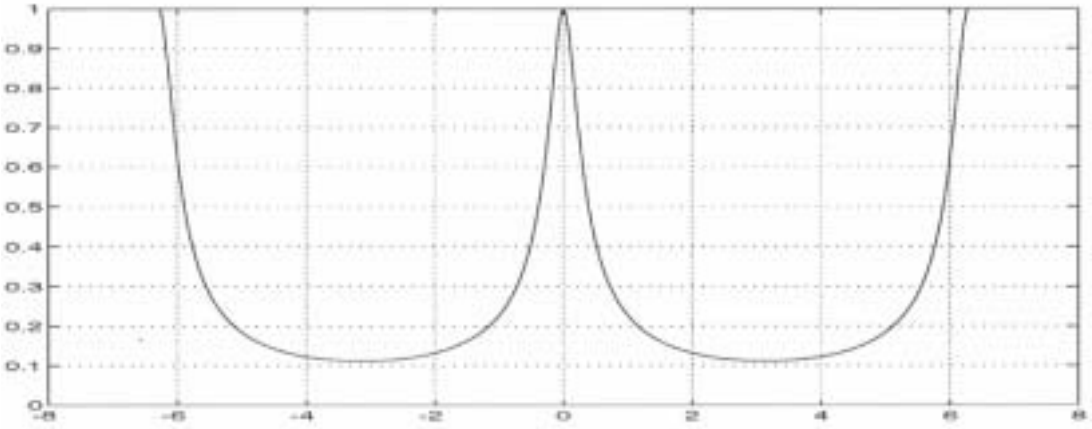


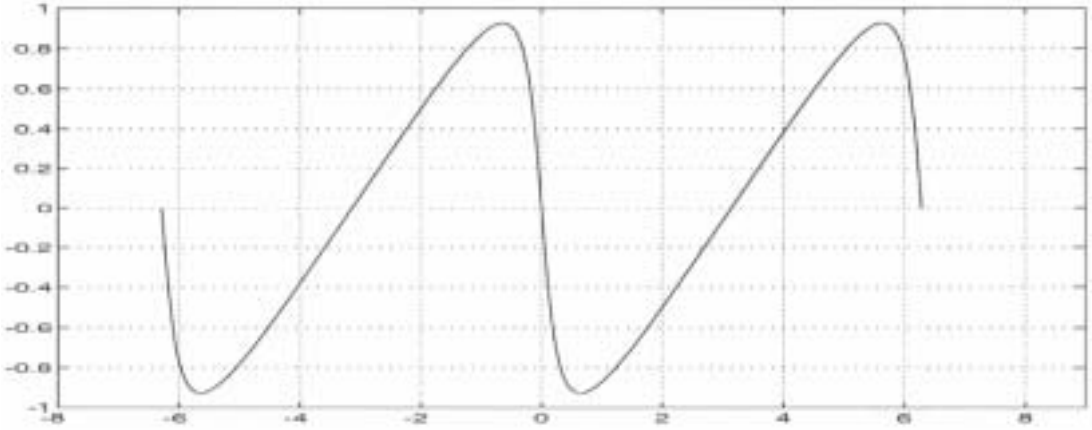


Tansformada de Fourier de una exponencial

$$x(n) = (0.8)^n u(n)$$

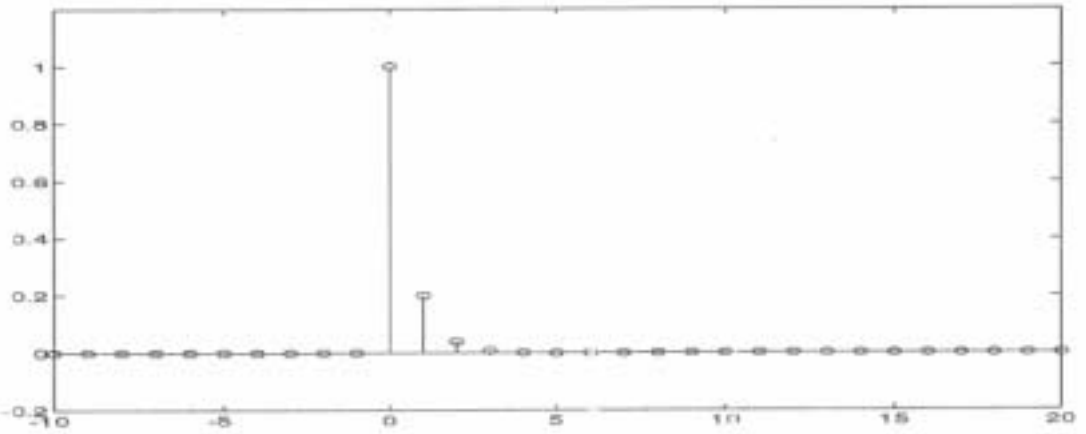


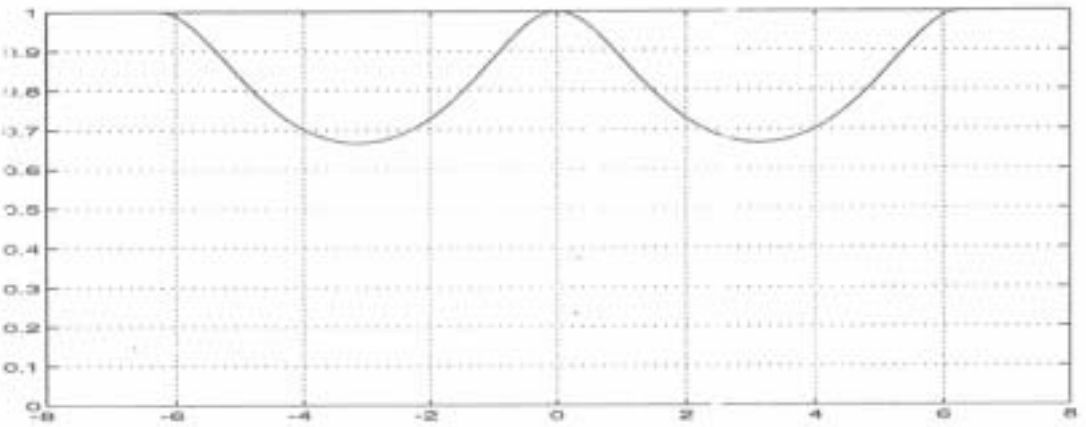


