Taller número 4

Comunicaciones

Convolución de señales discretas y continuas

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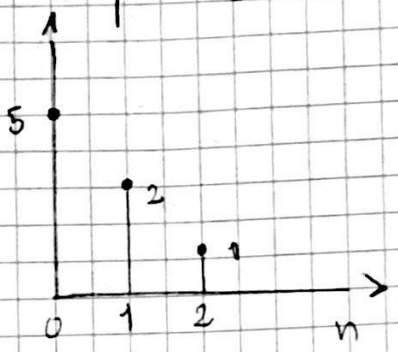
Escaneado con CamScanner

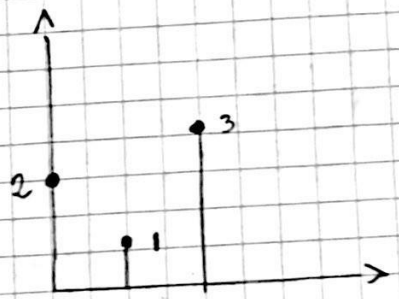
Ejercicio

Suma por Columnas

1.

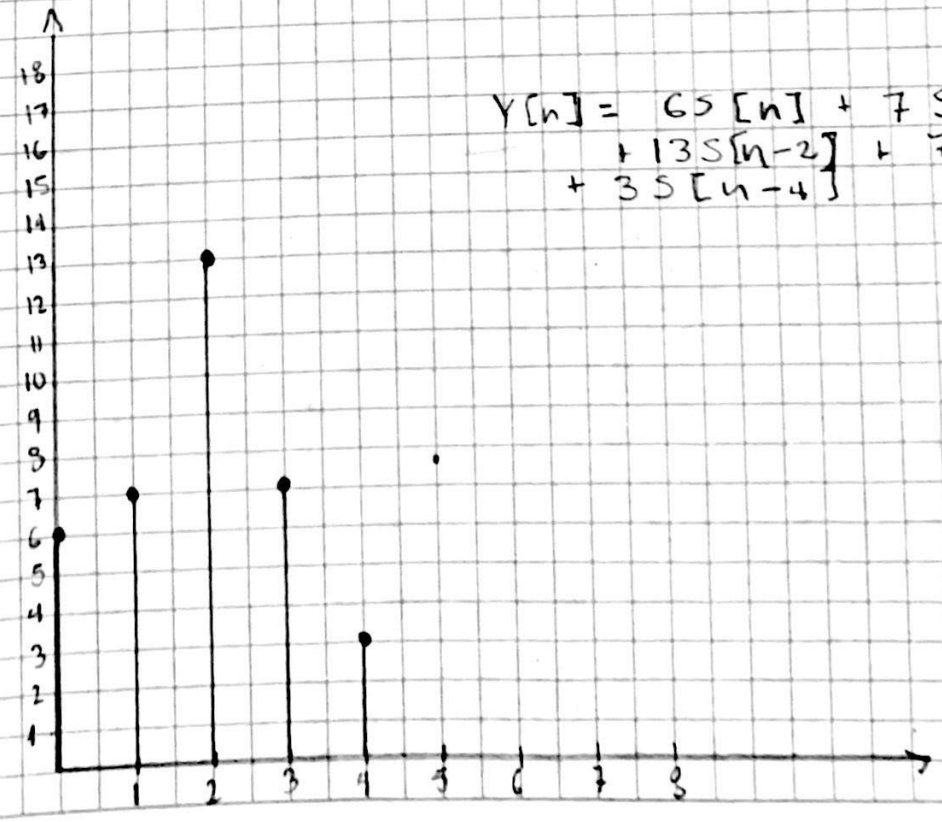


Sistema L.T.I



n =	0	1	2	3	4
	6	3	9	0	0
	0	4	2	6	0
