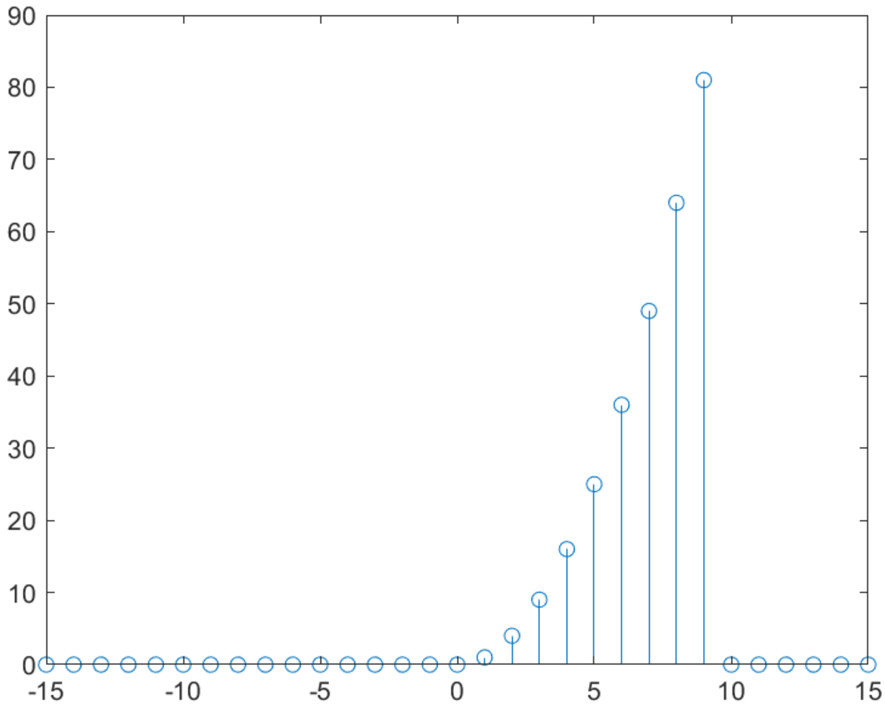
PRÁCTICA 1

1.4.1 Enunciados

1. **Representar las siguientes secuencias en el intervalo indicado. Cuando una secuencia tome valores complejos, represente por separado la parte real y la parte imaginaria y también el módulo y la fase.**

1.1. $x_1[n] = n^2\,[\mathrm{u}[n] - \mathrm{u}[n - n_1]]$ $\qquad -N_1 \leq n \leq N_1$

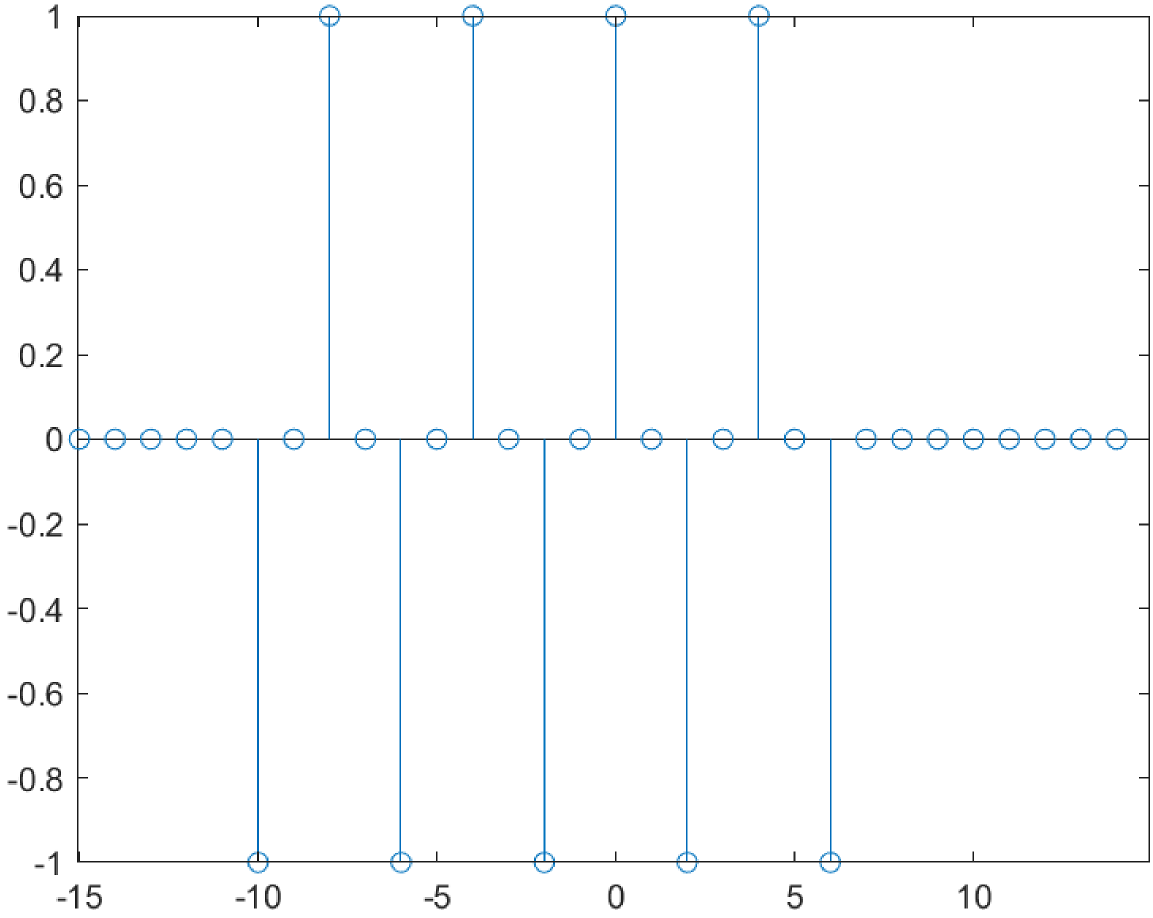
```
n=-15:15;

u=[zeros(1,15) ones(1,15+1)];

u10=[zeros(1,15+10) ones(1,(15-10+1))];

x1=(n.^2).*(u-u10);

stem(n,x1);
```



