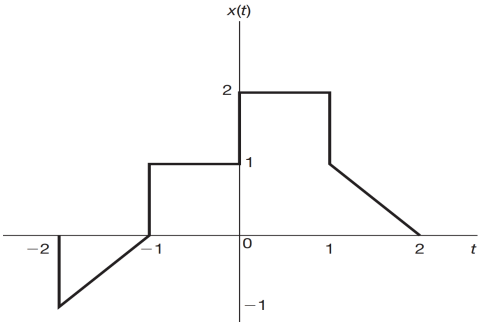
Laboratório de Transformação na Variável Independente



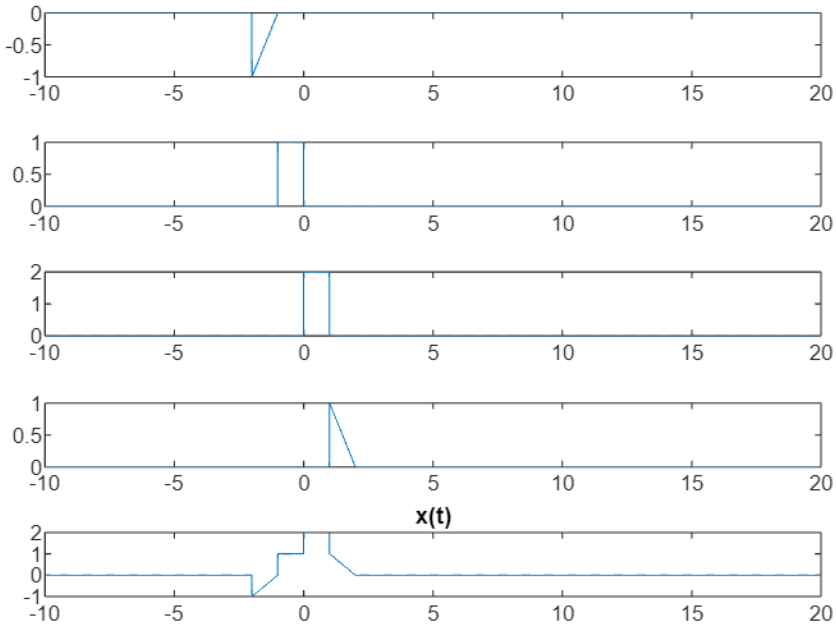
a) $x(t-1)$

b) $x(2-t)$

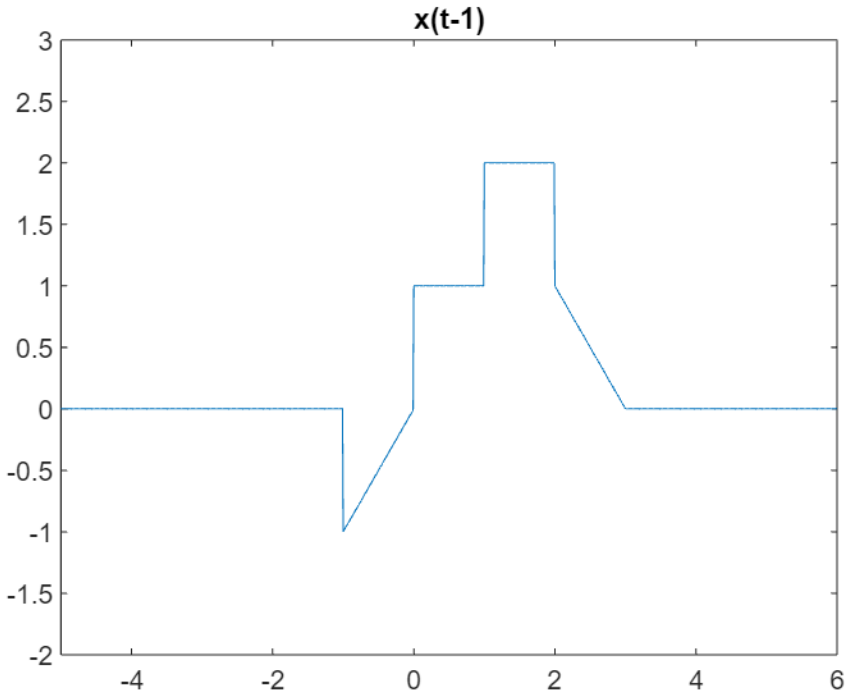
c) $x(2t+1)$

d) $x\left(4-\frac{t}{2}\right)$

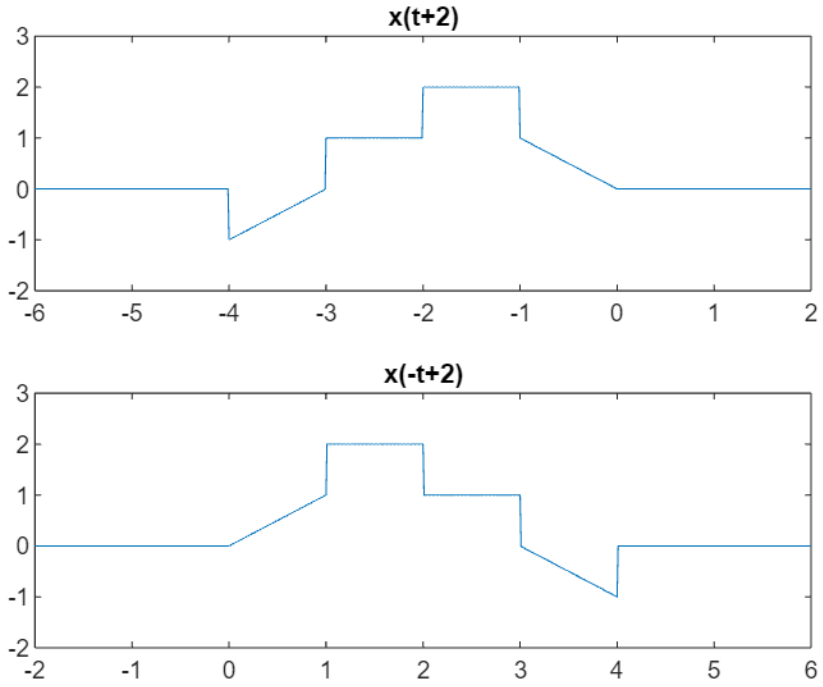
```
u=@(t) t>=0;
x1=@(t) (t+1).*(u(t+2)-u(t+1));
x2=@(t) (u(t+1)-u(t));
x3=@(t) 2*(u(t)-u(t-1));
x4=@(t) (-t+2).*(u(t-1)-u(t-2));
x=@(t) x1(t)+x2(t)+x3(t)+x4(t);
t=-10:0.01:20;
figure(1)
subplot(5,1,1)
plot(t, x1(t))
subplot(5,1,2)
plot(t, x2(t))
subplot(5,1,3)
plot(t, x3(t))
subplot(5,1,4)
plot(t, x4(t))
subplot(5,1,5)
plot(t, x(t))
title('x(t)');
```