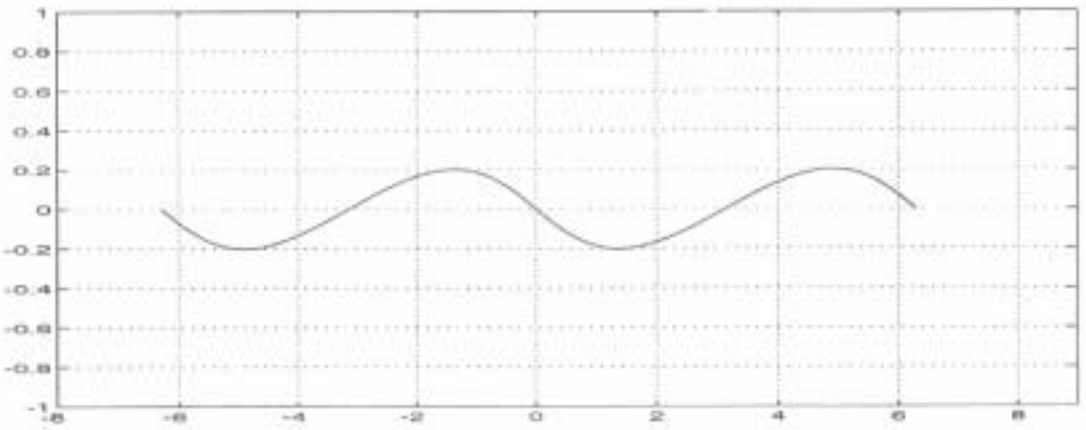


Tansformada de Fourier de una exponencial

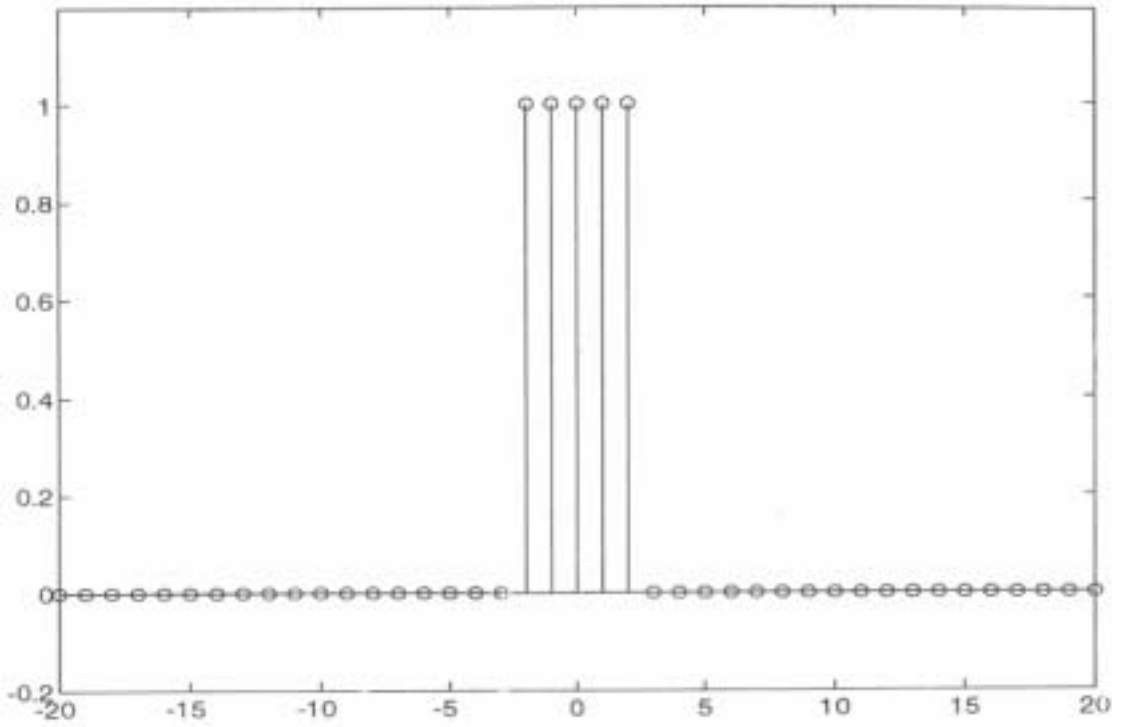
$$x(n) = (0.2)^n u(n)$$

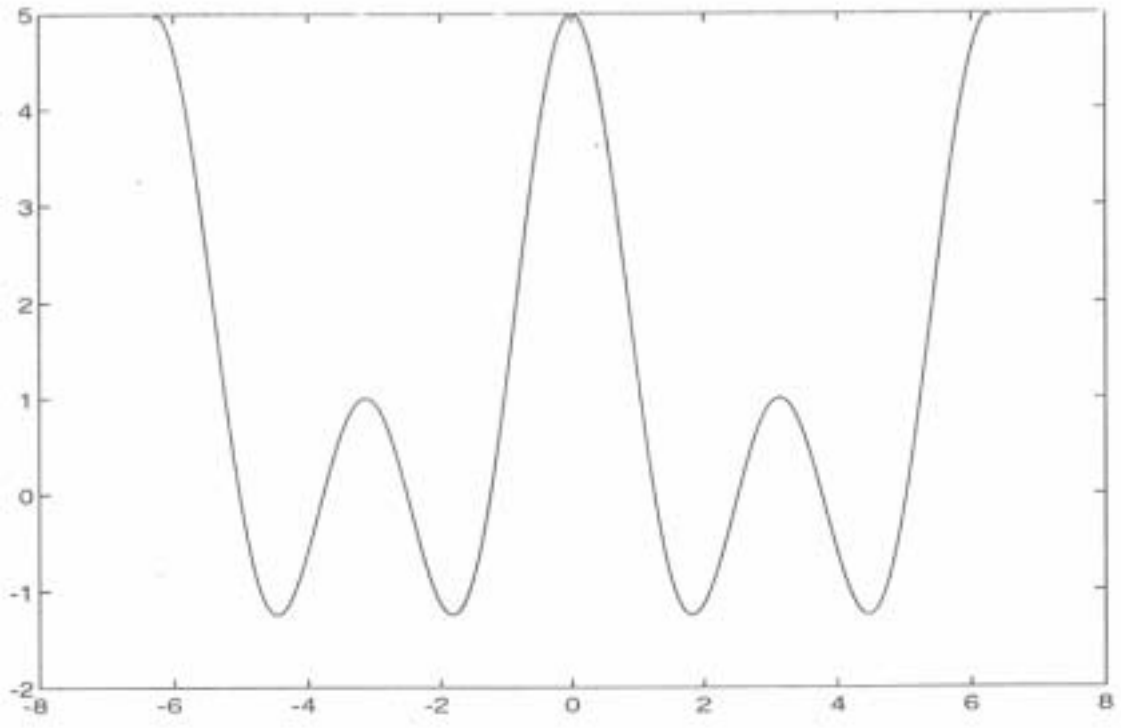