	0	0	2	1	3
	6	7	13	7	3

$$Y[n] = 6S[n] + 7S[n-1] + 13S[n-2] + 7S[n-3] + 3S[n-4]$$



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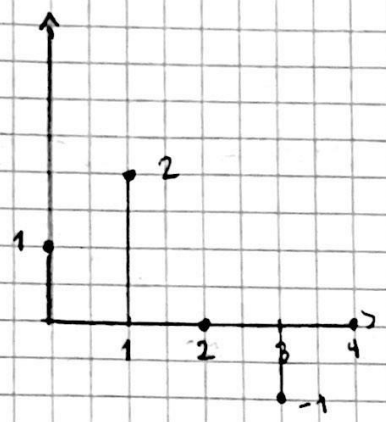
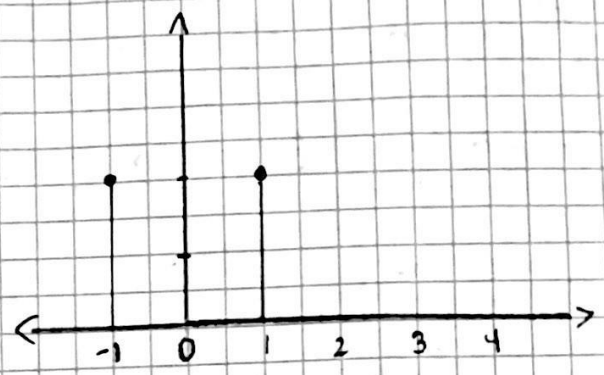
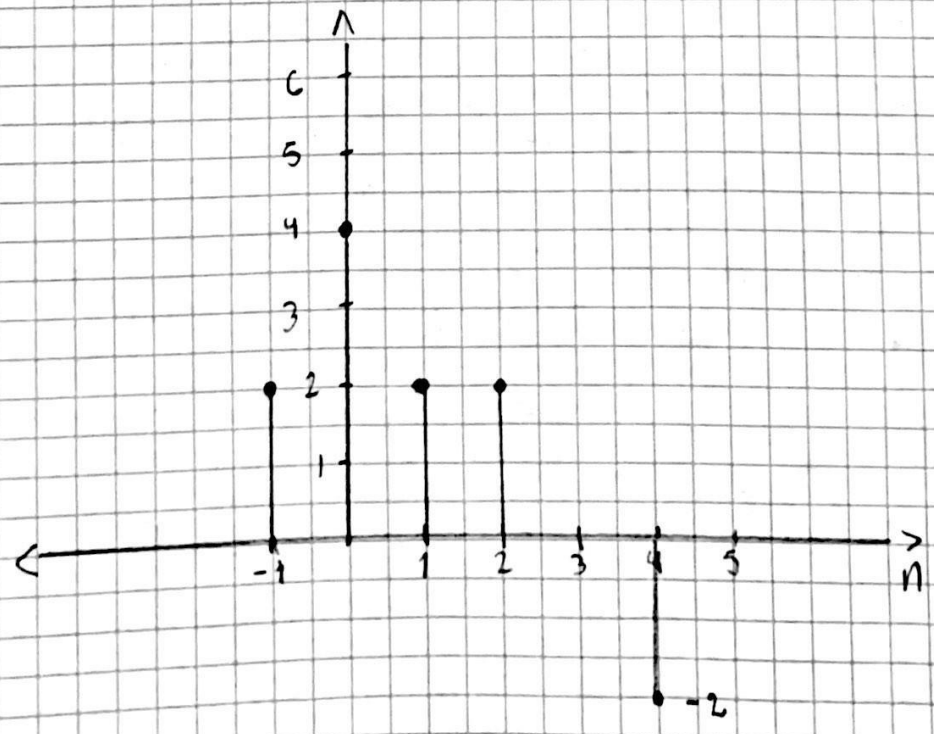
Sistema LTI

2.





n =	-1	0	1	2	3	4
	2	0	2	0		
		4	0	4	0	
			0	0	0	0
				-2	0	-2	0
					0	0	0	0
	2	4	2	2	0	-2	0	0