1.2. $x_2[n] = \cos(\pi n/2)\,[\mathrm{u}[n + n_3] - \mathrm{u}[n - n_2]]$ $\qquad -N_1 \leq n \leq N_1$

```
n= -15:15;
```

```
u11=[zeros(1,15-11) ones(1,15+11+1)];
u8=[zeros(1,15+8) ones(1,(15-8+1))];
x2 = cos((pi*n)/2).*(u11-u8);

stem(n,x2);
```

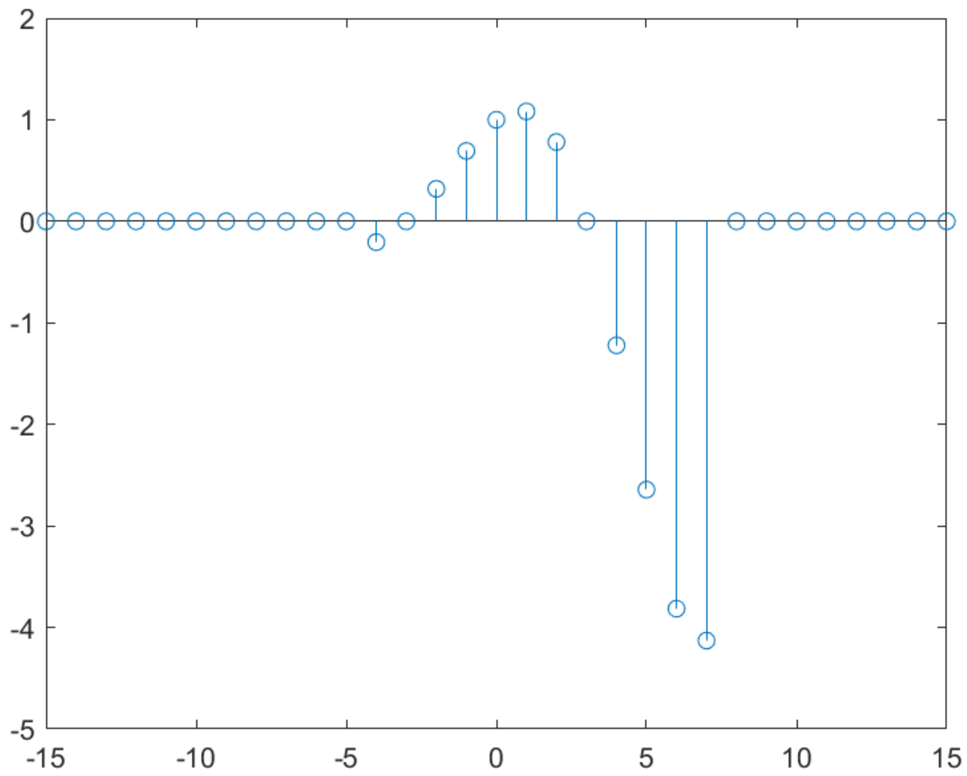


1.3. $x_3[n] = z_0^{\,n}\,[\mathbf{u}[n + n_4] \cdot \mathbf{u}[-n + n_5]]$ $\qquad -N_1 \le n \le N_1$

```
n = -15:15;
```

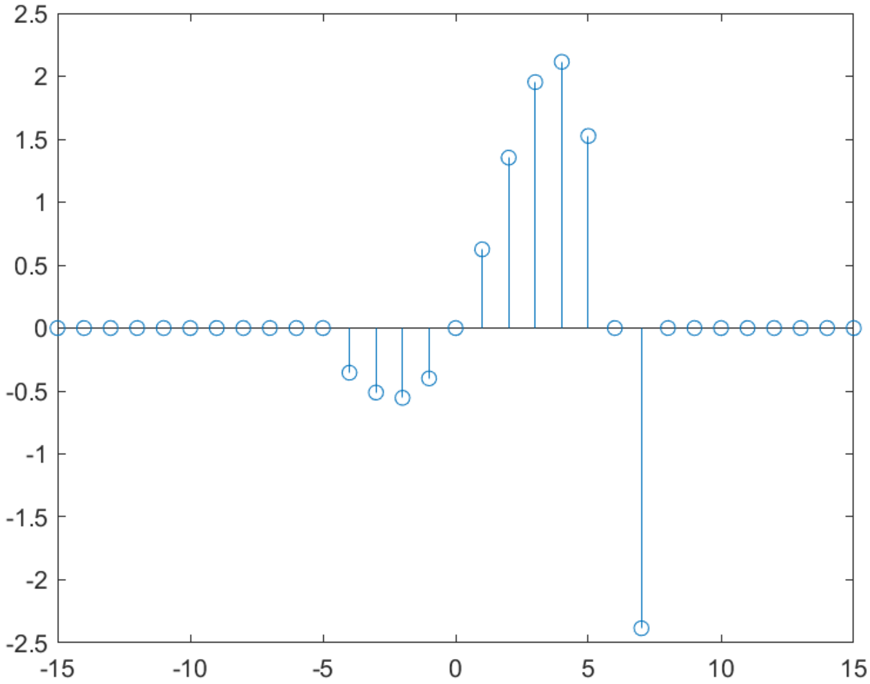
```
u4=[zeros(1,15-4) ones(1,15+4+1)];
u8=[ones(1,15+8) zeros(1,15-8+1)];

z0=(5/4)*exp(1i.*pi/6);

x3=(z0.^n).*(u4.*u8);


stem(n,real(x3));
```