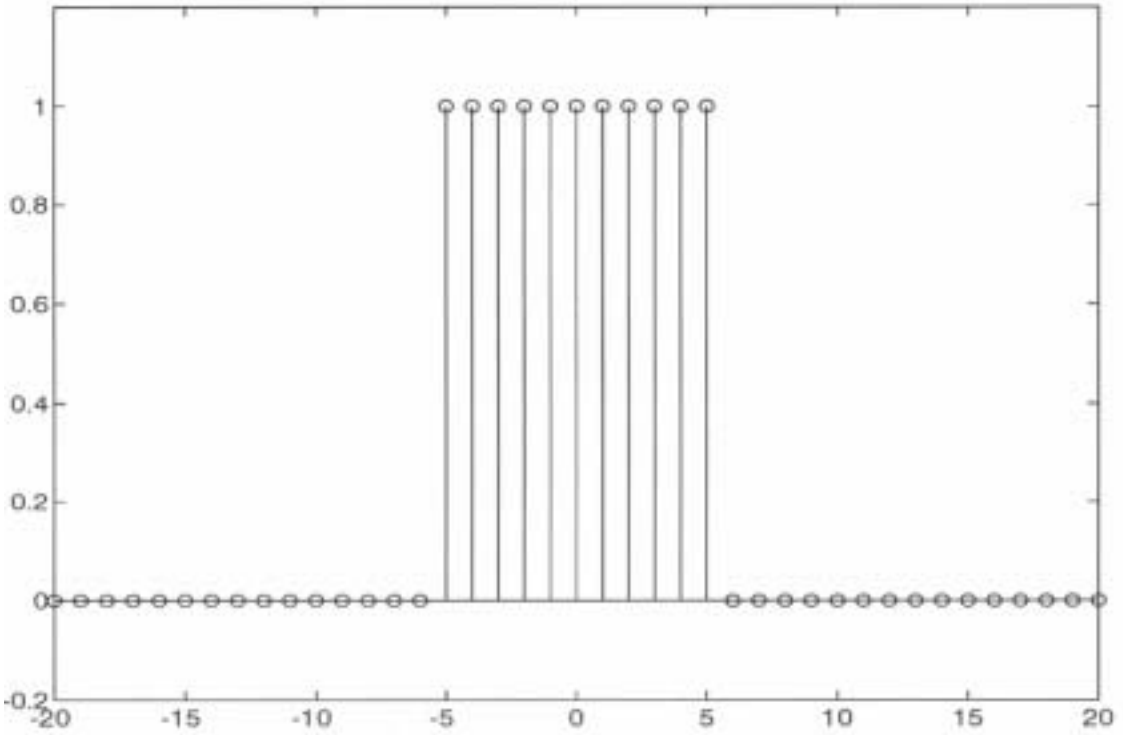


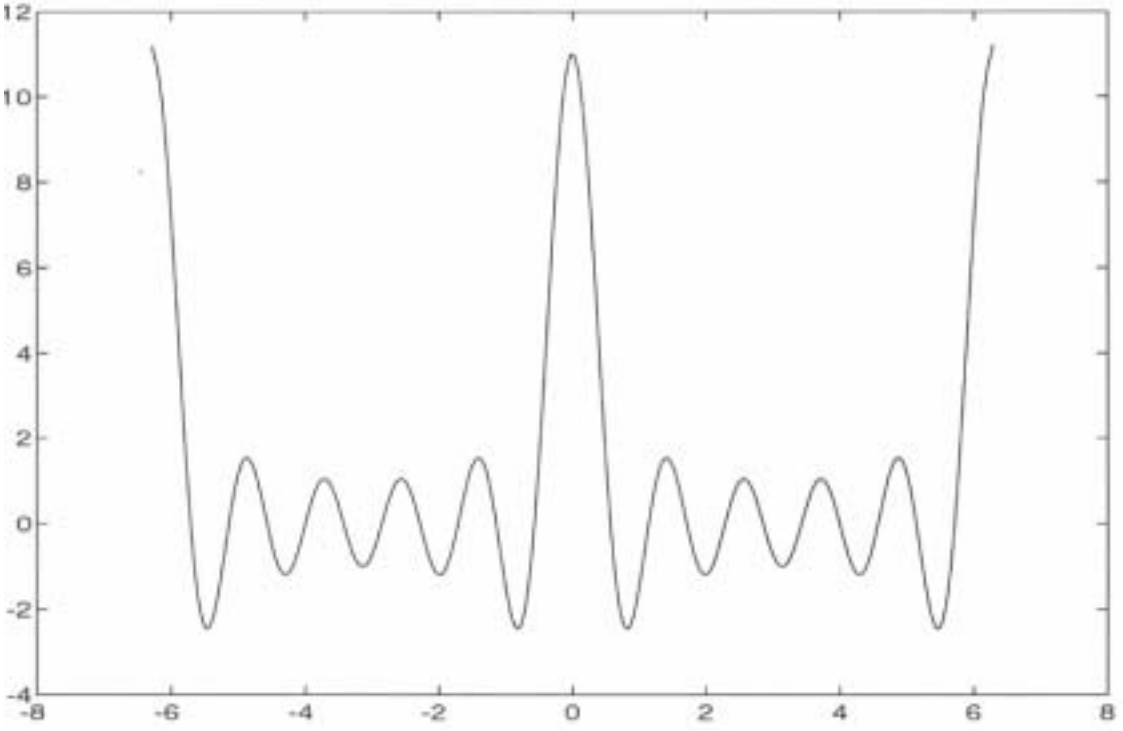
Tansformada de Fourier de un pulso rectangular $N = 2$





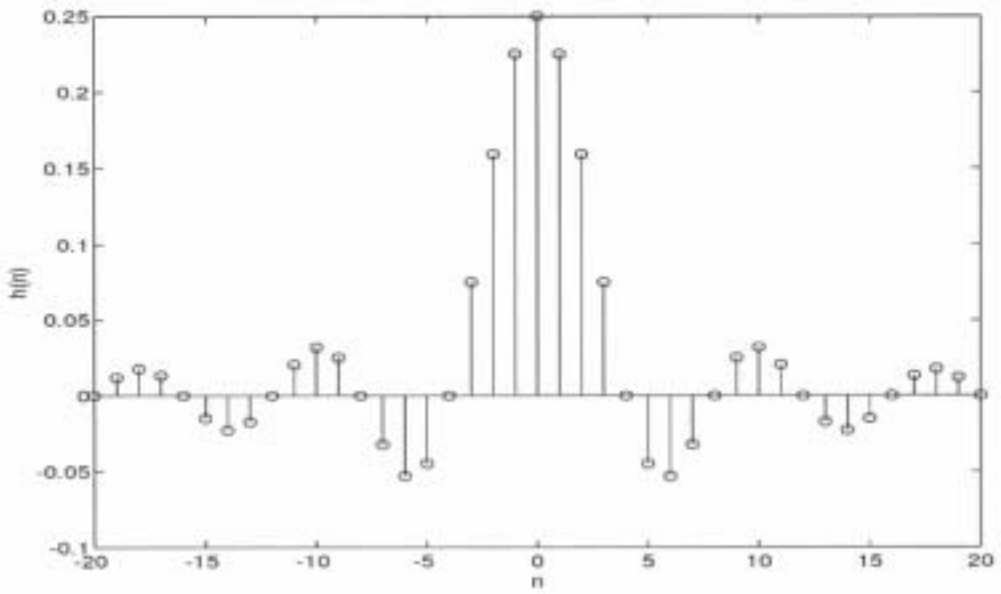
Tansformada de Fourier de un pulso rectangular $N = 5$