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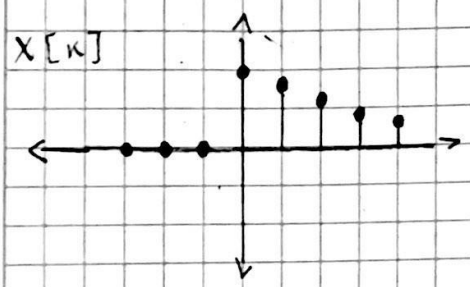
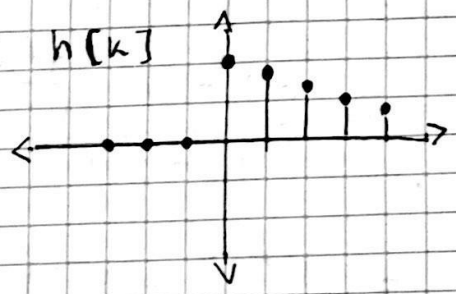
④ $x[n] = a^n u[n]$ $\quad h[n] = b^n u[n]$

$y[n] = x[n] * h[n] \longrightarrow y[n] = a^n u[n] * b^n u[n]$

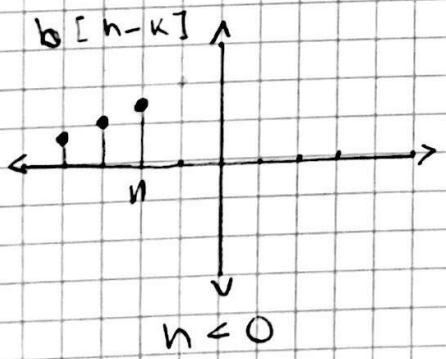
$h[n]$ = Señal de respuesta al impulso (Dezplaza)

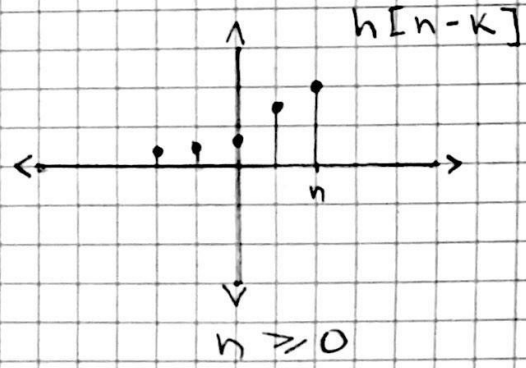




$$y[n] = \sum_{k=-\infty}^{\infty} a^k u[k] * b^{n-k} u[n-k]$$

$n < 0$ No hay solapamiento





$n \geq 0 \quad y[n] = \sum_{k=0}^{n} a^k b^{n-k}$

$$y[n] = \sum_{k=0}^{n} a^k b^n b^{-k}$$

$$y[n] = b^n \sum_{k=0}^{n} a^k b^{-k}$$

$$= b^n \sum_{k=0}^{n} (a^k)\left(\frac{1}{b^k}\right)$$

$$= b^n \sum_{k=0}^{n} \left(\frac{a}{b}\right)^k$$

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Si $a \neq b$ $\quad y[n] = \sum_{k=0}^{n} (\alpha)^k$ $\quad \frac{a}{b} = \alpha$

$$= \frac{1 - \alpha^{n+1}}{1 - \alpha}$$

$$= \left(\frac{1 - \left(\frac{a}{b}\right)^{n+1}}{1 - \left(\frac{a}{b}\right)} \right) b^n$$