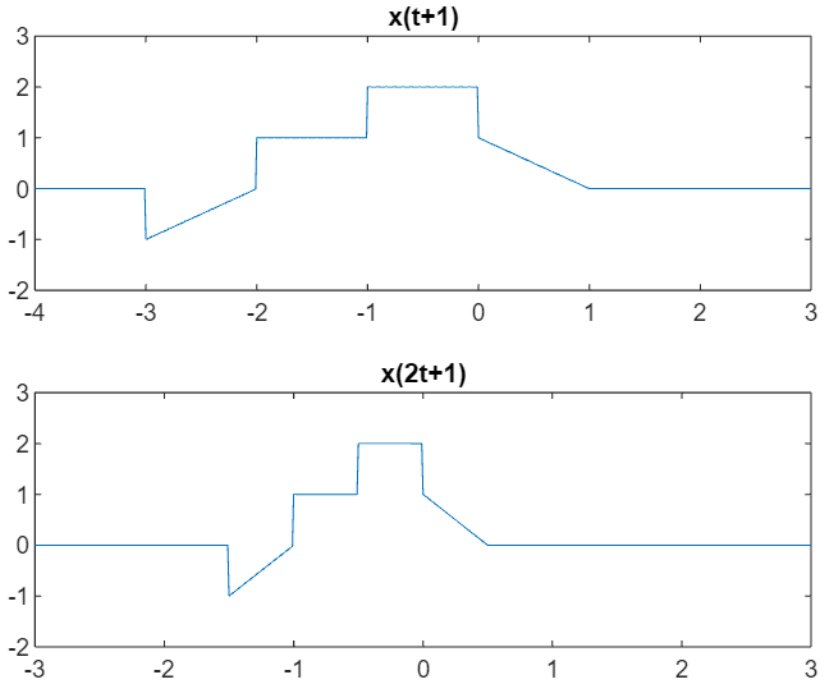

```
xa=@(t) x(t-1);
figure(2)
plot(t, xa(t));
title('x(t-1)');
axis([-5 6 -2 3])
```



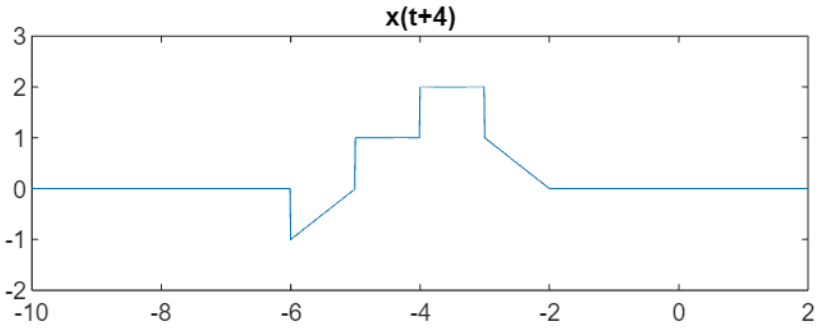
```
xb_aux=@(t) x(t+2);
xb=@(t) xb_aux(-t);
figure(3)
subplot(2,1,1)
plot(t, xb_aux(t));
title('x(t+2)');
axis([-6 2 -2 3])
subplot(2,1,2)
plot(t, xb(t));
title('x(-t+2)');
axis([-2 6 -2 3])
```

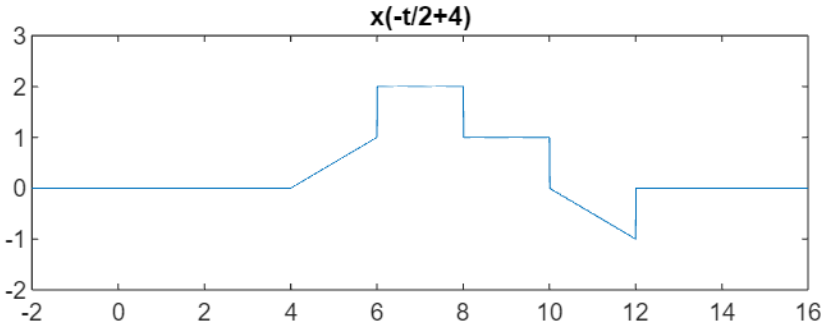



```
xc_aux=@(t) x(t+1);
xc=@(t) xc_aux(2*t);
figure(4)
subplot(2,1,1)
plot(t, xc_aux(t))
title('x(t+1)');
axis([-4 3 -2 3])
subplot(2,1,2)
plot(t, xc(t))
title('x(2t+1)');
axis([-3 3 -2 3])
```

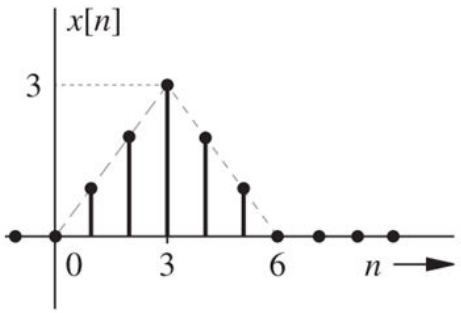



```
xd_aux=@(t) x(t+4);
xd=@(t) xd_aux(-t/2);
figure(5)
subplot(2,1,1)
plot(t, xd_aux(t))
title('x(t+4)');
axis([-10 2 -2 3])
subplot(2,1,2)
plot(t, xd(t))
title('x(-t/2+4)');
axis([-2 16 -2 3])
```





Considere o sinal a seguir:



Faça as seguintes transformações na variável independente:

a) $x[-n]$

b) $x[n+6]$

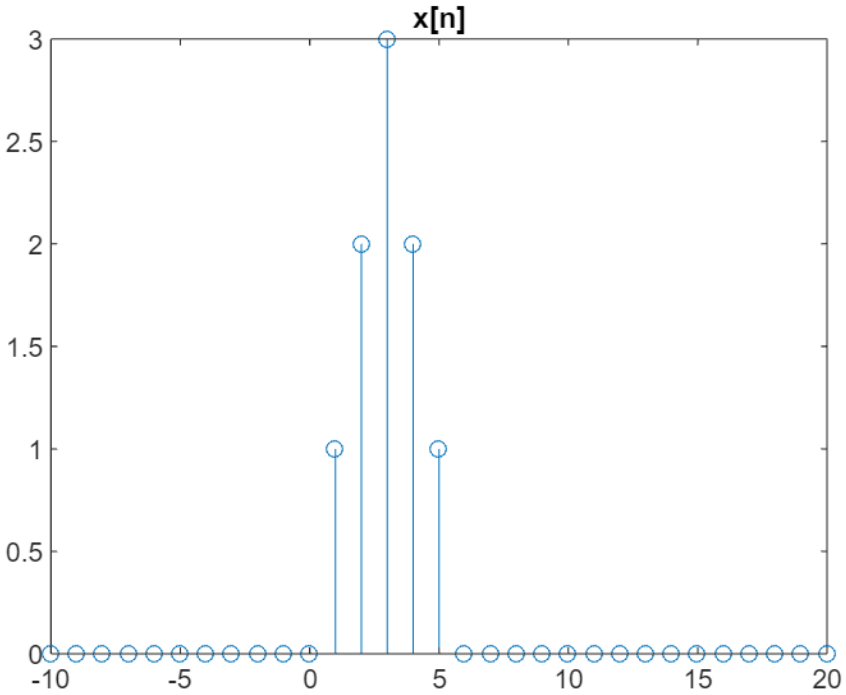
c) $x[n-6]$

d) $x[3n]$

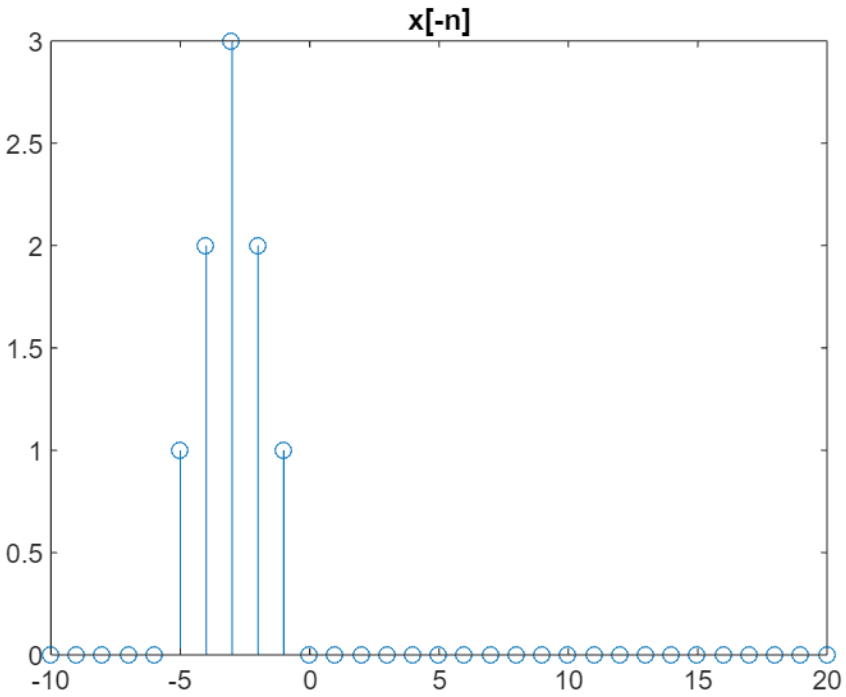
e) $x[n/3]$

f) $x[3-n]$

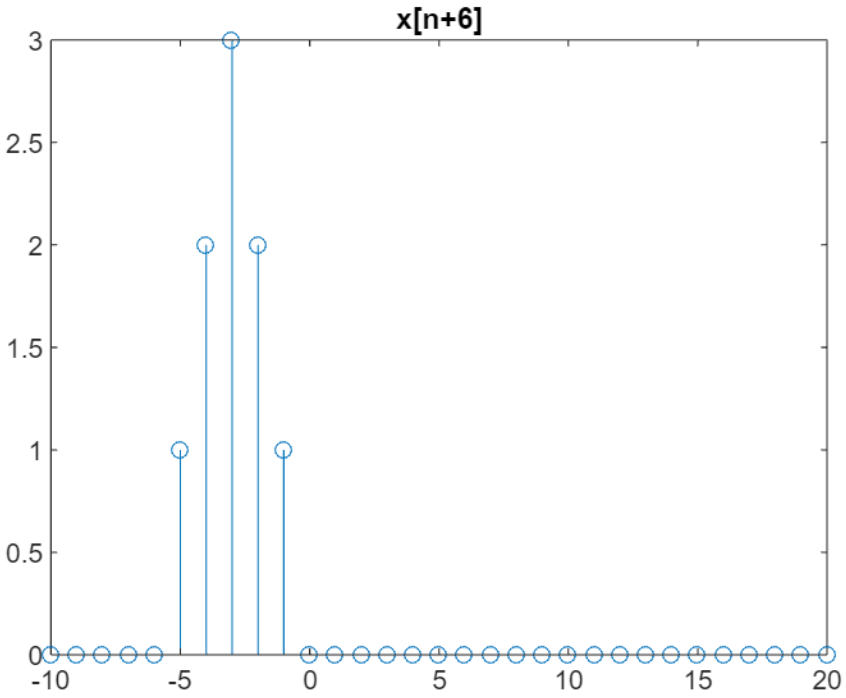
```
imp=@(n) (n==0);
x=@(n) imp(n-1)+2*imp(n-2)+3*imp(n-3)+2*imp(n-4)+imp(n-5);
n=-10:20;
figure(6)
stem(n,x(n))
title('x[n]');
```



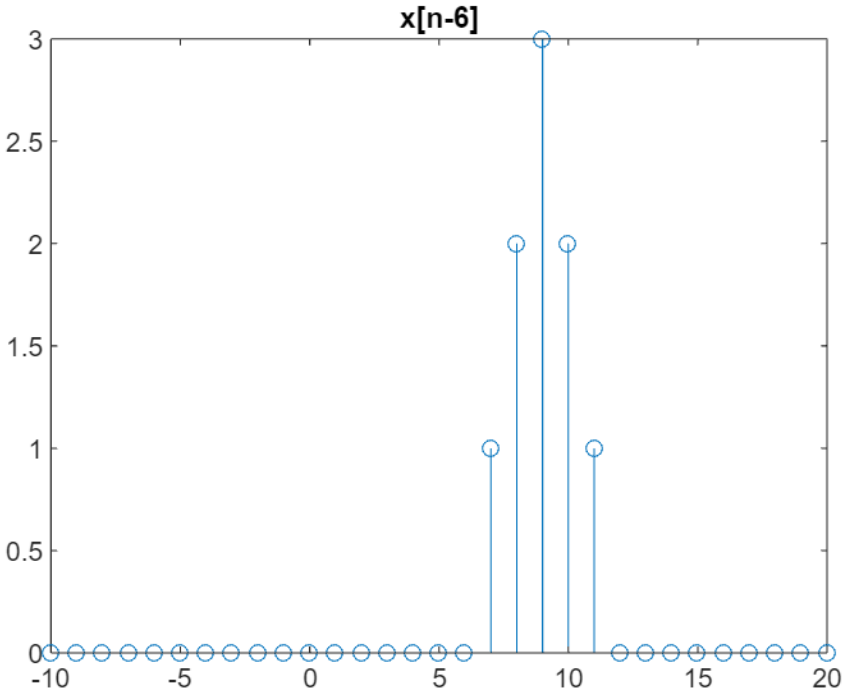

```
figure(7)
stem(n,x(-n))
title('x[-n]');
```



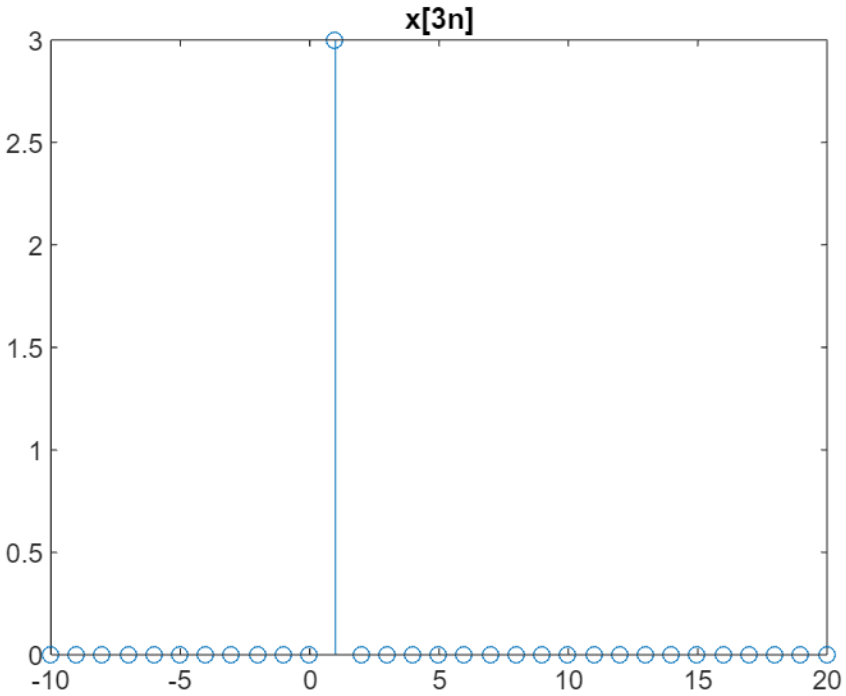

```
figure(8)
stem(n,x(n+6))
title('x[n+6]');
```