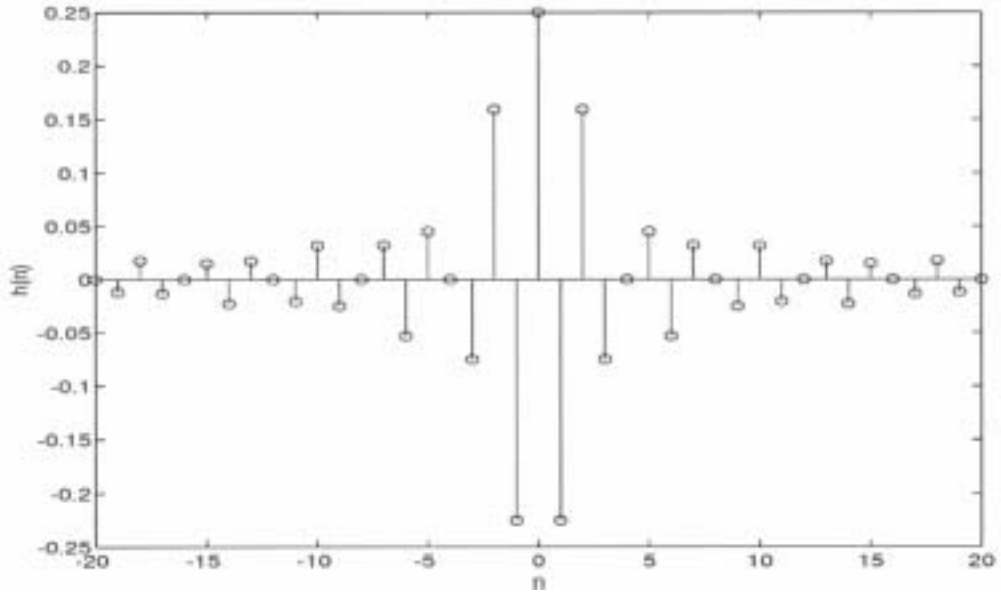
Respuesta al impulso de filtro paso bajo

$$h(n) = \frac{sen\ Wn}{\pi n}$$



Respuesta al impulso de filtro paso alto

$$h(n) = (-1)^n \frac{sen\ Wn}{\pi n}$$



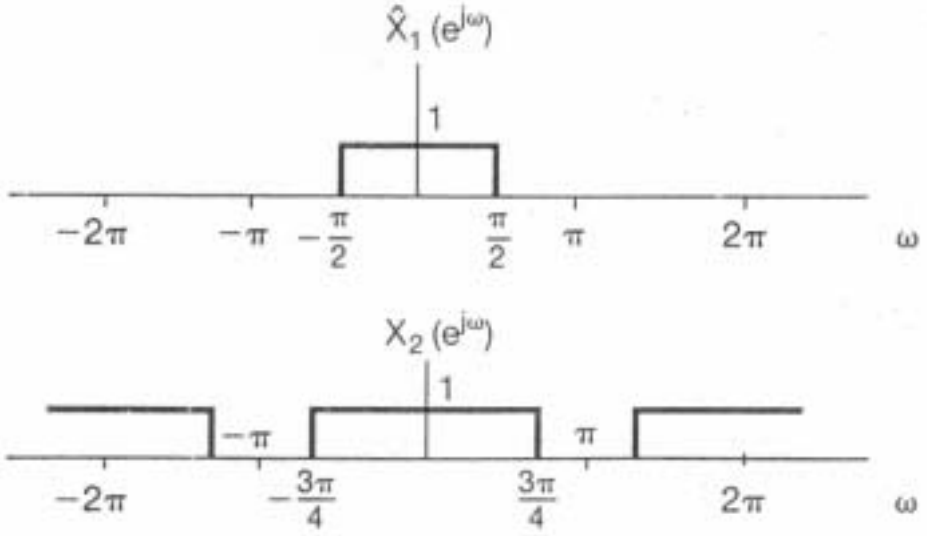


Figure 5.19 $\hat{X}_1(e^{j\omega})$ representing one period of $X_1(e^{j\omega})$, and $X_2(e^{j\omega})$. The linear convolution of $\hat{X}_1(e^{j\omega})$ and $X_2(e^{j\omega})$ corresponds to the periodic convolution of $X_1(e^{j\omega})$ and $X_2(e^{j\omega})$.

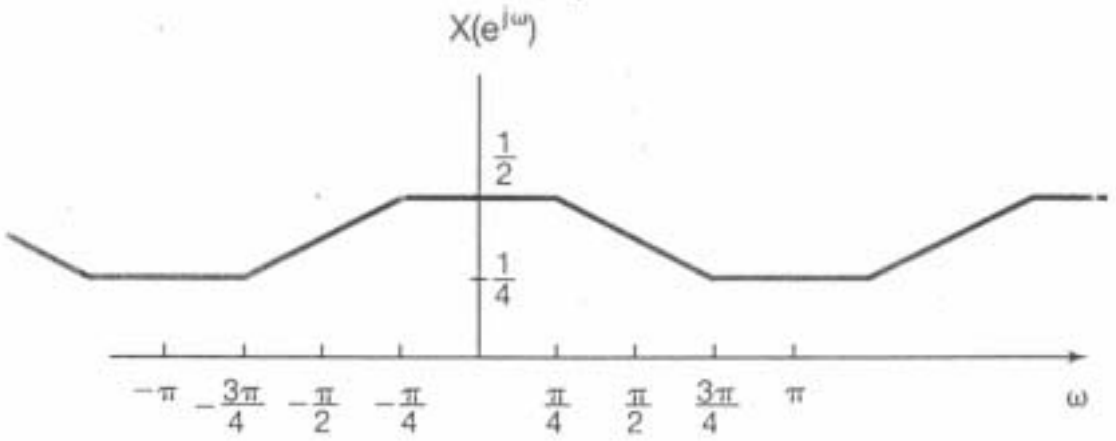
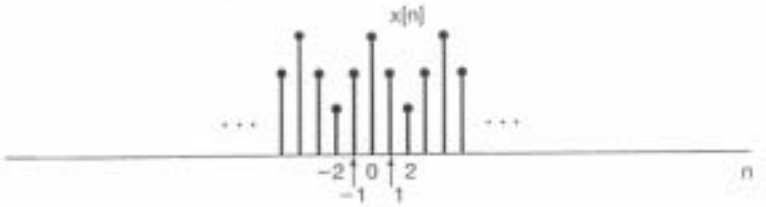


Figure 5.20 Result of the periodic convolution in Example 5.15.



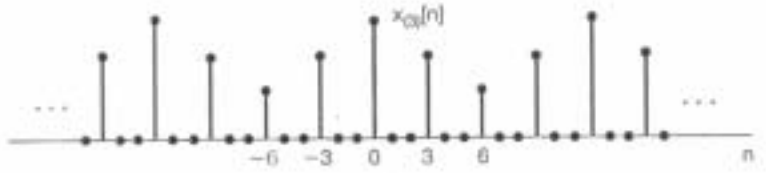


Figure 5.13 The signal $x_{(3)}[n]$ obtained from $x[n]$ by inserting two zeros between successive values of the original signal.