$$= \frac{b^n - b^n \frac{a^{n+1}}{b^{n+1}}}{1 - \frac{a}{b}}$$

$$= \frac{b^{n+1} - a^{n+1}}{b - a}$$

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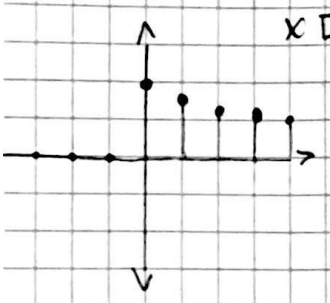
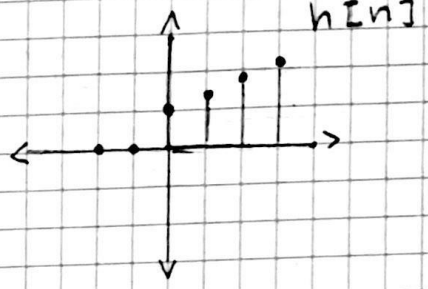
⑤ $x[n] = \left(\frac{1}{5}\right)^n \cup[n]$ $\quad h[n] = 3^n \cup[n]$

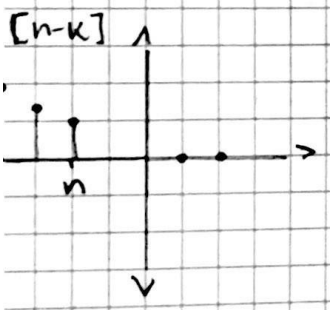
$Y[n] = x[n] * h[n] \longrightarrow y[n] = \left(\frac{1}{3}\right)^n \cup[n] * 3^n \cup[n]$

$y[n] = \sum_{k=-\infty}^{\infty} \left(\frac{1}{5}\right)^k \cup[k] * 3^{n-k} \cup[n-k]$

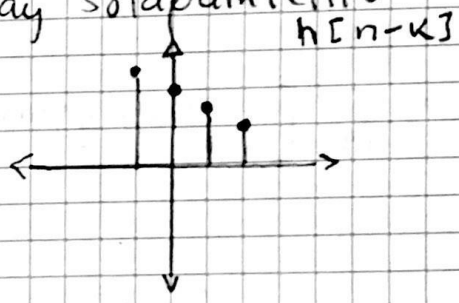




$n < 0$ no hay solapamiento



$n < 0$



$n \geq 0$

$n \geq 0 \quad Y[n] = \sum_{k=0}^{n} \left(\frac{1}{5}\right)^k * 3^{n-k}$

$Y[n] = \sum_{k=0}^{n} \left(\frac{1}{5}\right)^k * 3^n \, 3^{-k}$

$= 3^n \sum_{k=0}^{n} \left(\frac{1}{5}\right)^k * \frac{1}{3^k}$

$= 3^n \sum_{k=0}^{n} \frac{1}{5^k} * \frac{1}{3^k}$

$= 3^n \sum_{k=0}^{n} \left(\frac{1}{15}\right)^k$

Escaneado con CamScanner

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$a = \frac{1}{5} \qquad b = 3$

$$Y[n] = \frac{3^{n+1} - \left(\frac{1}{5}\right)^{n+1}}{\frac{1}{5} - 3}$$

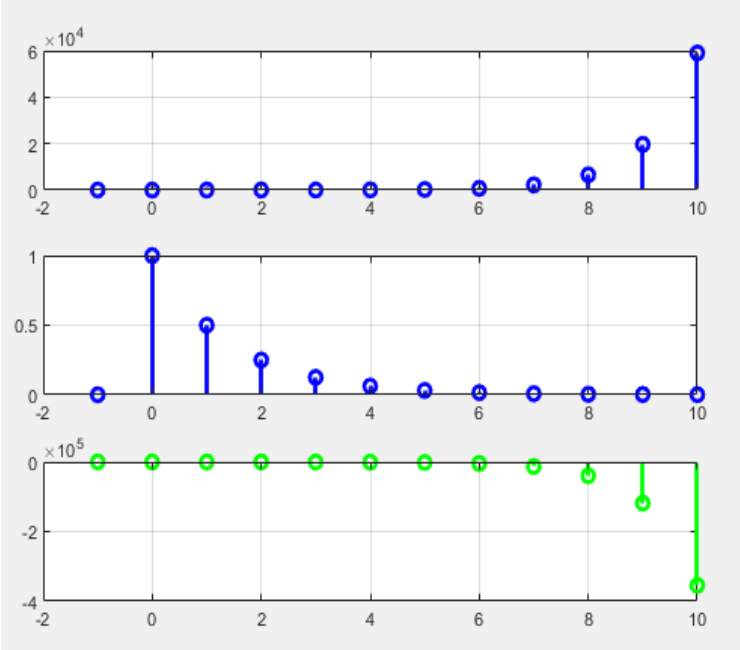
$$Y[n] = \frac{3^{n+1} - \left(\frac{1}{5}\right)^{n+1}}{\frac{14}{5}}$$

