Principles of Communication Systems Lab

Lab 1, 13th August 2019

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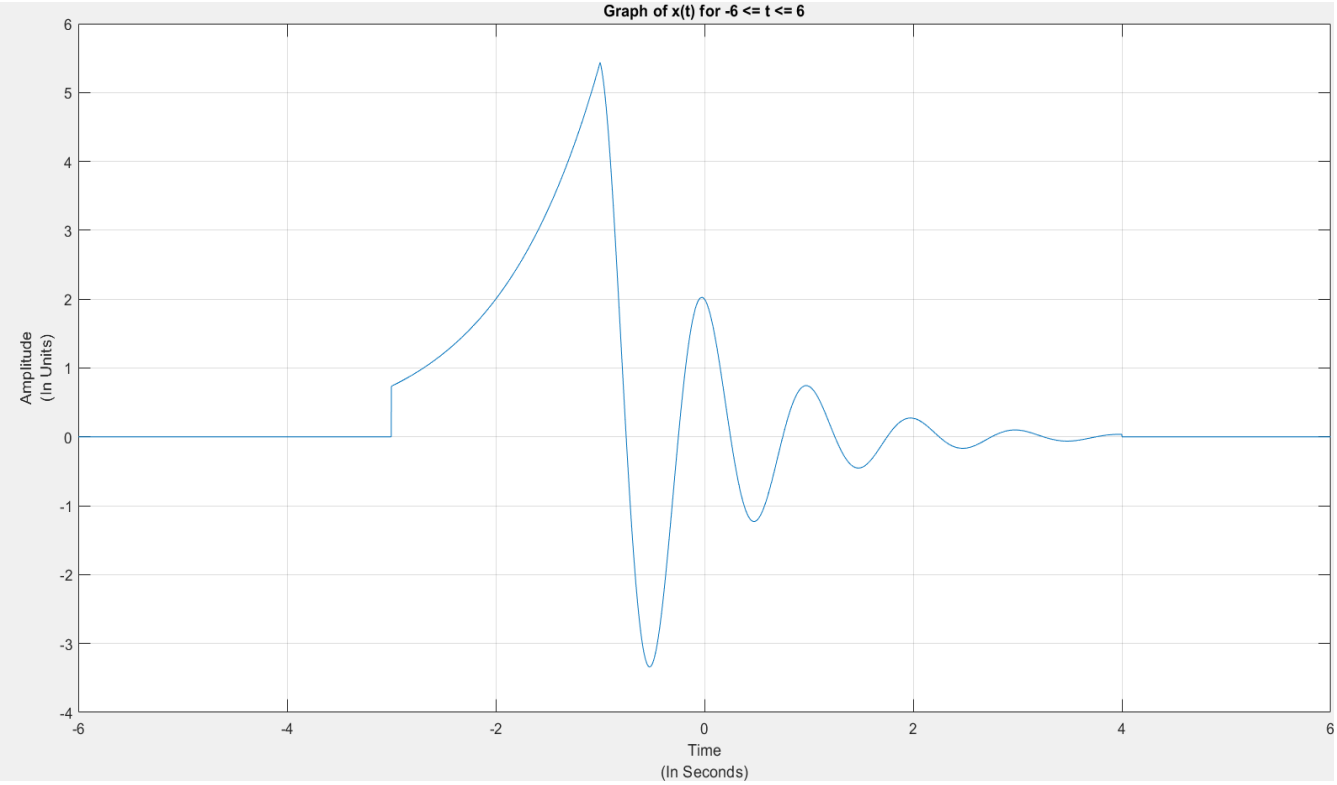
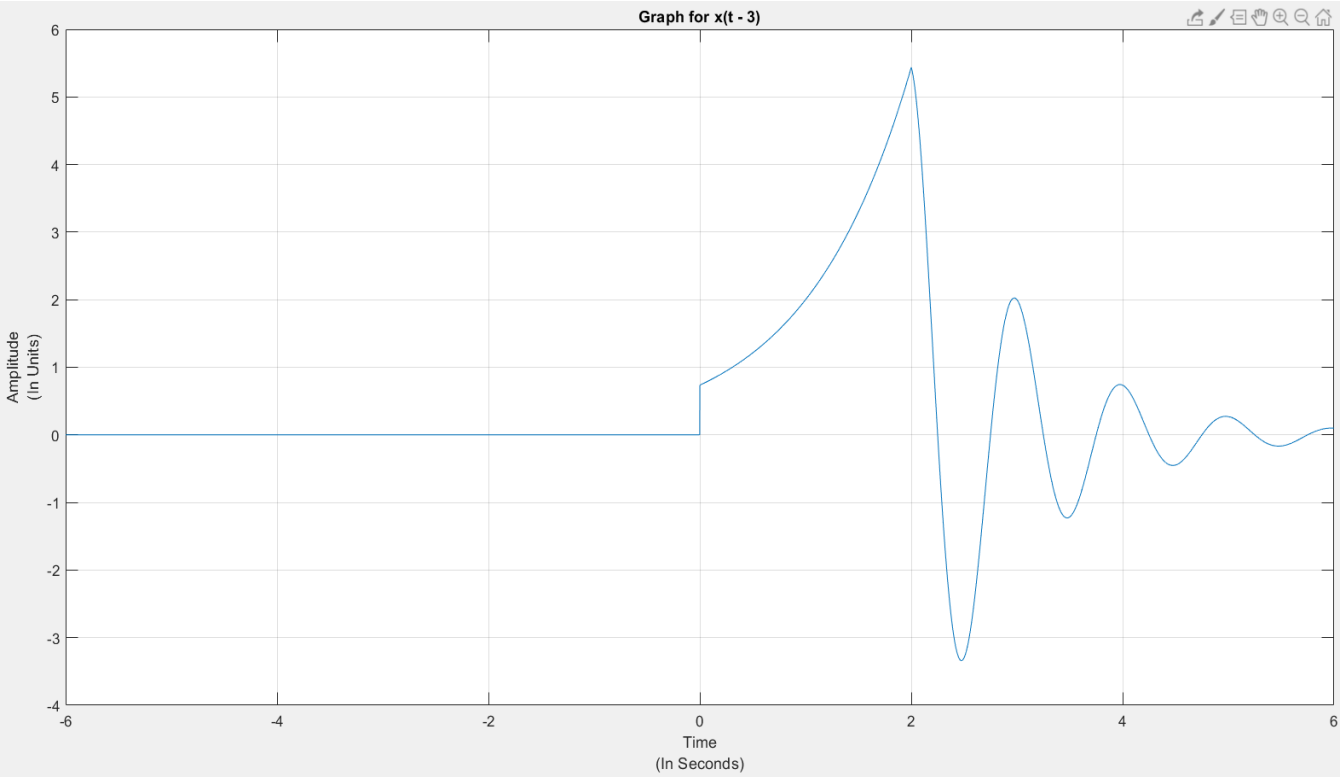
Answer to Q1

