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Lab 5

Task 1:

a & b:

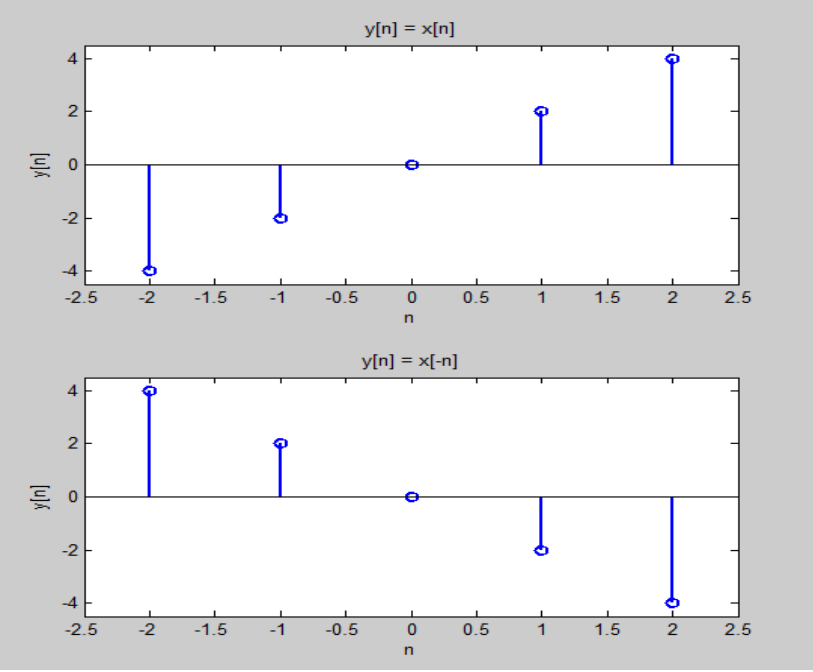
Code:

```
n = -2:2;
x = 2.*n; % .* =>Element-wise multiplication
subplot(2,1,1)
stem(n,x,'LineWidth',2)
xlim([-2.5,2.5])
ylim([-4.5,4.5])
xlabel('n')
ylabel('y[n]')
title('y[n] = x[n]')

y = -x;
subplot(2,1,2)
stem(n,y,'LineWidth',2)
xlim([-2.5,2.5])
ylim([-4.5,4.5])
xlabel('n')
ylabel('y[n]')
title('y[n] = x[-n]')

```

Graph:



c:

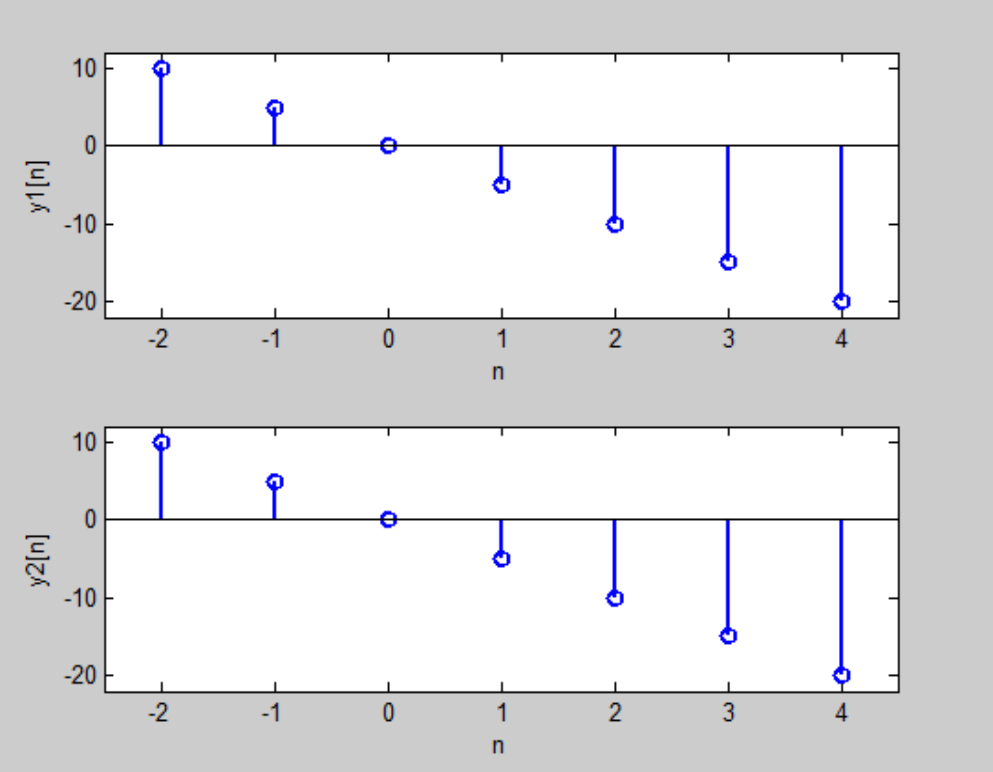
Code:

```
n = -2:4;
x1 = 2.*n;
x2 = n./3; % ./ => Element-wise right division
a1 = 2;
a2 = 3;
x = a1.*x1 + a2.*x2; %left side of the equation 5.1
y = -x;
subplot(2,1,1)
stem(n,y,'LineWidth',2)
xlim([-2.5,4.5])
ylim([-22,12])
xlabel('n')
ylabel('y1[n]')

y1 = -x1;
y2 = -x2;
y = a1.*y1 + a2.*y2; %right side of the equation 5.1
subplot(2,1,2)
stem(n,y,'LineWidth',2)
xlim([-2.5,4.5])
ylim([-22,12])
xlabel('n')
ylabel('y2[n]')