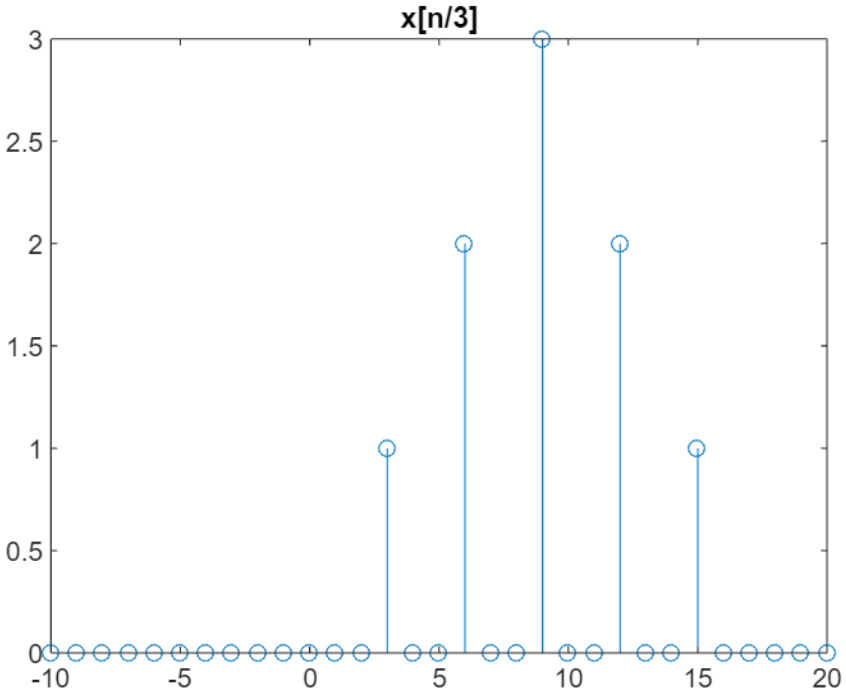

```
figure(9)
stem(n,x(n-6))
title('x[n-6]');
```



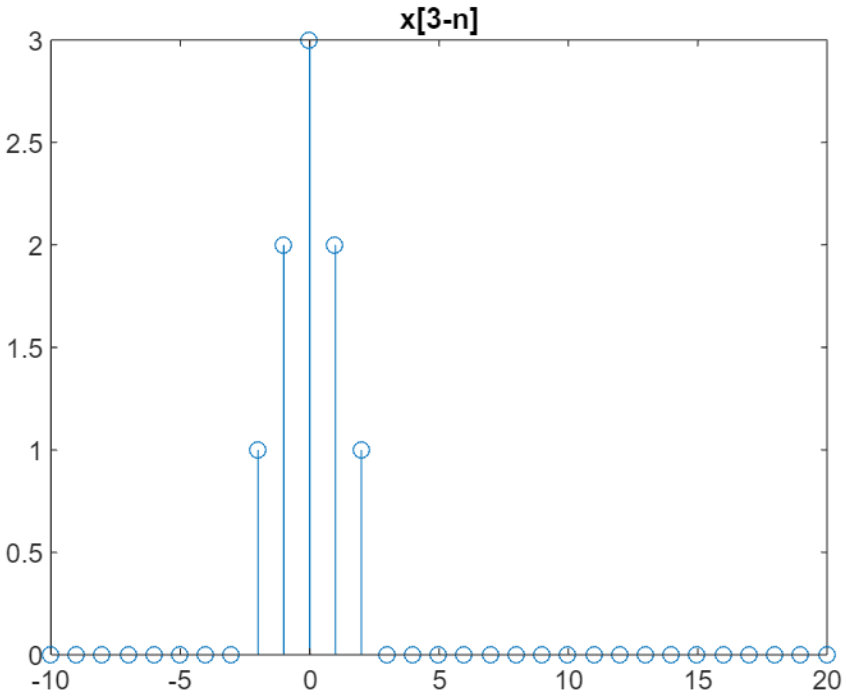

```
figure(10)
stem(n,x(3*n))
title('x[3n]');
```



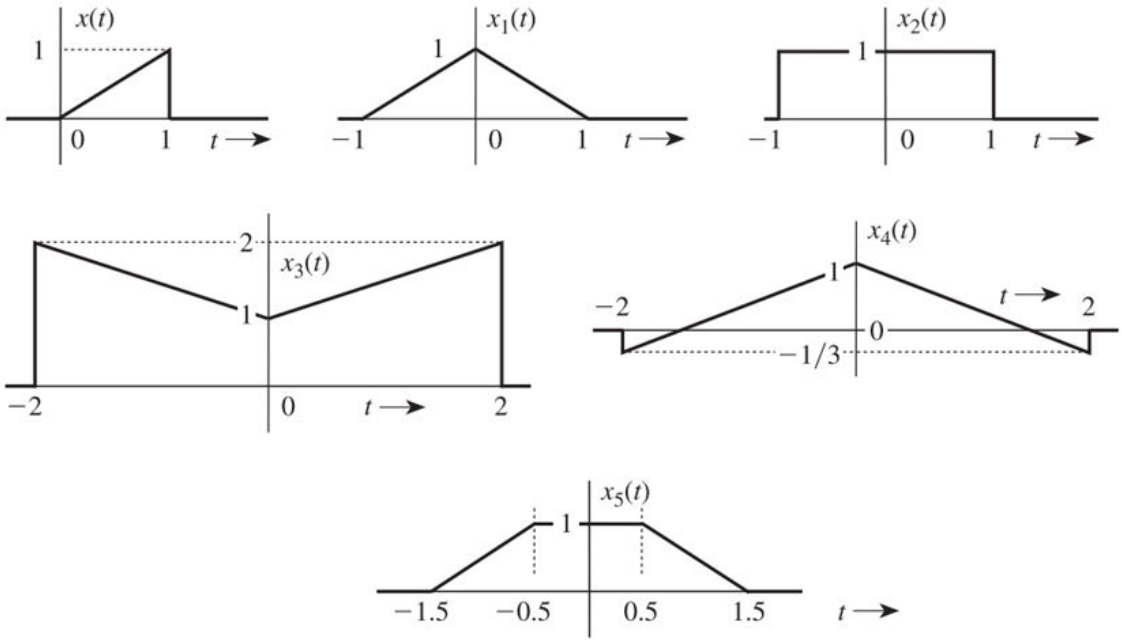

```
figure(11)
stem(n,x(n/3))
title('x[n/3]');
```