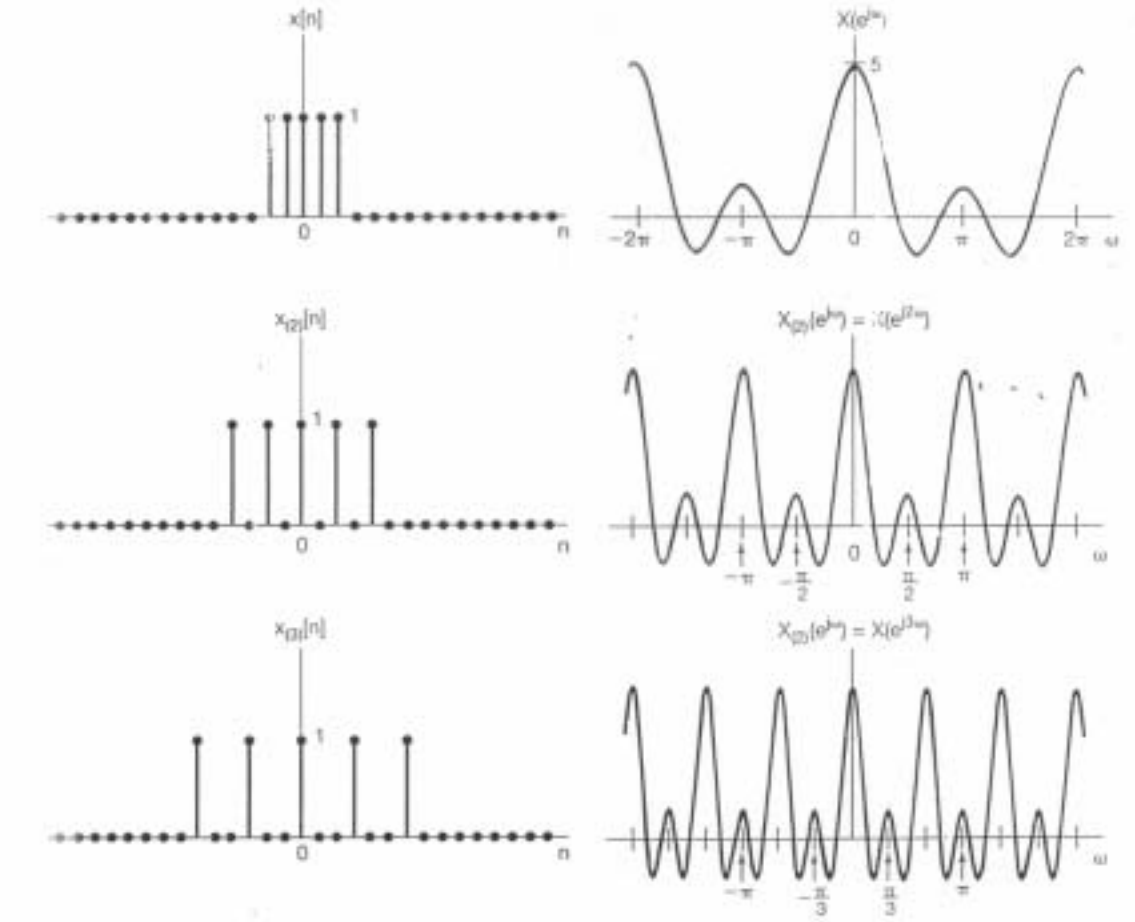
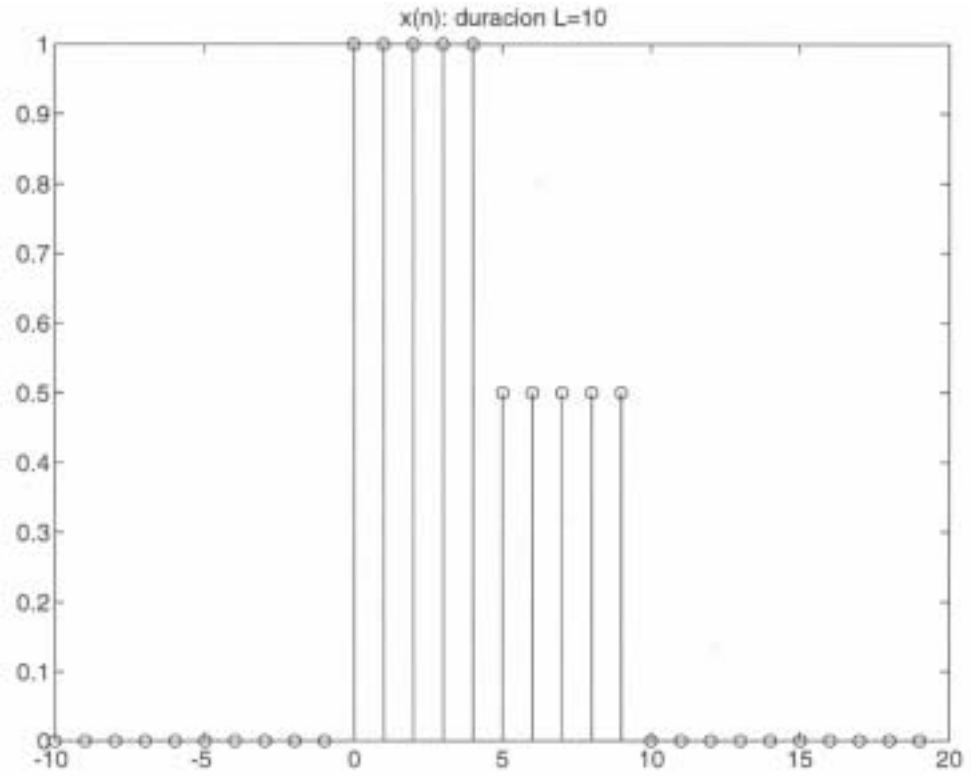
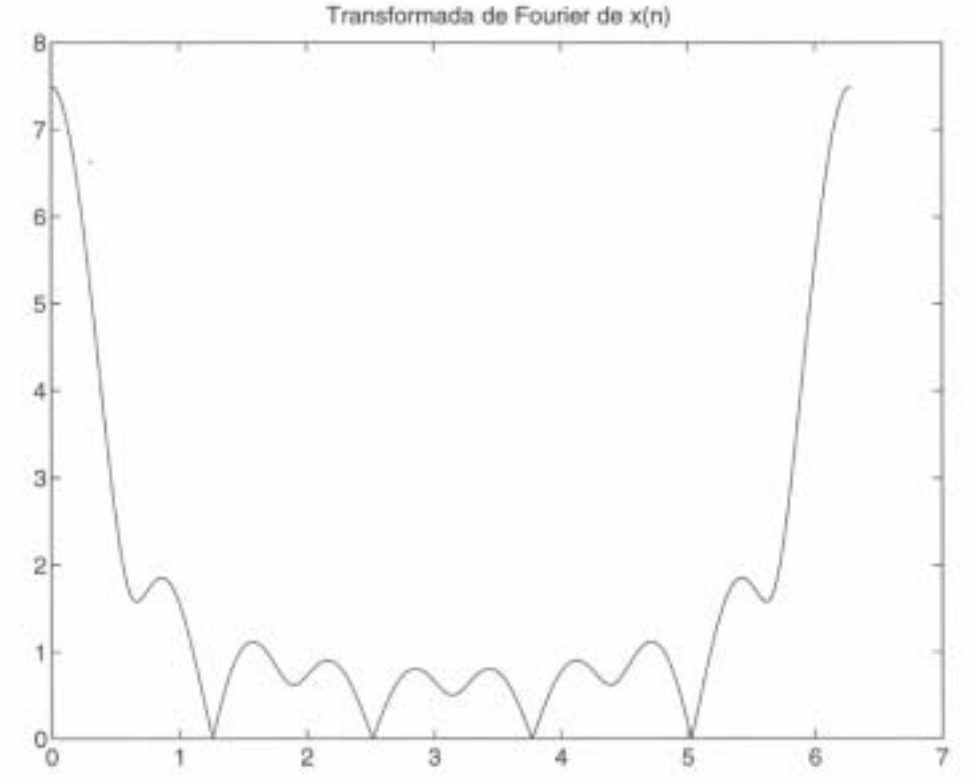
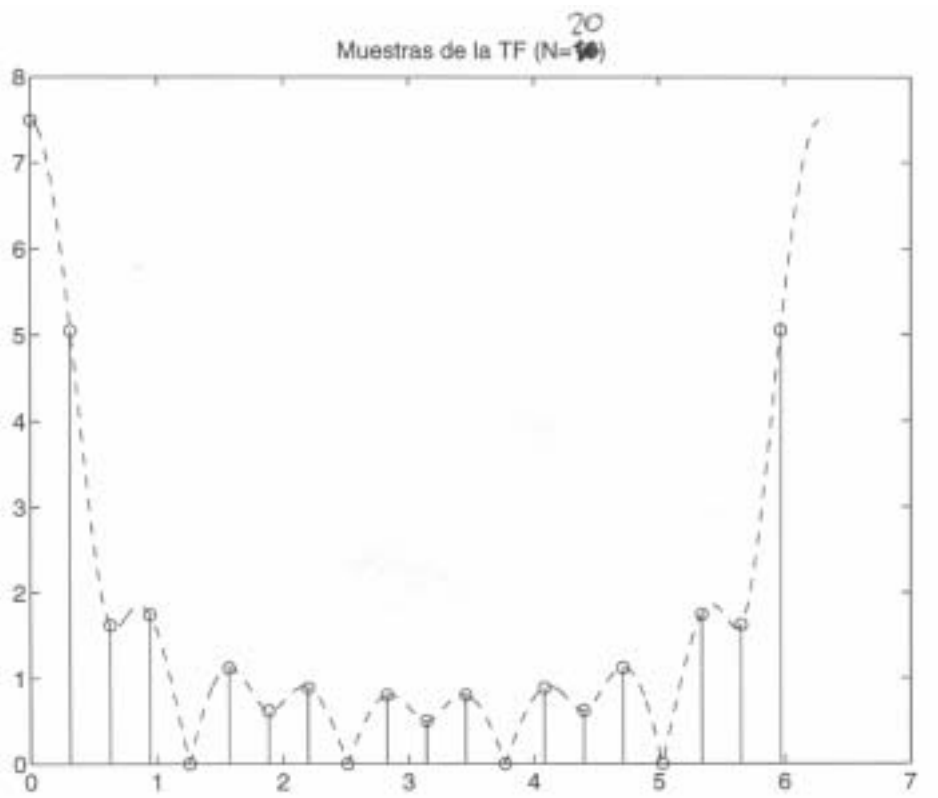
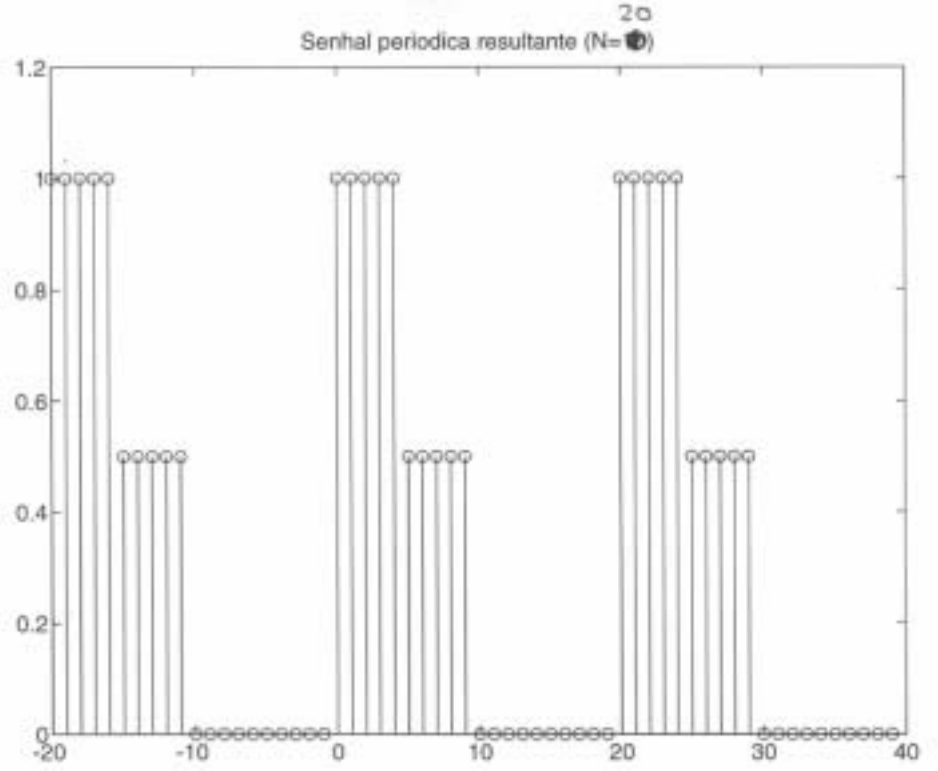