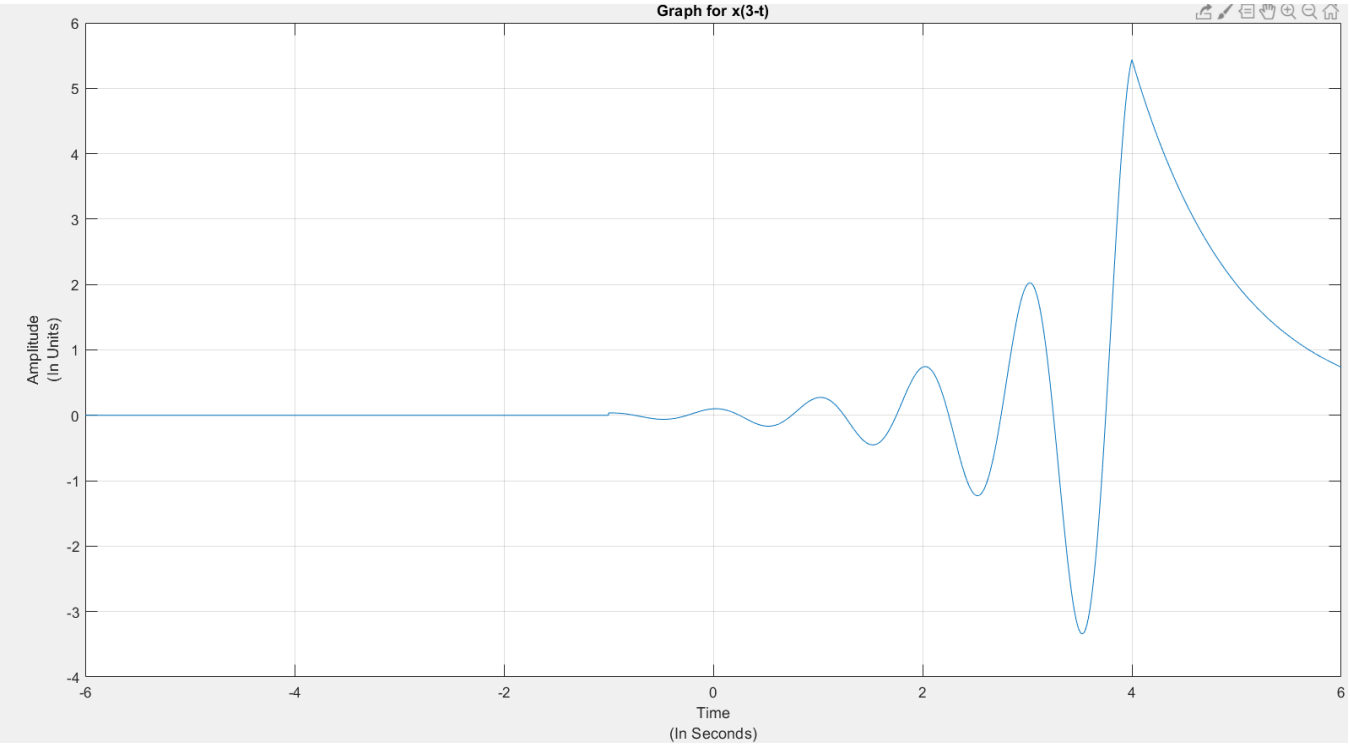
1(b):