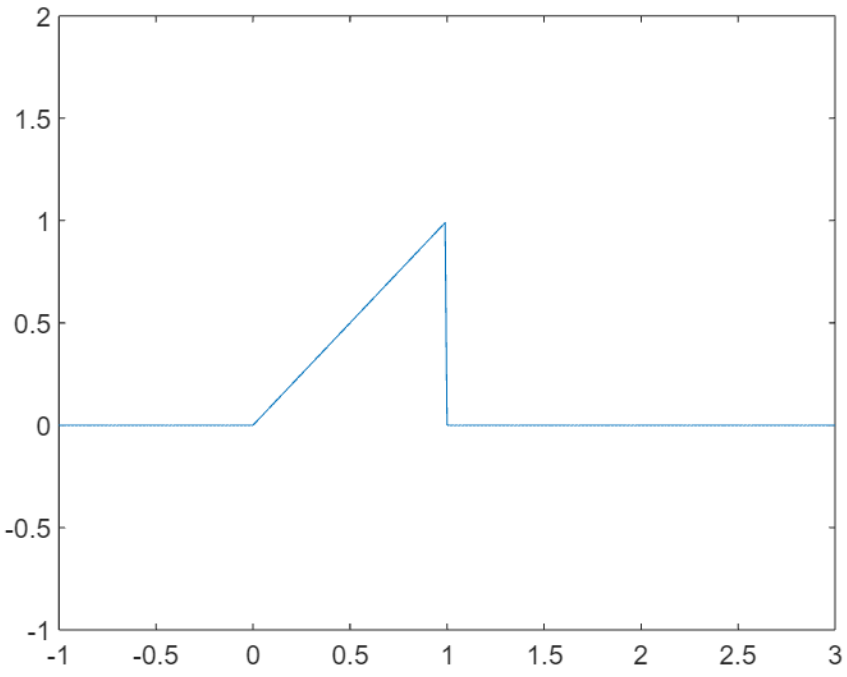

```
figure(12)
stem(n,x(3-n))
title('x[3-n]');
```



Na Figura a seguir, expresse os sinais e em termos do sinal $x(t)$ e suas versões deslocadas no tempo, escalonadas no tempo ou revertidas no tempo.

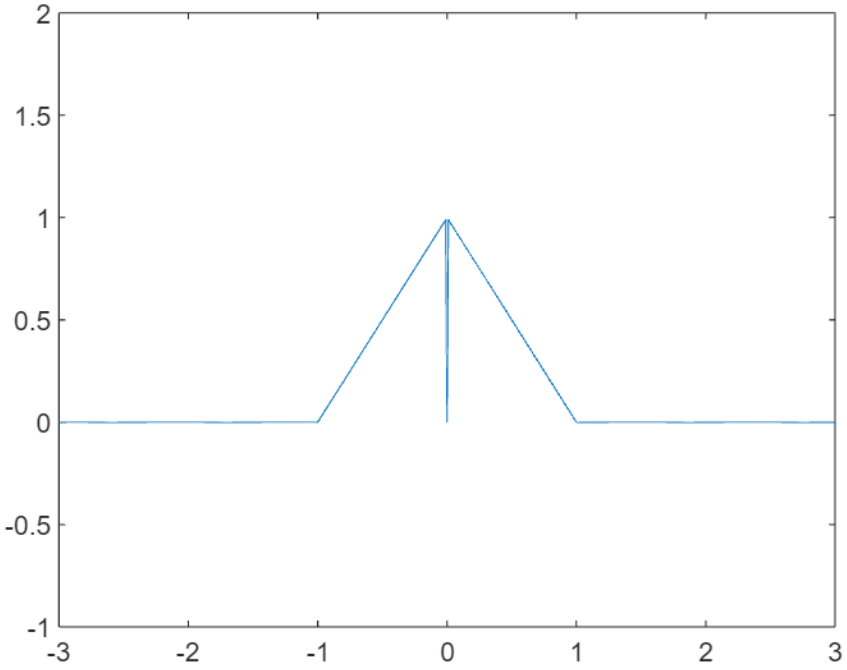



```
x=@(t) t.*(u(t)-u(t-1));
figure(13)
plot(t,x(t))
axis([-1 3 -1 2]);
```

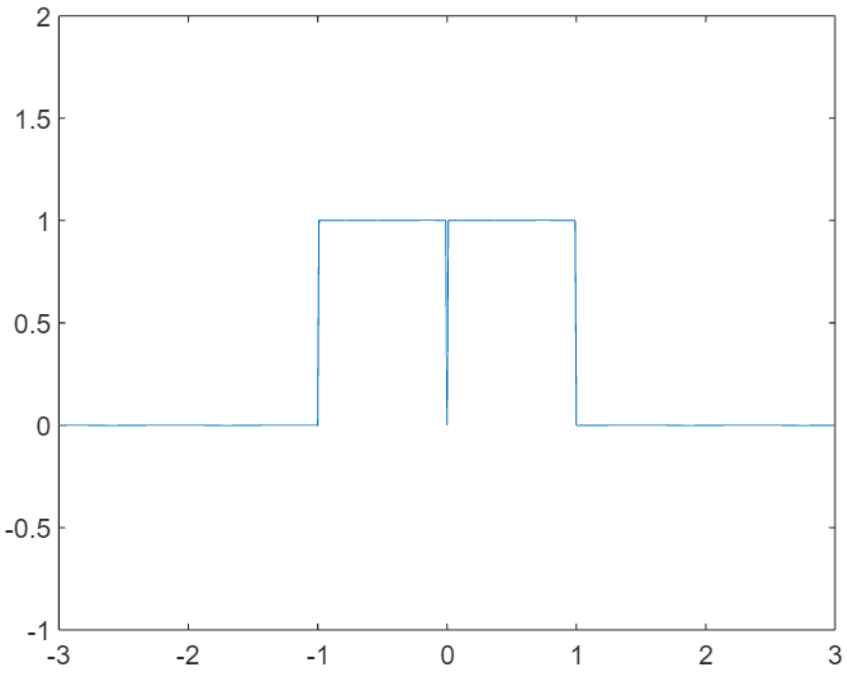



```
x1=@(t) x(t+1)+x(-t+1);
```

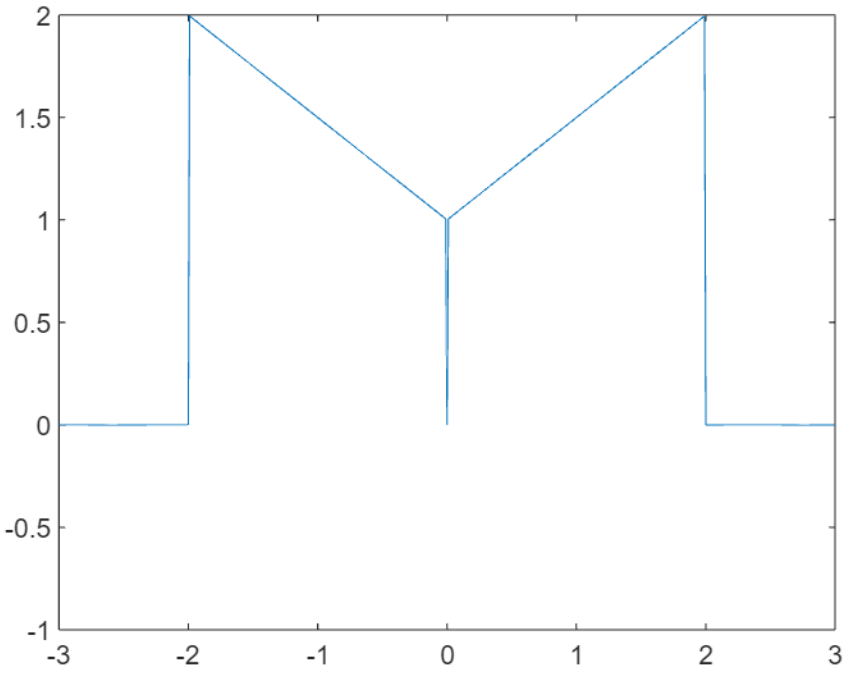
```
figure(14)
plot(t,x1(t))
axis([-3 3 -1 2]);
```




```
x2=@(t) x(t+1)+x(-t+1)+x(t)+x(-t);
figure(15)
plot(t,x2(t))
axis([-3 3 -1 2]);
```