$$Y[n] = \frac{5\left(3^{n+1} - \left(\frac{1}{5}\right)^{n+1}\right)}{14}$$

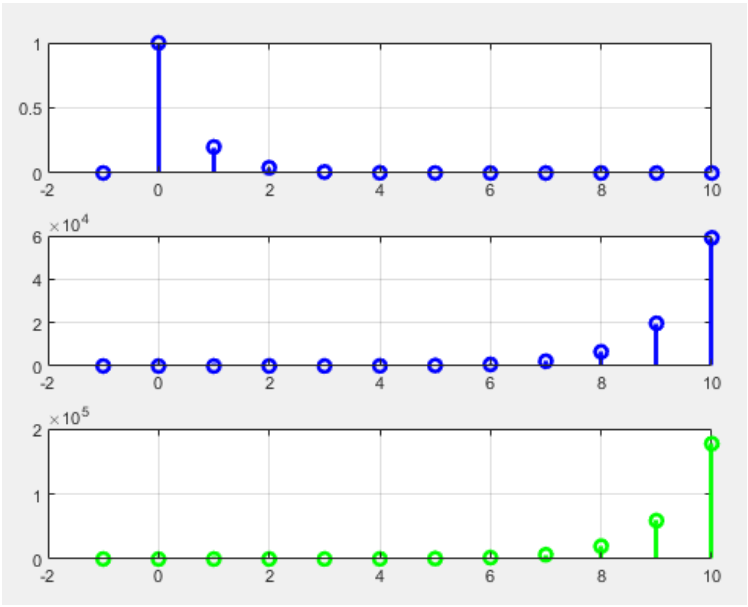
$$Y[n] = \frac{5}{14}\left[3^{n+1} - \left(\frac{1}{5}\right)^{n+1}\right] u[n]$$

Escaneado con CamScanner

```
n = -1:1:10;
u = (n>=0);
a = 3;
b = 1/2;

xn = (a.^n).*u;
subplot(3,1,1);
stem(n,xn,'b','LineWidth',2);
grid on;

hn = (b.^n).*u;
subplot(3,1,2);
stem(n,hn,'b','LineWidth',2);
grid on;

yn =((b.^(n+1))-(a.^(n+1))/b-a).*u;
subplot(3,1,3);
stem(n,yn,'g','LineWidth',2);
grid on;
```