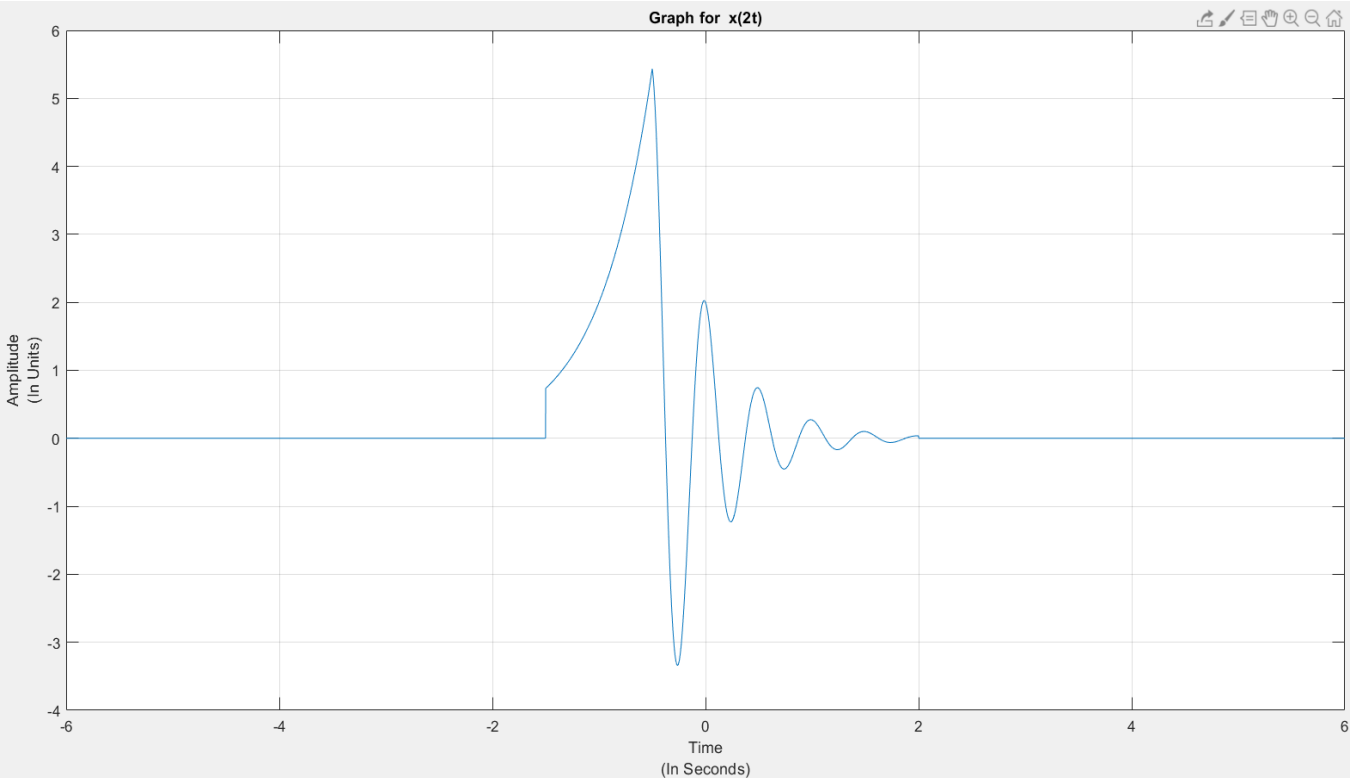
1(c):