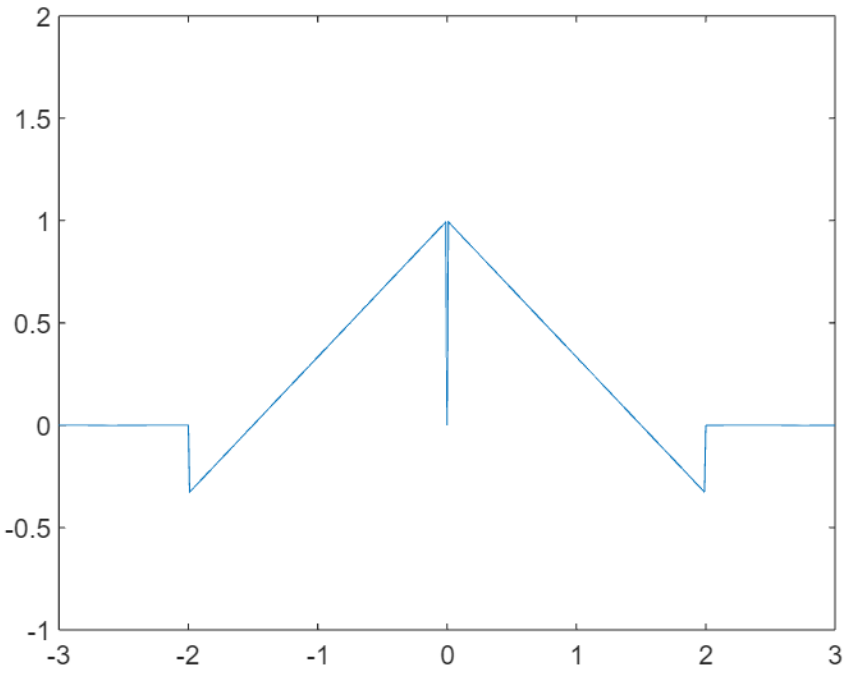



```
x3=@(t) x2(t/2)+x(t/2)+x(-t/2);
figure(16)
plot(t,x3(t))
axis([-3 3 -1 2]);
```

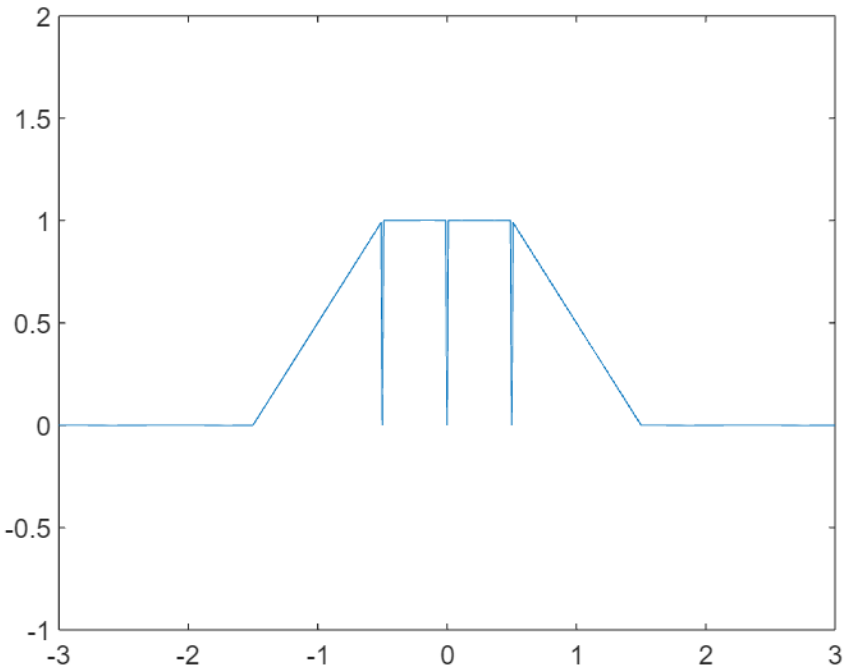



```
x4=@(t) (4/3)*x1(t/2)-(1/3)*x2(t/2);
```

```
figure(17)
plot(t,x4(t))
axis([-3 3 -1 2]);
```

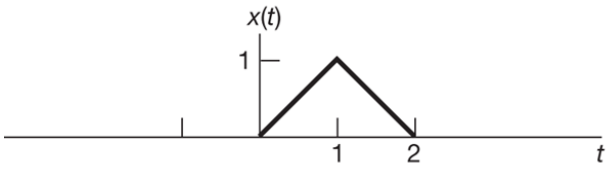



```
x5=@(t) x(t+1.5)+x(-t+1.5)+x2(2*t);
figure(18)
plot(t,x5(t))
axis([-3 3 -1 2]);
```



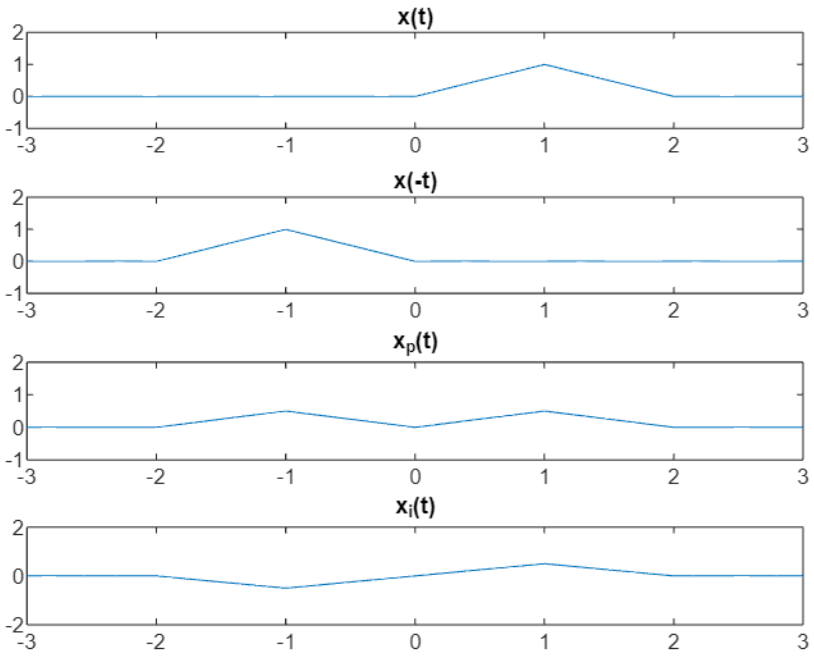
Determine e esboce as partes par e ímpar dos sinais a seguir. Coloque cuidadosamente escala em seus esboços.

a)