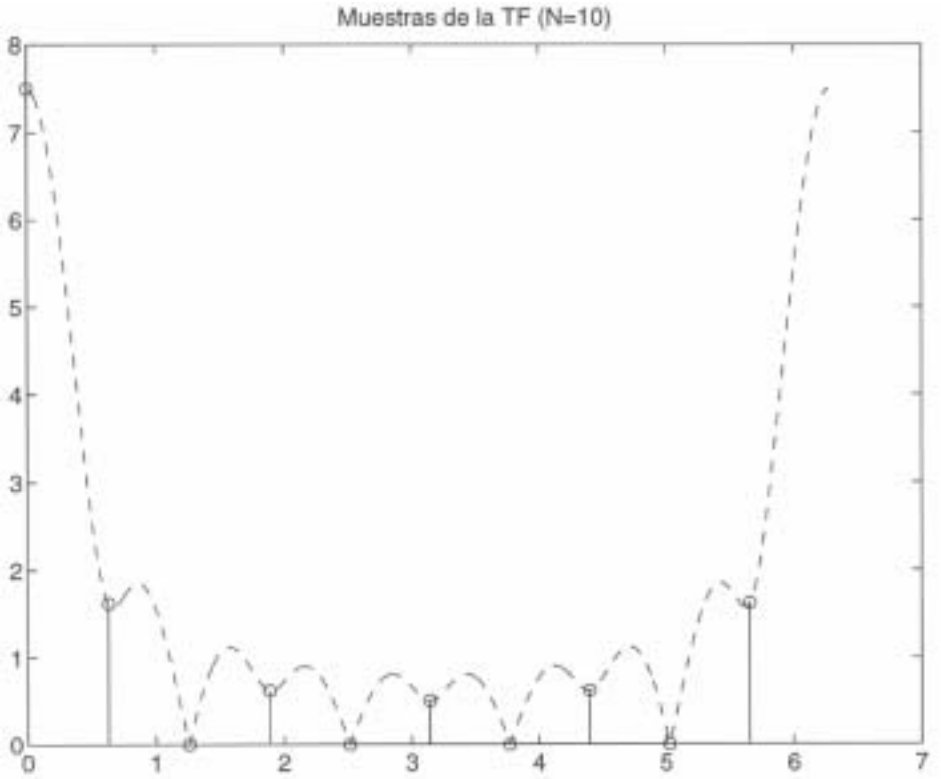
Figure 5.14 Inverse relationship between the time and frequency domains: As k increases, $x_{(k)}[n]$ spreads out while its transform is compressed.