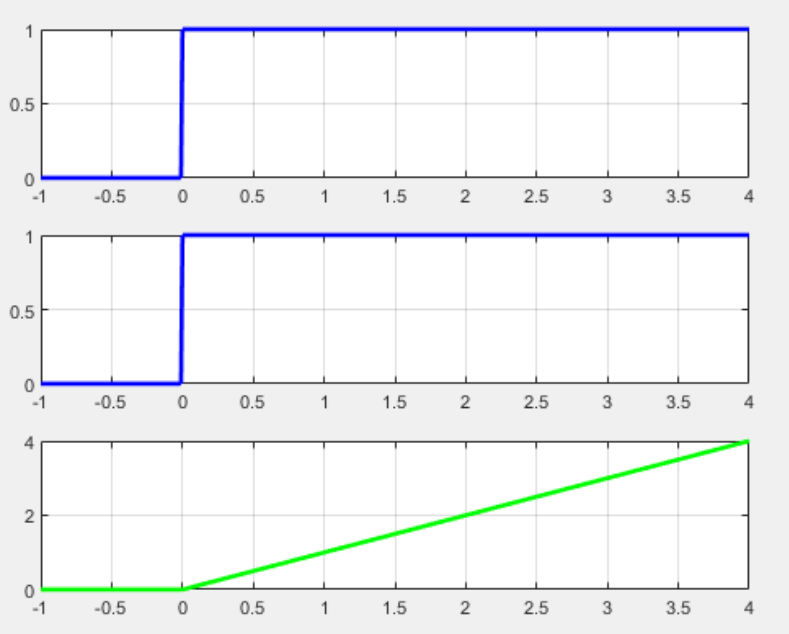



```
n = -1:1:10;
u = (n>=0);
a = 1/5;
b = 3;

xn = (a.^n).*u;
subplot(3,1,1);
stem(n,xn,'b','LineWidth',2);
grid on;

hn = (b.^n).*u;
subplot(3,1,2);
stem(n,hn,'b','LineWidth',2);
grid on;

yn =((b.^(n+1))-(a.^(n+1))/b-a).*u;
subplot(3,1,3);
stem(n,yn,'g','LineWidth',2);
grid on;
```

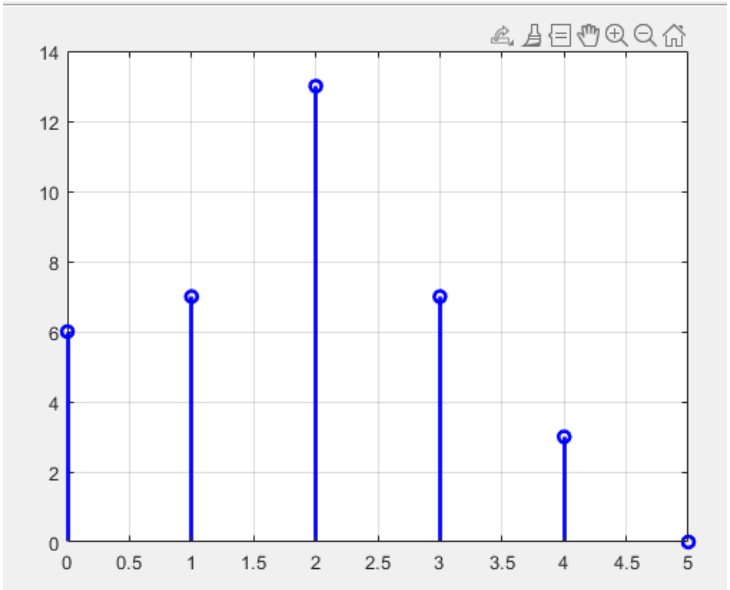


Escaneado con CamScanner

```
t = -1:0.01:4;
u = (t>=0);

xt = u;
subplot(3,1,1);
plot(t,xt,'b','LineWidth',2);
grid on;

ht = u;
subplot(3,1,2);
plot(t,ht,'b','LineWidth',2);
grid on;

yt = t.*u;
subplot(3,1,3);
plot(t,yt,'g','LineWidth',2);
grid on;
```

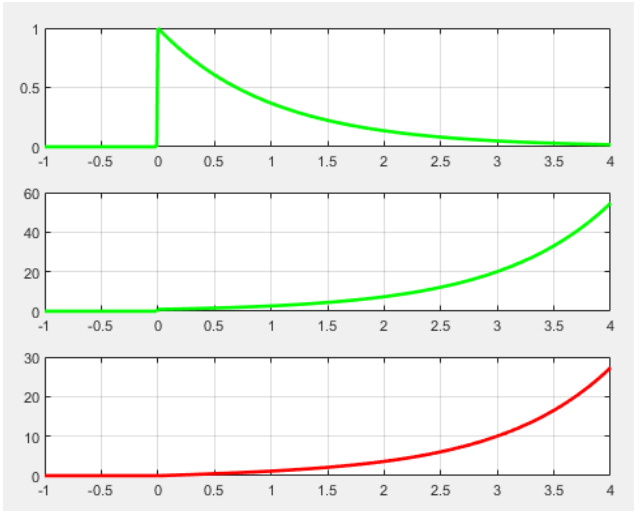


```
n = 0:1:5;
u1 = (n==0);
u2 = (n==1);
u3 = (n==2);
u4 = (n==3);
u5 = (n==4);

i = 6*u1+7*u2+13*u3+7*u4+3*u5;
stem(n,i,'b','LineWidth',2);
grid on;
```