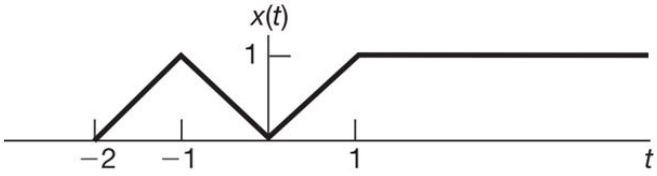



```
x=@(t) t.*(u(t)-u(t-1))+(-t+2).*(u(t-1)-u(t-2));
figure(19)
subplot(4,1,1)
plot(t,x(t))
title('x(t)')
axis([-3 3 -1 2]);
subplot(4,1,2)
plot(t,x(-t))
title('x(-t)')
axis([-3 3 -1 2]);
xp=@(t) (x(t)+x(-t))/2;
subplot(4,1,3)
plot(t,xp(t))
title('x_p(t)')
axis([-3 3 -1 2]);
xi=@(t) (x(t)-x(-t))/2;
```

```
subplot(4,1,4)
plot(t,xi(t))
title('x_i(t)')
axis([-3 3 -2 2]);
```

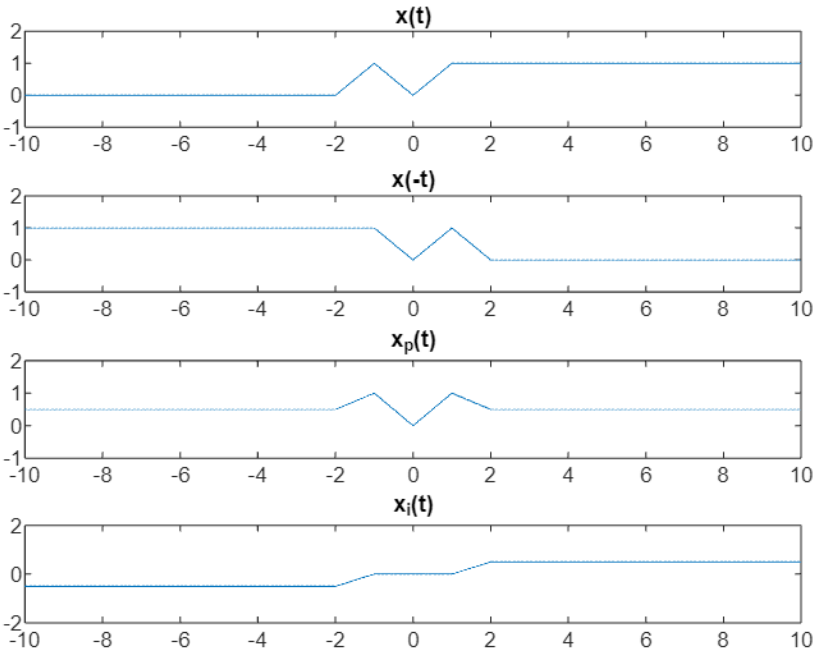


b)

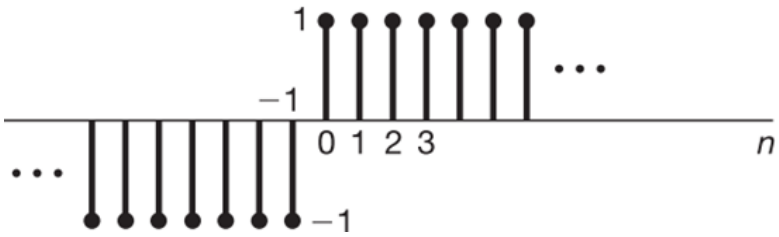



```
xb=@(t) x(-t)+t.*(u(t)-u(t-1))+u(t-1);
figure(20)
subplot(4,1,1)
plot(t,xb(t))
title('x(t)')
axis([-10 10 -1 2]);
subplot(4,1,2)
plot(t,xb(-t))
title('x(-t)')
axis([-10 10 -1 2]);
xp=@(t) (xb(t)+xb(-t))/2;
subplot(4,1,3)
plot(t,xp(t))
title('x_p(t)')
```

```
axis([-10 10 -1 2]);
xi=@(t) (xb(t)-xb(-t))/2;
subplot(4,1,4)
plot(t,xi(t))
title('x_i(t)')
axis([-10 10 -2 2]);
```

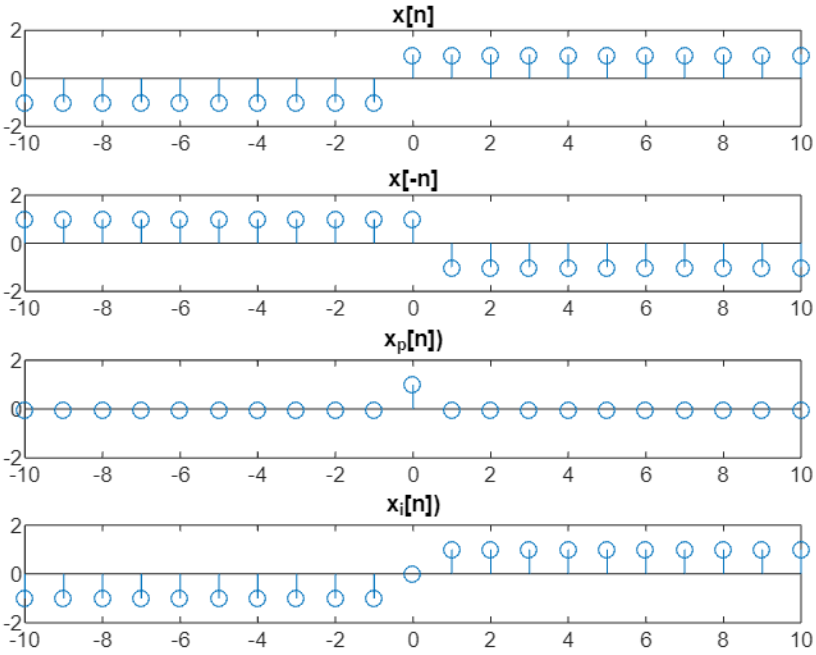


c)

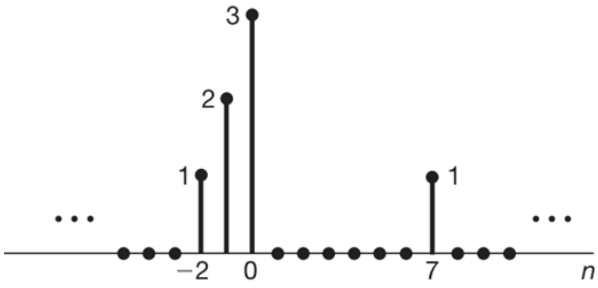



```
x=@(n) n>=0;
xc=@(n) x(n)-x(-n-1);
n=-10:10;
figure(21)
subplot(4,1,1)
stem(n,xc(n))
title('x[n]')
axis([-10 10 -2 2]);
subplot(4,1,2)
stem(n,xc(-n))
title('x[-n]')
axis([-10 10 -2 2]);
```

```
xp=@(n) (xc(n)+xc(-n))/2;
subplot(4,1,3)
stem(n,xp(n))
title('x_p[n])')
axis([-10 10 -2 2]);
xi=@(n) (xc(n)-xc(-n))/2;
subplot(4,1,4)
stem(n,xi(n))
title('x_i[n])')
axis([-10 10 -2 2]);
```