```

Graph:



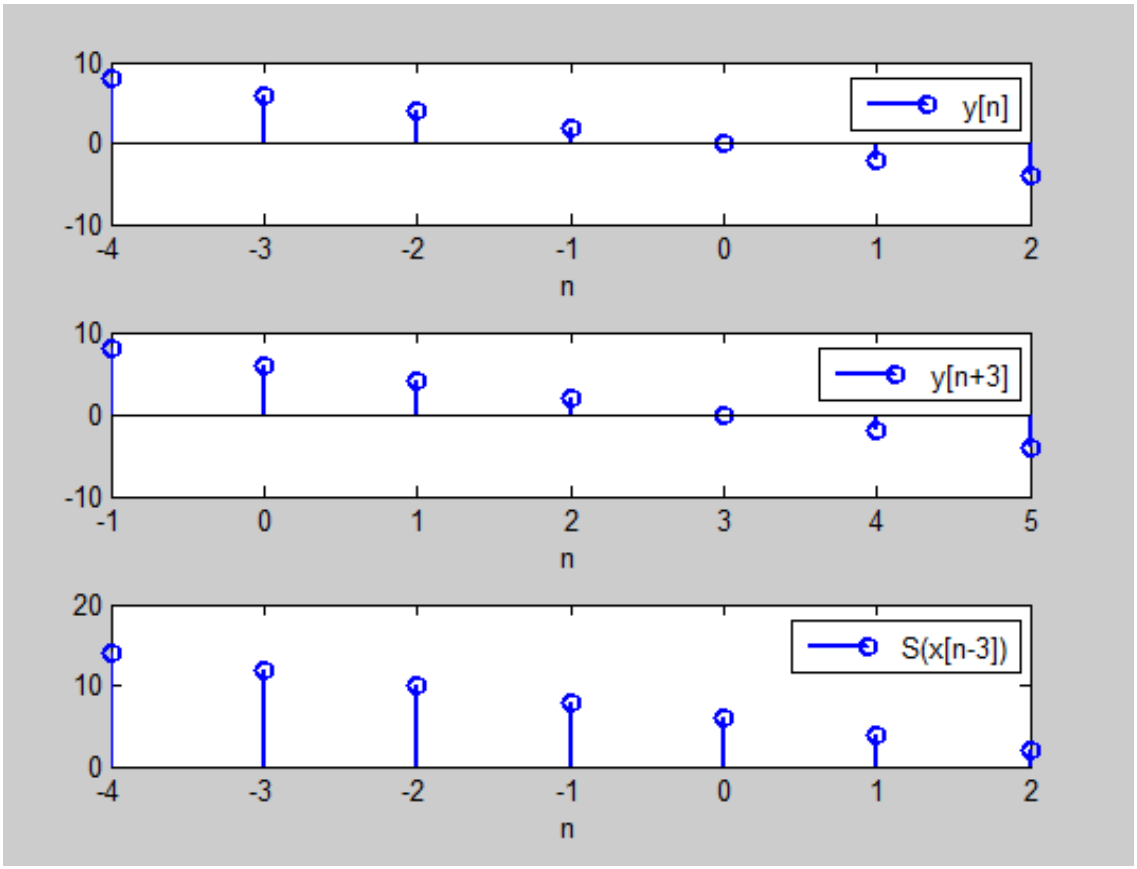
d:

Code:

```
n = -2:4; % : => Vector creation
x = 2.*n;
n0 = 3;
subplot(3,1,1)
stem(-n,x,'LineWidth',2)
legend('y[n]')
xlabel('n')
subplot(3,1,2)
stem(-(n-3),x,'LineWidth',2)
legend('y[n+3]')
xlabel('n')
x = 2.*(n+3);
subplot(3,1,3)
stem(-n,x,'LineWidth',2)
legend('S(x[n-3])')
xlabel('n')

```

Graph:



Task 2:

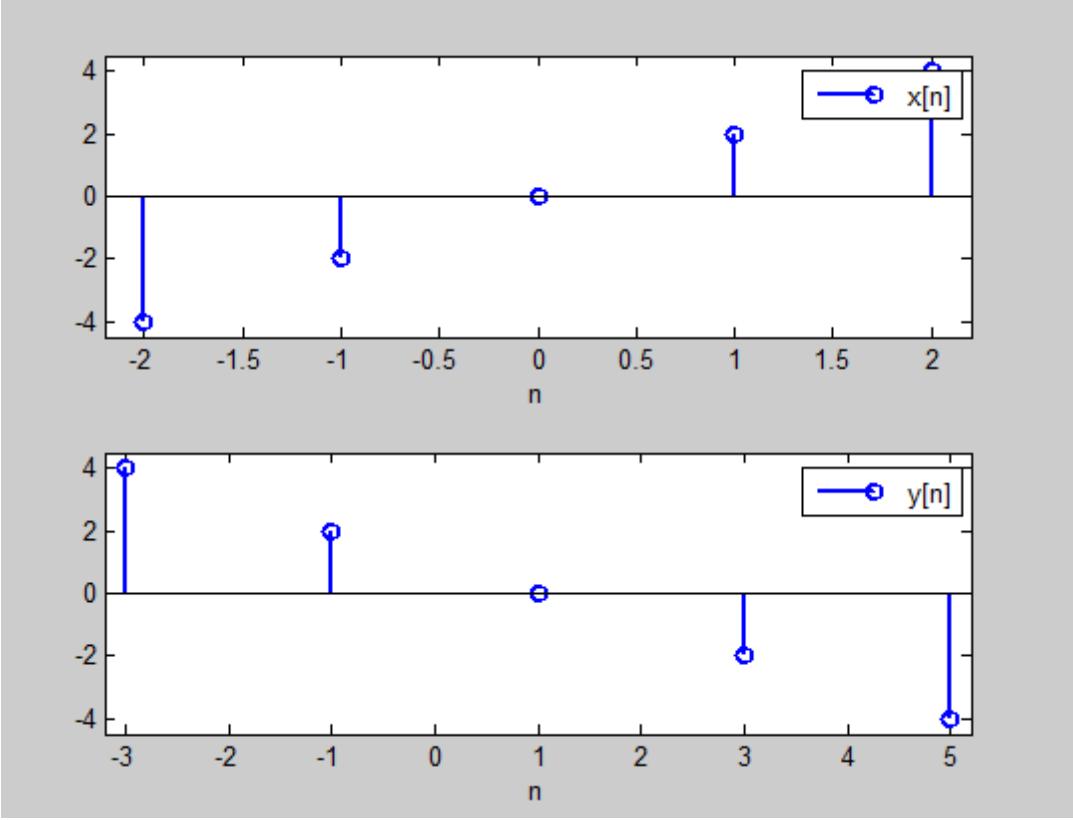
a & b:

Code:

```
n = -2:2;
x = 2.*n;
subplot(2,1,1)
stem(n,x,'LineWidth',2) %print x[n]
xlim([-2.2 2.2])
ylim([-4.5 4.5])
legend('x[n]')
xlabel('n')

y = x;
subplot(2,1,2)
stem(1-2.*n,y,'LineWidth',2) %print y[n]
xlim([-3.2 5.2])
ylim([-4.5 4.5])
legend('y[n]')
xlabel('n')
```

Graph:



c:

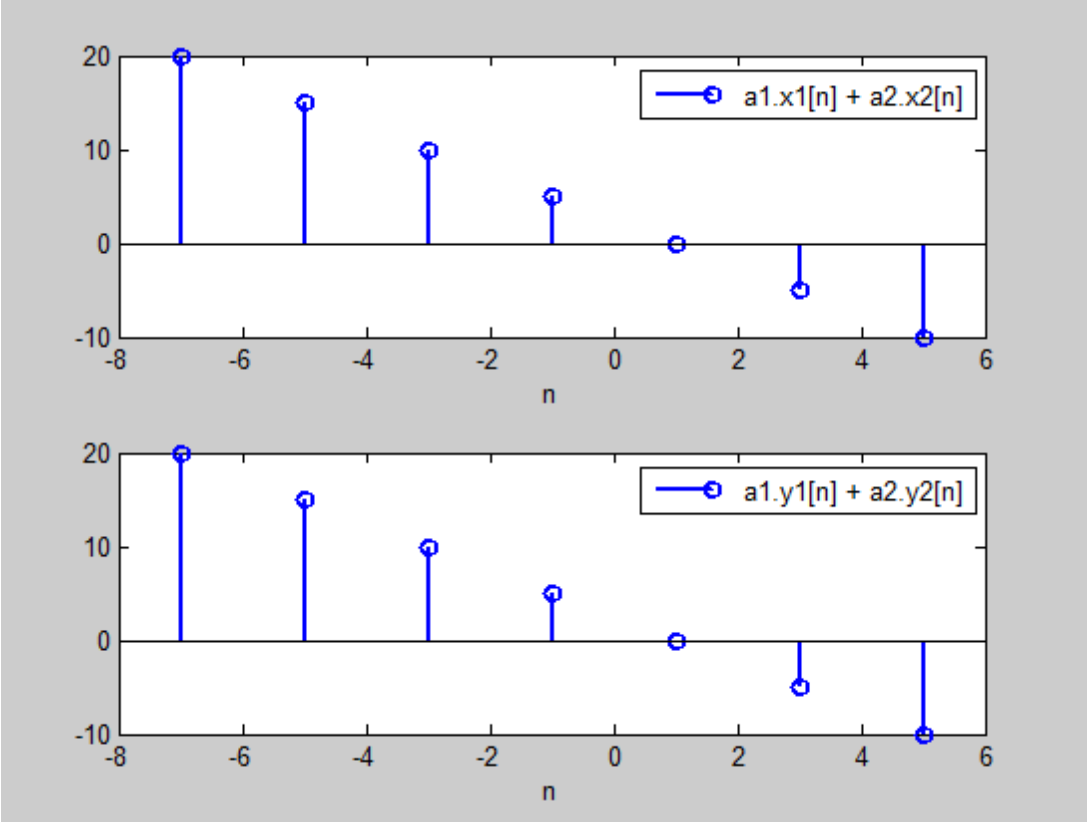
Code:

```
n = -2:4;
x1 = 2.*n;
x2 = n./3;
a1 = 2;
a2 = 3;
x = a1.*x1 + a2.*x2;
subplot(2,1,1)
stem(1-2.*n,x,'LineWidth',2)
legend('a1.x1[n] + a2.x2[n]')
xlabel('n')

legend('a1.x1[n] + a2.x2[n]')
xlabel('n')
subplot(2,1,2)
y1 = a1.*x1;
y2 = a2.*x2;
y = y1 + y2;
stem(1-2.*n,y,'LineWidth',2)
legend('a1.y1[n] + a2.y2[n]')
xlabel('n')