Graph for x(t - 3)
Amplitude
(In Units)
Time
(In Seconds)
6
5
4
3
2
1
0
-1
-2
-3
-4
-6
-4
-2
0
2
4
6

1(d):


Graph for x(3-t)
Amplitude
(In Units)
Time
(In Seconds)
6
5
4
3
2
1
0
-1
-2
-3
-4
-6
-4
-2
0
2
4
6

1(e):



Question 1 Explanation:

In first question part 1 we are forming a signal with given conditions.

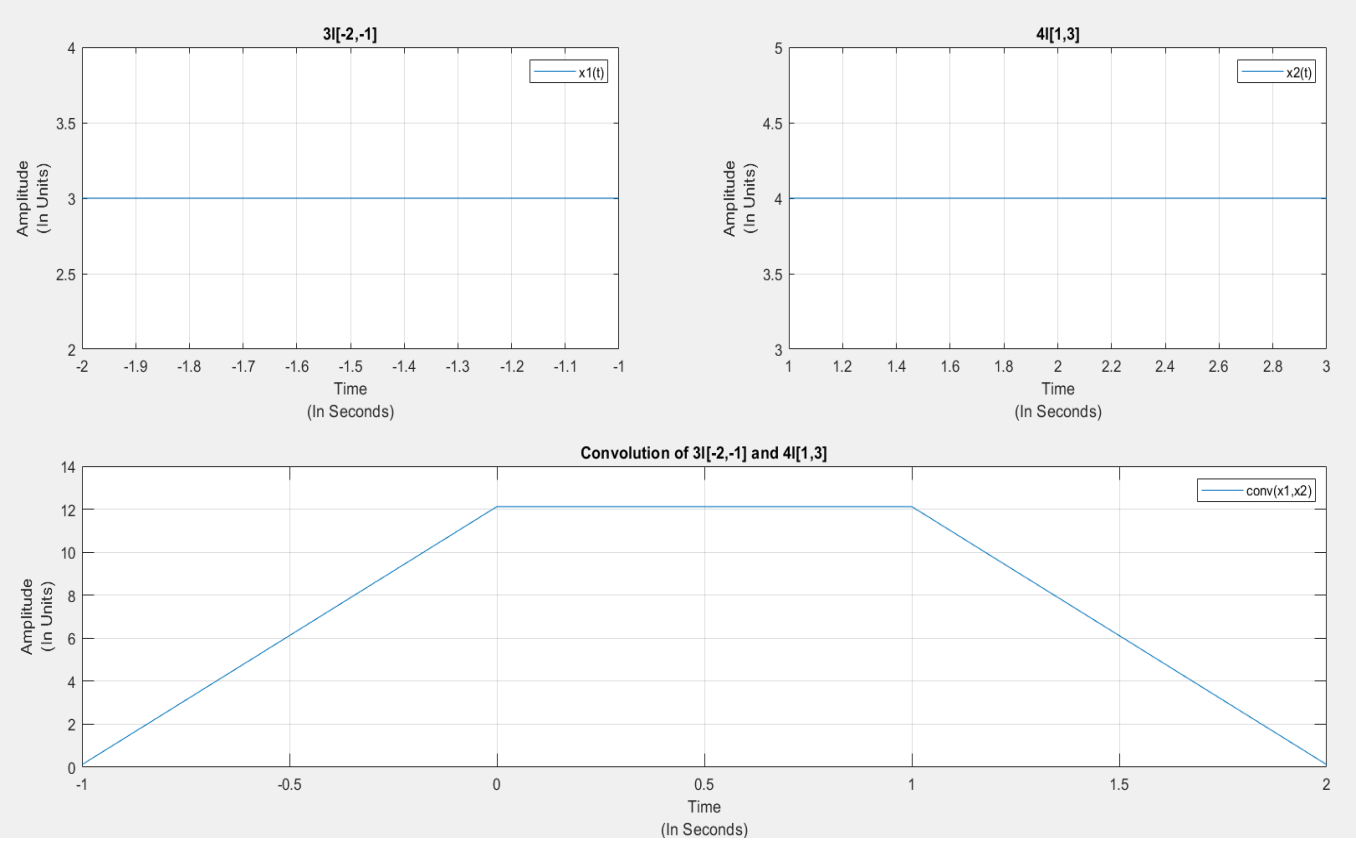
In part 2 of first question we are shifting the signal by 3 units on +ve x-axis.

In part 3 we are inverting the signal and shifting it by 3 units on x-axis.