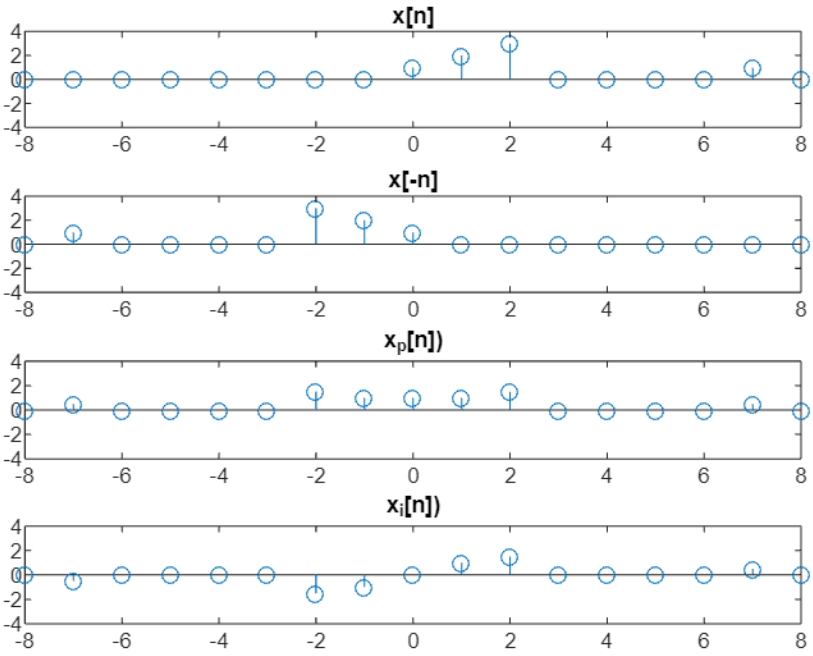


d)

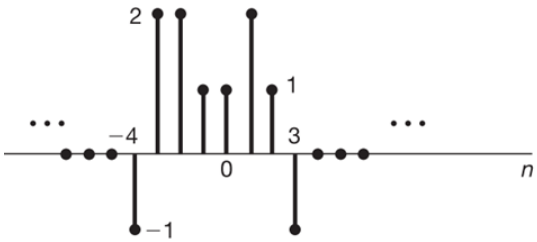



```
x=@(n) n==0;
xd=@(n) x(n)+2*x(n-1)+3*x(n-2)+x(n-7);
n=-10:10;
figure(22)
subplot(4,1,1)
stem(n,xd(n))
```

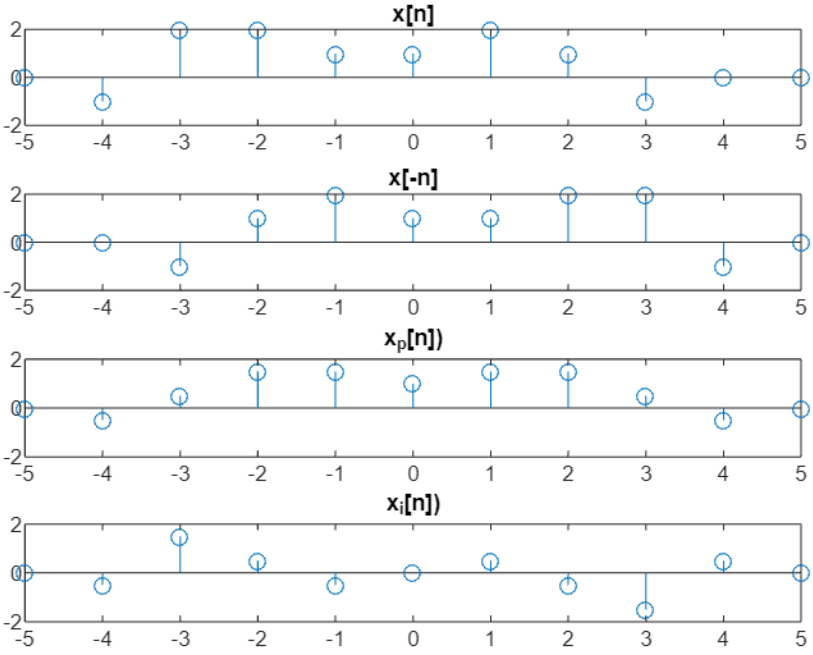
```
title('x[n]')
axis([-8 8 -4 4]);
subplot(4,1,2)
stem(n,xd(-n))
title('x[-n]')
axis([-8 8 -4 4]);
xp=@(n) (xd(n)+xd(-n))/2;
subplot(4,1,3)
stem(n,xp(n))
title('x_p[n])')
axis([-8 8 -4 4]);
xi=@(n) (xd(n)-xd(-n))/2;
subplot(4,1,4)
stem(n,xi(n))
title('x_i[n])')
axis([-8 8 -4 4]);
```



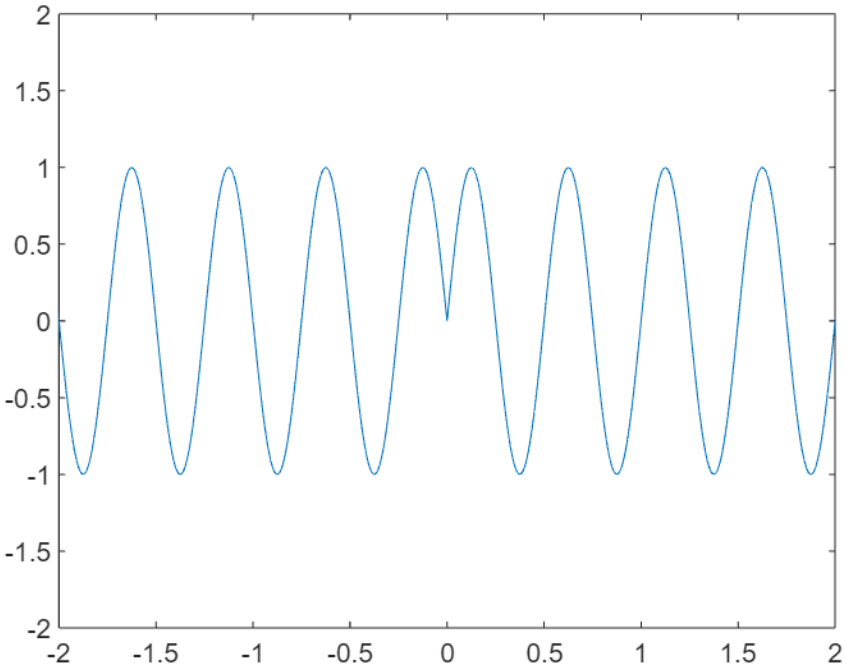
e)



```
x=@(n) n==0;
xe=@(n) -x(n+4)+2*x(n+3)+2*x(n+2)+x(n+1)+x(n)+2*x(n-1)+x(n-2)-x(n-3);
n=-10:10;
figure(23)
subplot(4,1,1)
stem(n,xe(n))
title('x[n]')
axis([-5 5 -2 2]);
subplot(4,1,2)
stem(n,xe(-n))
title('x[-n]')
axis([-5 5 -2 2]);
xp=@(n) (xe(n)+xe(-n))/2;
subplot(4,1,3)
stem(n,xp(n))
title('x_p[n])')
axis([-5 5 -2 2]);
xi=@(n) (xe(n)-xe(-n))/2;
subplot(4,1,4)
stem(n,xi(n))
title('x_i[n])')
axis([-5 5 -2 2]);
```




```
u=@(t) t>=0;
x=@(t) (sin(4*pi*t)).*(u(t)-u(-t));
figure(24)
plot(t, x(t))
axis([-2 2 -2 2])
```


2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2