```

Graph:



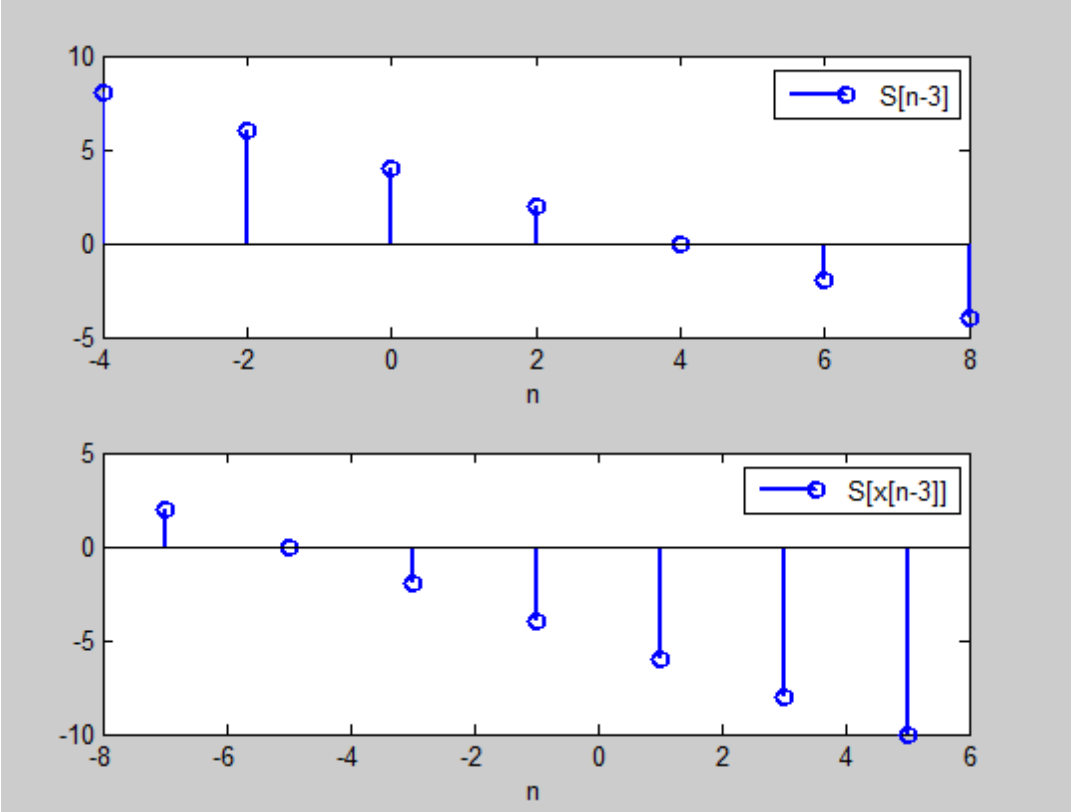
d:

Code:

```
n = -2:4;
x = 2.*n;
n0 = 3;
subplot(2,1,1)
stem(n0+1-2.*n,x,'LineWidth',2)
legend('S[n-3]')
xlabel('n')

y = 2.*(n-n0);
subplot(2,1,2)
stem(1-2.*n,y,'LineWidth',2)
legend('S[x[n-3]]')
xlabel('n')
```

Graph:



Critical Analysis:

In this lab I learnt:

- A system is causal if output depends only at time ‘t’ or before ‘t’(or [n]).
- A system is called static or memory-less if output at time ‘t’ depends only on the input at time ‘t’ or [n]
- A system is called linear if its I/O behavior satisfies the additivity and homogeneity properties as well as superposition property.
- A system is called time-invariant if the way it responds to inputs does not change over time.
- A system is called invertible if it produces distinct outputs for distinct inputs.
- A system is called stable if it produces bounded outputs for all bounded inputs.

All of these properties can be implemented on MATLAB and signal and system behavior can be observed.

THE END