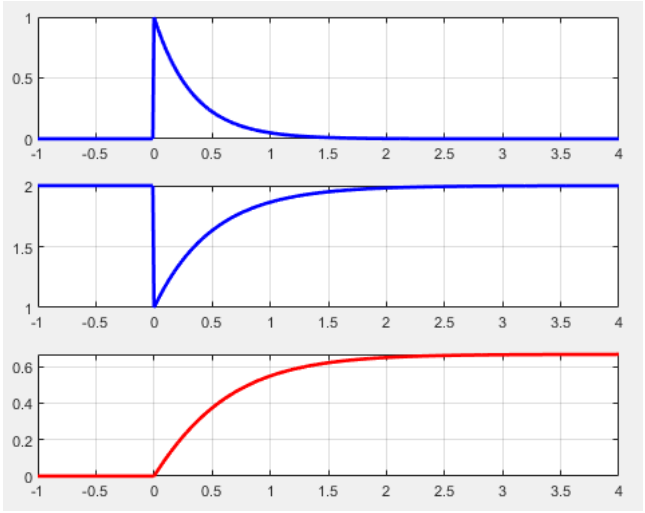


Escaneado con CamScanner

```
t = -1:0.01:4;
u = (t>=0);
a1 = -1;
a2 = 1;

xt = exp(a1.*t).*u;
subplot(3,1,1);
plot(t,xt,'g','LineWidth',2);
grid on;

ht = exp(a2.*t).*u;
subplot(3,1,2);
plot(t,ht,'g','LineWidth',2);
grid on;

div = 1/(a1-a2);

yt = -div.*(exp(a2.*t)-exp(a1.*t)).*u;
subplot(3,1,3);
plot(t,yt,'r','LineWidth',2);
grid on;
xlim([-1 4]);
```

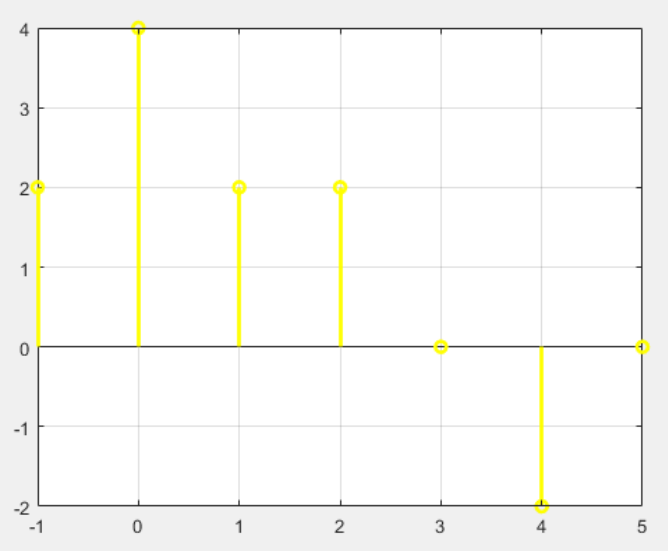


```
t = -1:0.01:4;
u = (t>=0);
a1 = -3;
a2 = -2;

xt = exp(a1.*t).*u;
subplot(3,1,1);
plot(t,xt,'b','LineWidth',2);
grid on;

ht = 2-exp(a2.*t).*u;
subplot(3,1,2);
plot(t,ht,'b','LineWidth',2);
grid on;

yt = (1/3.*exp(a1.*t)-exp(a2.*t)+2/3).*u;
subplot(3,1,3);
plot(t,yt,'r','LineWidth',2);
grid on;
xlim([-1 4]);
```