PARTE REAL



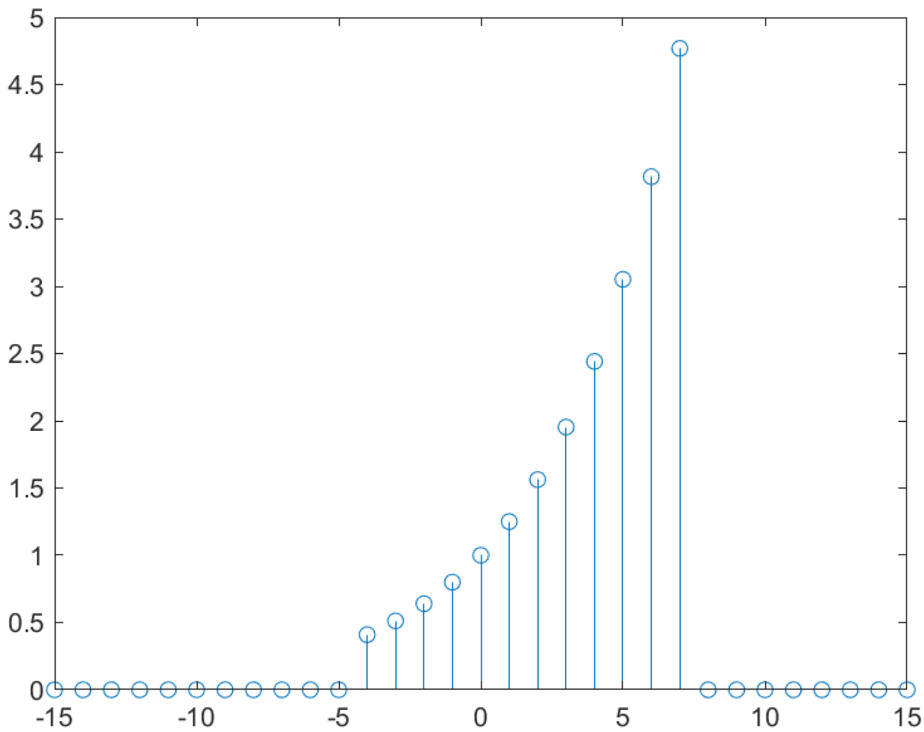
PARTE IMAGINARIA

```
stem(n, imag(x3));
```