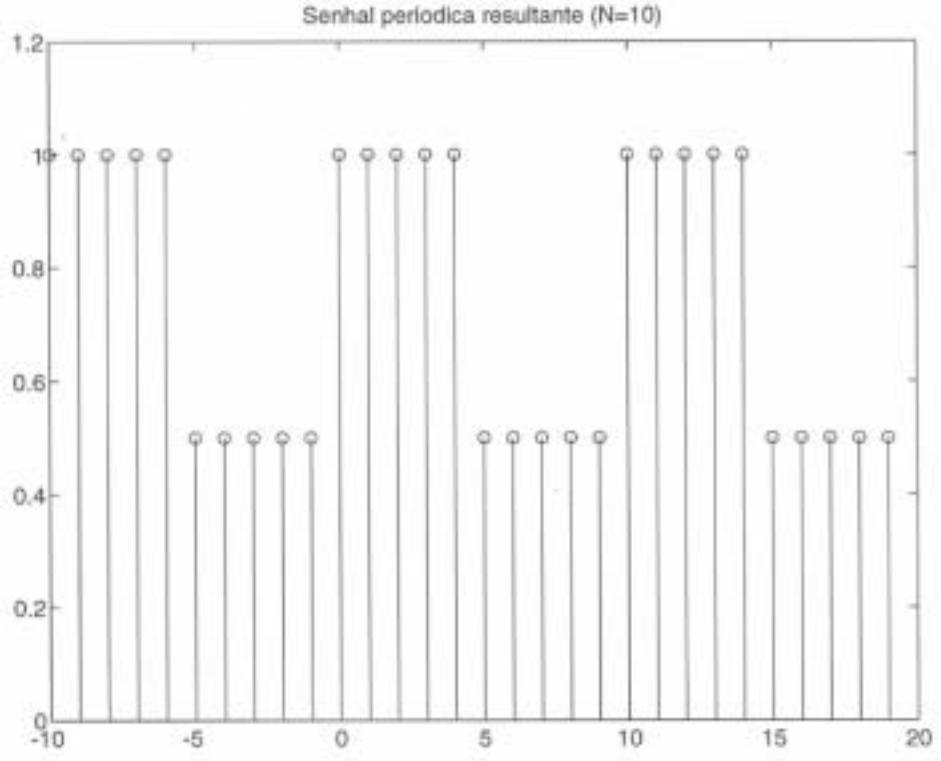

x(n): duracion L=10
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-10
-5
0
5
10
15
20

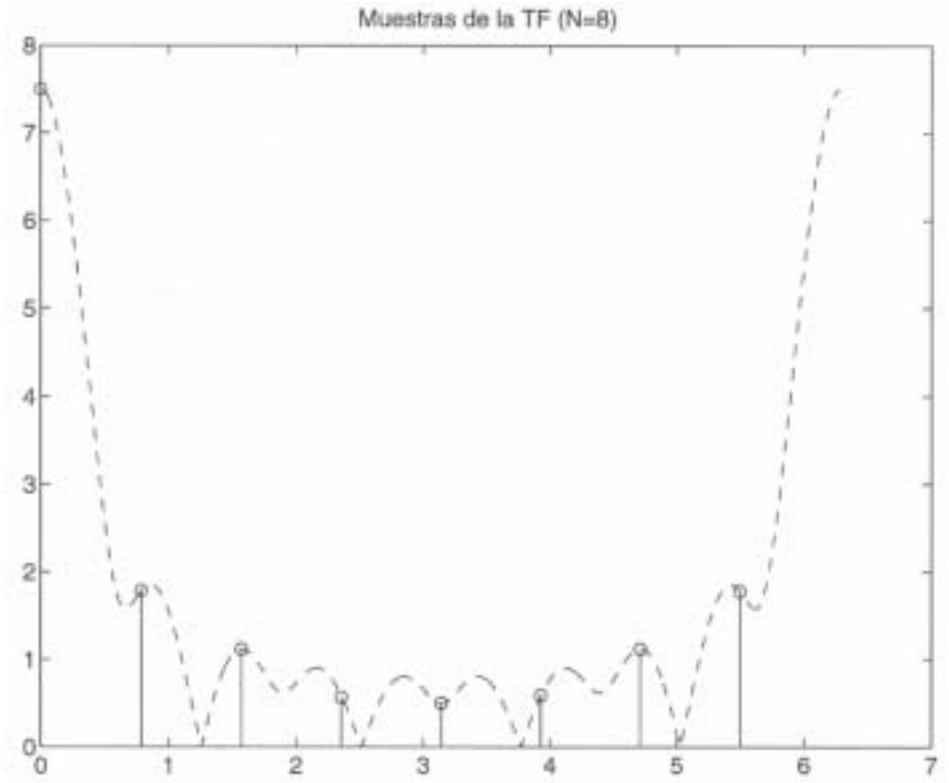

Transformada de Fourier de x(n)
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7