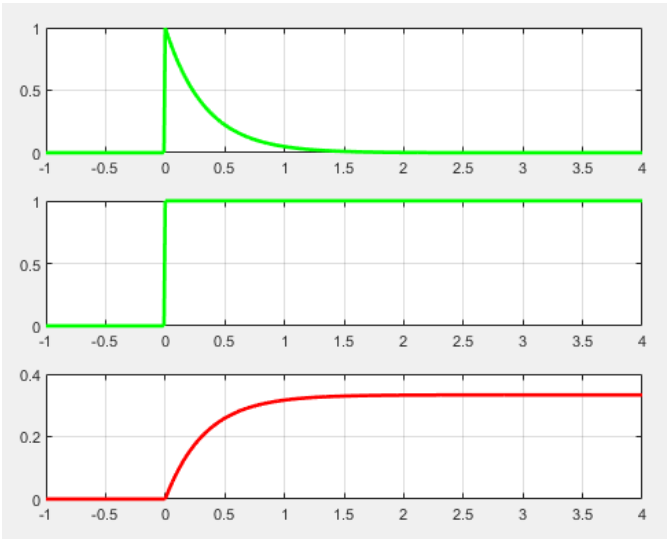


Escaneado con CamScanner

```
n = -1:1:5;
u1 = (n==-1);
u2 = (n==0);
u3 = (n==1);
u4 = (n==2);
u5 = (n==4);

i = 2*u1+4*u2+2*u3+2*u4-2*u5;
stem(n,i,'y','LineWidth',2);
grid on;
```

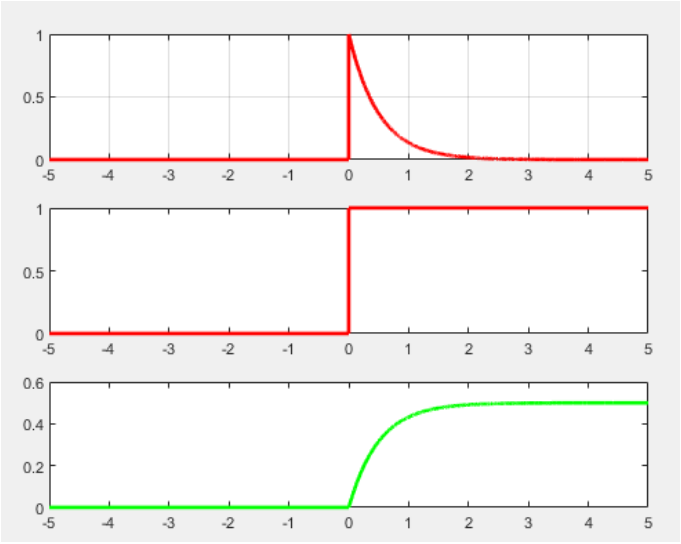



```
t = -1:0.01:4;
u = (t>=0);
a = -3;

xt = exp(a.*t).*u;
subplot(3,1,1);
plot(t,xt,'g','LineWidth',2);
grid on;

ht = u;
subplot(3,1,2);
plot(t,ht,'g','LineWidth',2);
grid on;

div = 1/a;

yt = div.*(exp(a.*t)-1).*u;
subplot(3,1,3);
plot(t,yt,'r','LineWidth',2);
grid on;
```



Escaneado con CamScanner

```
t = -5:0.001:5;
u = (t>=0);

x = (exp(-2.*t)).*u;
subplot(3,1,1);
plot(t,x,'r','LineWidth',2);
grid on;

h = u;
subplot(3,1,2);
plot(t,h,'r','LineWidth',2);

y = -1/2.*(exp(-2.*t)-1).*u;
subplot(3,1,3);
plot(t,y,'g','LineWidth',2);
```



Escaneado con CamScanner