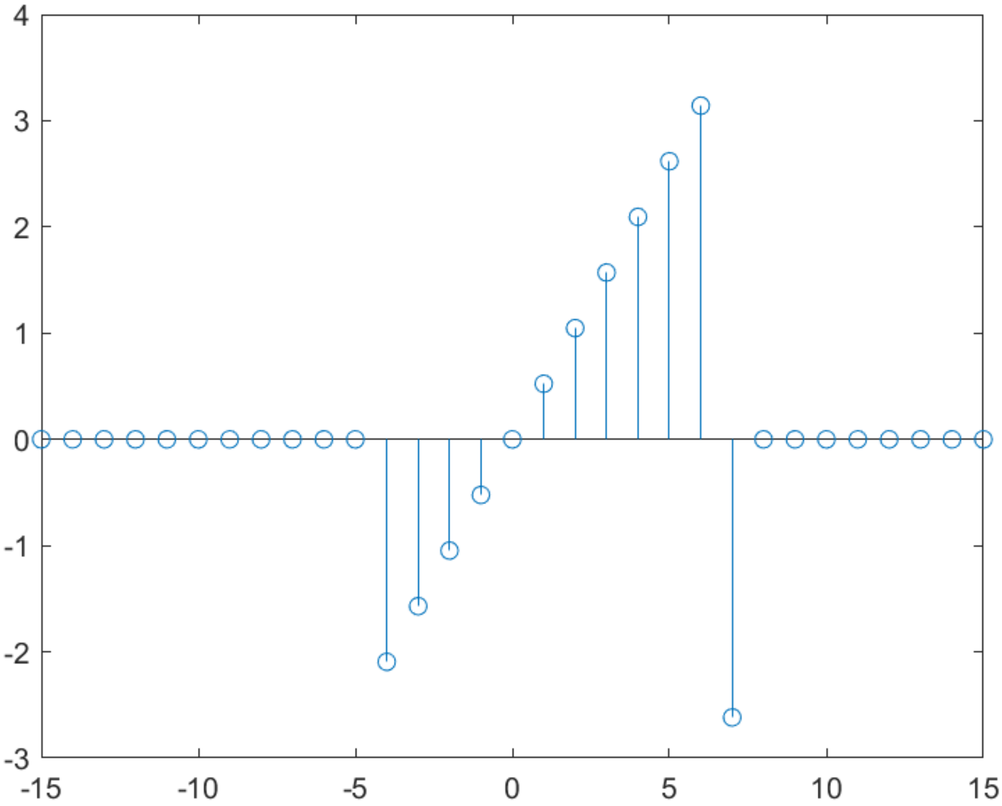
MÓDULO

```
stem(n,abs(x3));
```



FASE

```
stem(n,angle(x3));
```

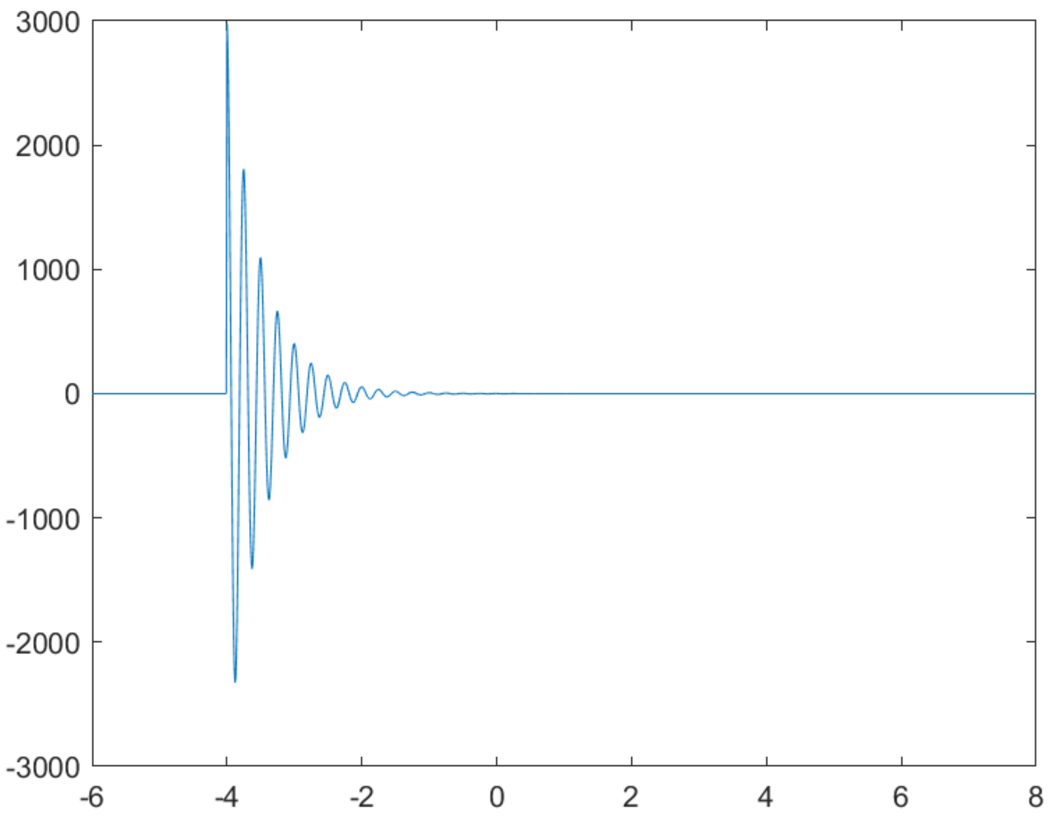


2. **Representar las siguientes señales de tiempo continuo. Es preciso tomar las muestras lo suficientemente juntas de forma que se vean con la claridad suficiente los resultados esperados.**

2.1. $x_1(t) = \mathrm{e}^{-s_0 t}[\mathrm{u}(t + t_2) - \mathrm{u}(t - t_2)]$ $\qquad T_2 \leq t \leq T_3$

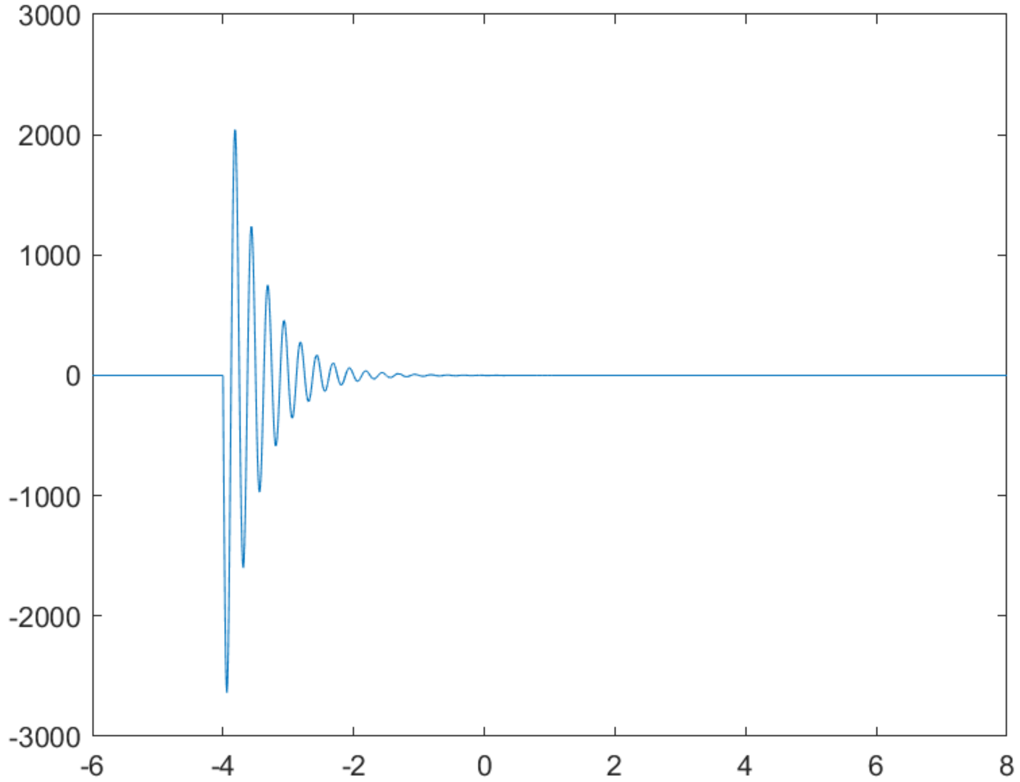
```
t=-6:0.01:8;
s0=2+(8*pi*1i);


u=zeros(size(t));
u(t>=-4 & t<=4)=1;

x=exp(-s0.*t);

x2=u.*x;

plot(t,real(x2));
```