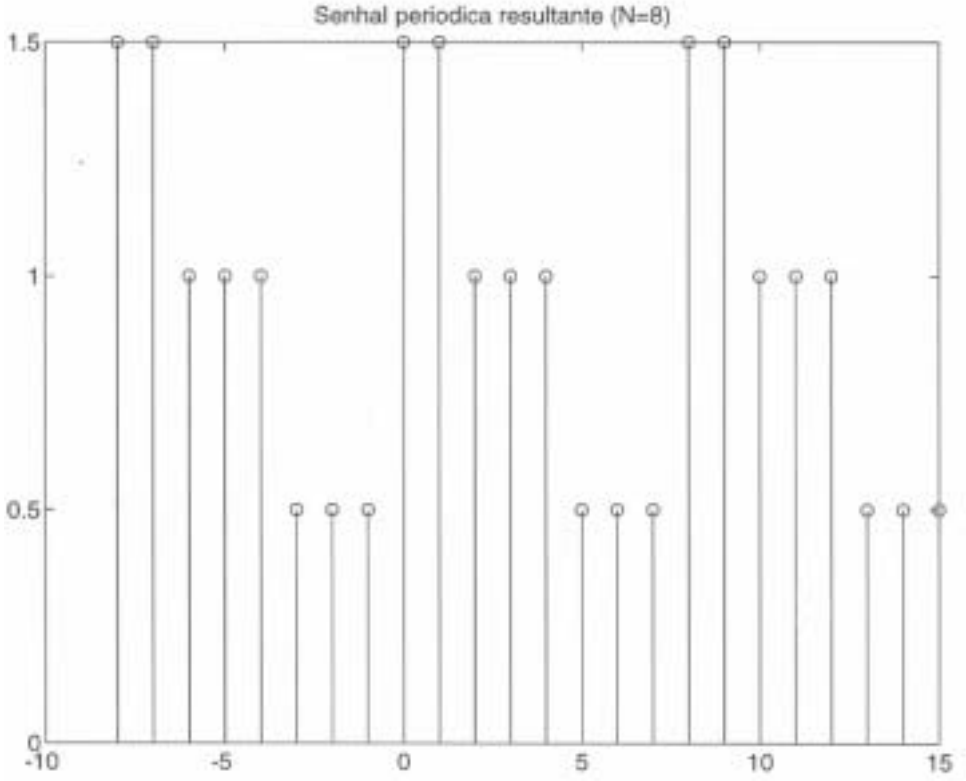

Muestras de la TF (N=20)
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7


Senhal periodica resultante (N=20)
1.2
1
0.8
0.6
0.4
0.2
0
-20
-10
0
10
20
30
40


Muestras de la TF (N=10)
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7


Senhal periodica resultante (N=10)
1.2
1
0.8
0.6
0.4
0.2
0
-10
-5
0
5
10
15
20


Muestras de la TF (N=8)
8
7
6
5
4
3
2
1
0
0
1
2
3
4
5
6
7


Senhal periodica resultante (N=8)
1.5
1
0.5
0
-10
-5
0
5
10
15

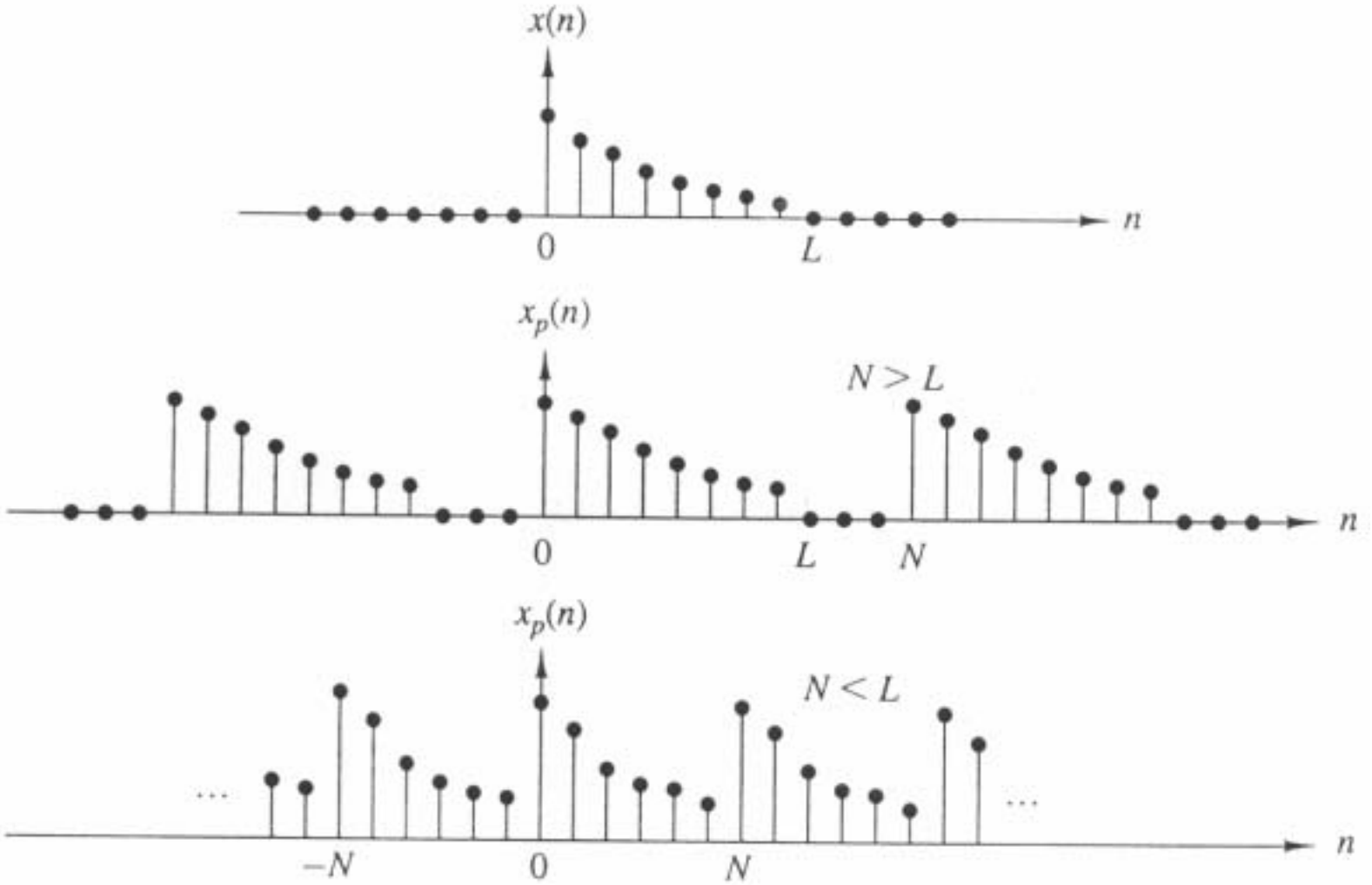


Figure 5.2 Aperiodic sequence $x(n)$ of length L and its periodic extension for $N \geq L$ (no aliasing) and $N < L$ (aliasing).