PARTE REAL



PARTE IMAGINARIA

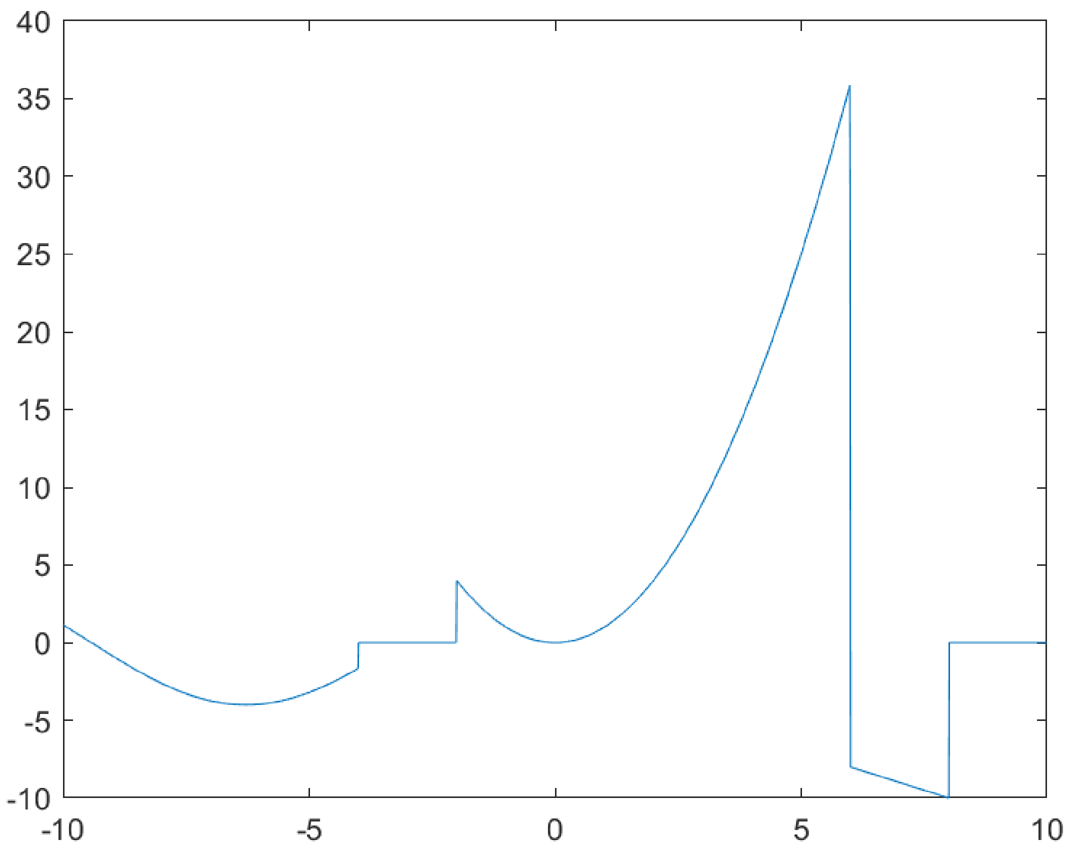
```
plot(t,imag(x2));
```



$$2.2.\ x_2(t) = \begin{cases} 4\cos(x_0 t/4) & t_0 \leq t \leq x_0 \\ t^2 & x_0 \leq t \leq x_1 - x_0 \\ -t + x_0 & x_1 - x_0 \leq t \leq t_1 \\ 0 & \text{resto} \end{cases}$$

$$-T_1 \leq t \leq T_1$$

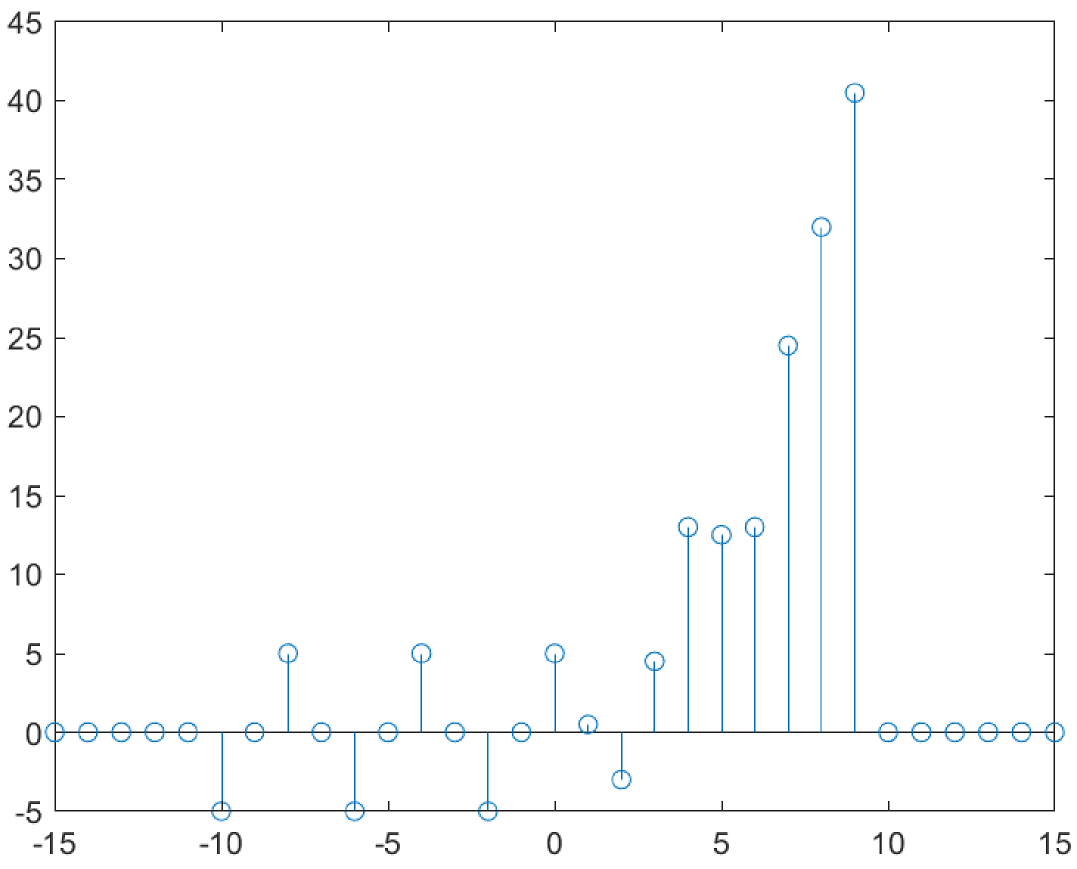
```
t=-10:0.01:10;
x0= -2;
x1=4.*cos(((-2).*t)/4).* ((t<= - 4) & (t <= x0));
x2=(t.^2).*((t >= x0) & (t<= 4 - x0));
x3= (-t+ x0).* ((t >= 4 - x0)  & (t<= 8)) ;
x4=0.*((t>=10) & (t<=8));
x=x1+x2+x3+x4;
plot(t,x);
```



3. **A partir de las secuencias definidas en el ejercicio 1, representar las siguientes secuencias,obtenidas mediante operaciones entre ellas.**

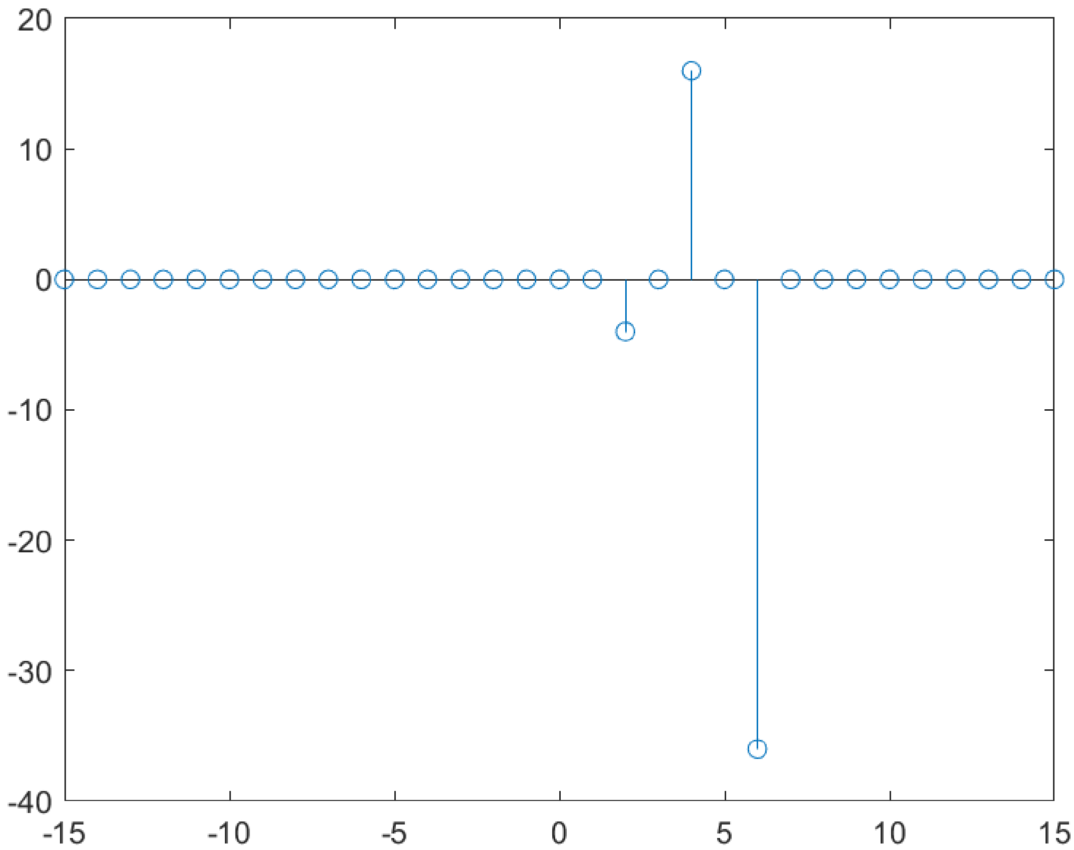
3.1. $x_7[n] = \alpha_1 \cdot x_1[n] + \alpha_2 \cdot x_2[n] \qquad -N_1 \leq n \leq N_1$

```
n=-15:15;

u=[zeros(1,15) ones(1,15+1)];
u10=[zeros(1,15+10) ones(1,(15-10+1))];

u11=[zeros(1,15-11) ones(1,15+11+1)];
u8=[zeros(1,15+8) ones(1,(15-8+1))];


x1=(n.^2).*(u-u10);
x2 = cos((pi*n)/2).*(u11-u8);

x7= 1/2 .* x1 + 5.*x2;

stem(n,x7);
```



3.2. $x_8[n] = x_1[n] \cdot x_2[n] \qquad -N_1 \leq n \leq N_1$

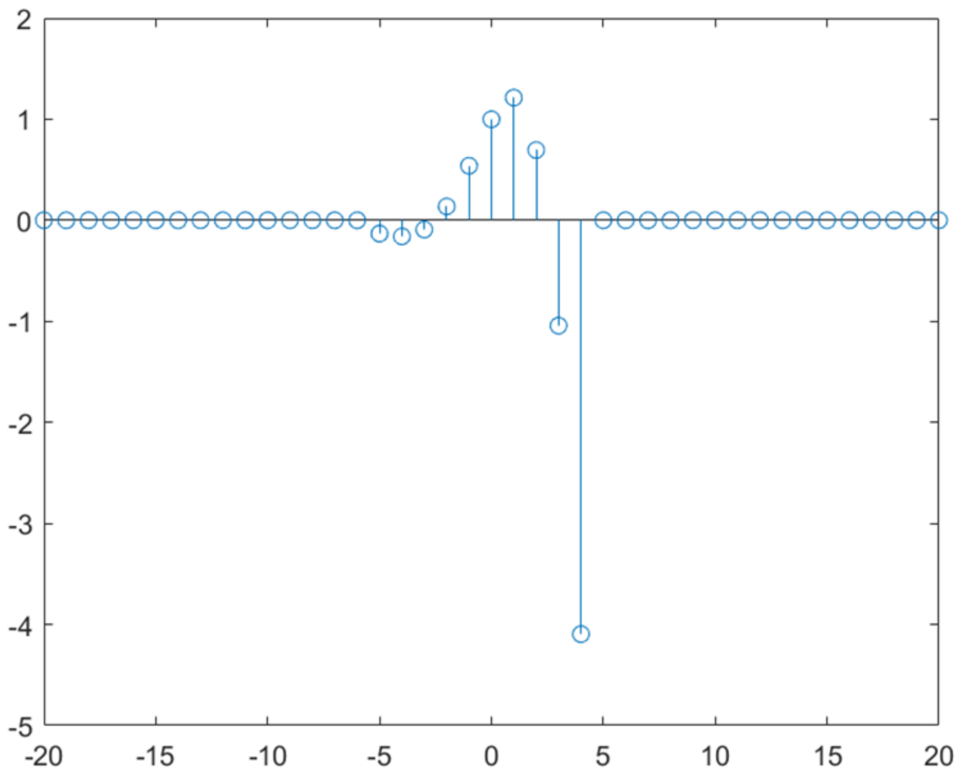
```
n=-15:15;

u=[zeros(1,15) ones(1,15+1)];
u10=[zeros(1,15+10) ones(1,(15-10+1))];

u11=[zeros(1,15-11) ones(1,15+11+1)];
u8=[zeros(1,15+8) ones(1,(15-8+1))];


x1=(n.^2).*(u-u10);
x2 = cos((pi*n)/2).*(u11-u8);

x8=x1.*x2;

stem(n,x8);
```



3.3. $x_9[n] = x_3^*[n] \qquad -N_1 \leq n \leq N_1$

NOTA: Para hacer este apartado puede ser de ayuda la función `conj()`.

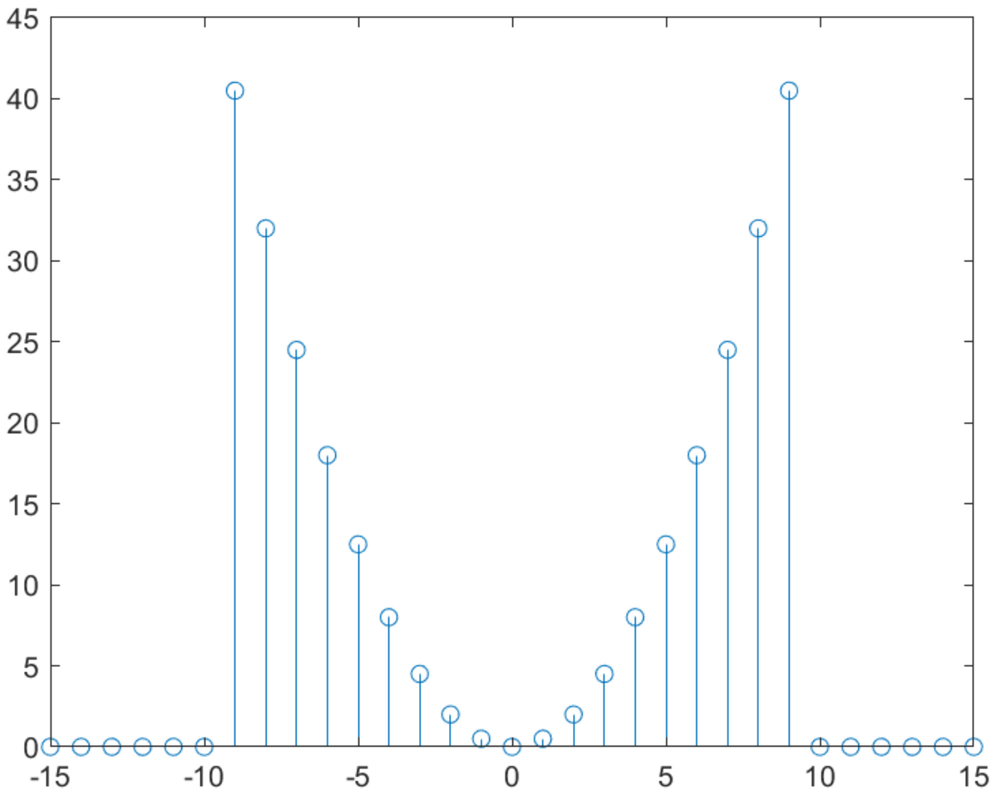
```
n = -15:15;
u4=[zeros(1,15-4) ones(1,15+4+1)];
u8=[ones(1,15+8) zeros(1,15-8+1)];

z0=(5/4)*exp(1i.*pi/6);

x3=(z0.^n).*(u4.*u8);


x9=conj(x3);

stem(n,x9);
```



4. Descomponer la señal $x_1[n]$ del ejercicio 1 en sus partes par e impar. Representar gráficamente las señales resultantes.

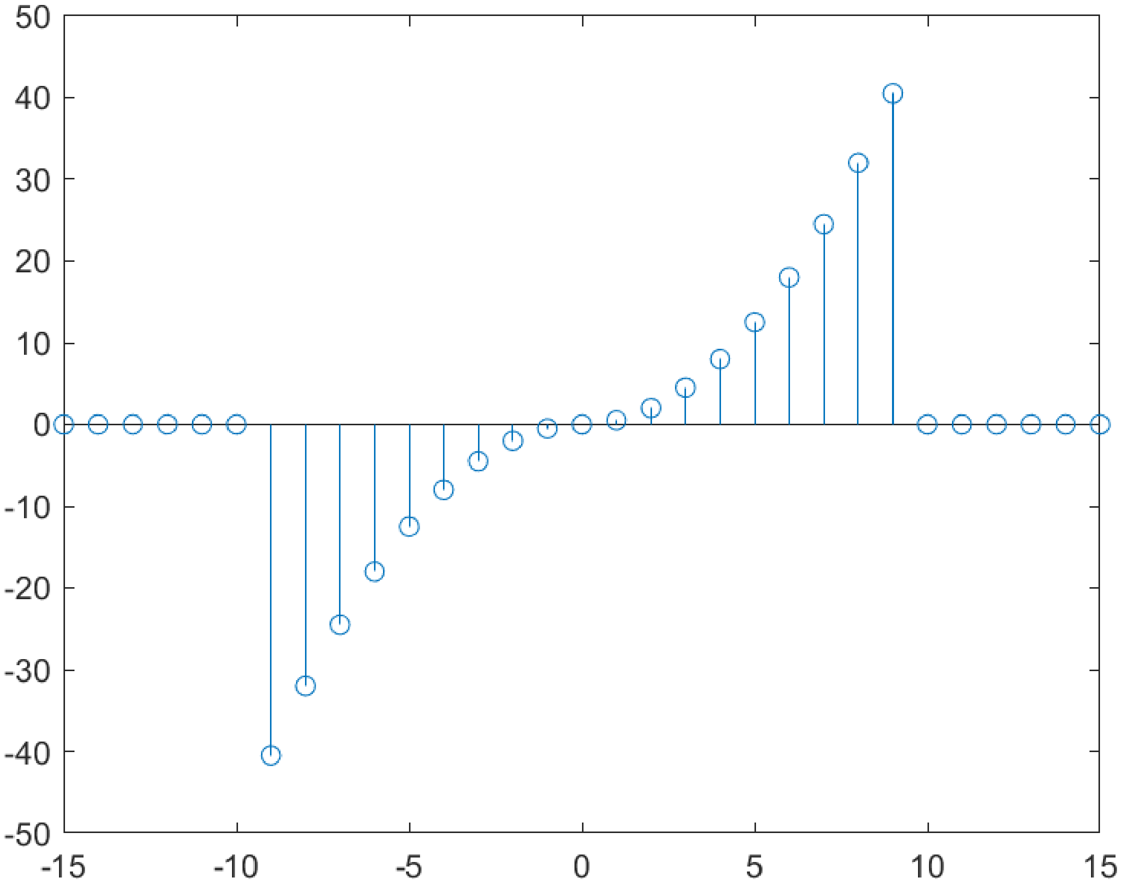
```
n=-15:15;
u=[zeros(1,15) ones(1,15+1)];
u10=[zeros(1,15+10) ones(1,(15-10+1))];
x1=(n.^2).*(u-u10);
xi=fliplr(x1);
x1par=(x1+xi)/2;
stem(n,x1par);
```

SIMETRÍA PAR



SIMETRÍA IMPAR

```
x1impar=(x1-xi)/2;
stem(n,x1impar);
```



1.4.2 Valores de las constantes

$n_1 = 10$; $N_1 = 15$

$n_2 = 8$; $n_3 = 11$

$z_0 = (5/4)e^{j\pi/6}$

$n_4 = 4$

$n_5 = 8$

$x_0 = -2$, $x_1 = 4$, $t_0 = -4$, $t_1 = 8$; $T_1 = 10$

$s_0 = 2 + 8\pi \cdot j$, $t_2 = 4$; $T_2 = -6$; $T_3 = 8$

$\alpha_1 = 1/2$,

$\alpha_2 = 5$