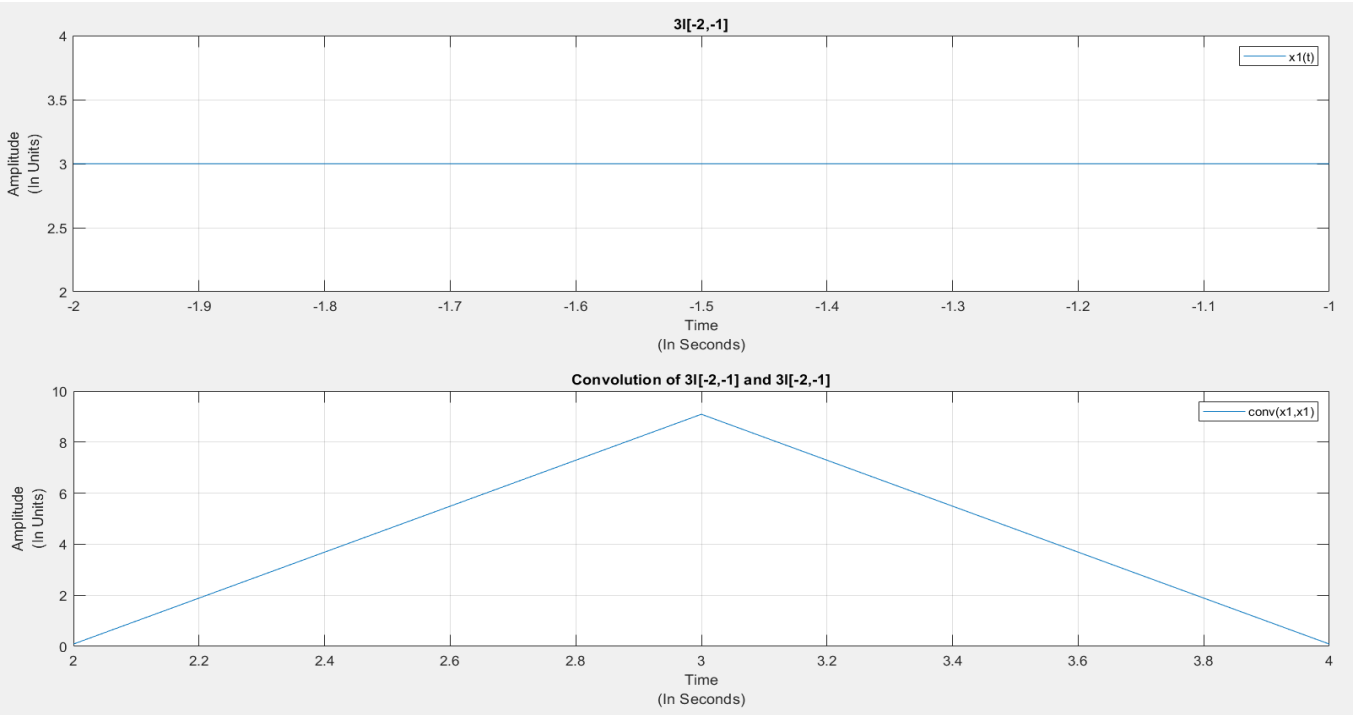
In part 4 we are multiplying the signals time component by 2 basically shrinking the signal in time domain.

Answer to Q2

2(b):



2(c):



Question 2 Explanation:

In second question part 1 we are convolving the signal x1 ie 3I[-2,-1] indicator function with x2 ie 4I[1,3] and we get a trapezium.

In part 2 of second question we are convolving the signal x1 with itself so we get a triangle.

Appendix:

Code for Question 1:

```
function plot_one

%Time vector
t = -6:0.001:6;
%Output vector
yb = signalx(t);
yc = signalx(t-3);
yd = signalx(3-t);
ye = signalx(2*t);
%Plot for q1
figure(1);
plot(t,yb);
%set(gca,'XLim',[-7 7])
xlabel({'Time','(In Seconds)'});
ylabel({'Amplitude','(In Units)'});
grid on;
title('Graph of x(t) for -6 <= t <= 6');
figure(2);
plot(t,yc);
%set(gca,'XLim',[-7 7])
xlabel({'Time','(In Seconds)'});
ylabel({'Amplitude','(In Units)'});
grid on;
title('Graph for x(t - 3)');
figure(3);
plot(t,yd);
%set(gca,'XLim',[-7 7])
xlabel({'Time','(In Seconds)'});
ylabel({'Amplitude','(In Units)'});
grid on;
title('Graph for x(3-t)');
figure(4);
plot(t,ye);
%set(gca,'XLim',[-7 7])
xlabel({'Time','(In Seconds)'});
ylabel({'Amplitude','(In Units)'});
grid on;
title('Graph for  x(2t)');
end


function s = signalx(t)
s = arrayfun(@arr_signal,t);
end
```

```
function x = arr_signal(t)
if(t>=-3 && t<=-1)
    x = 2*exp(t+2);
elseif(t>=-1 && t<= 4)
    x = 2*exp(-t)*cos(2*pi*t);
else
    x = 0;
end
end
```

Code for Question 2:

```
function plot_two
dt = 0.01;%sample spacing
s1 = -2:dt:-1; %sampling times over the interval [-2,-1]
s2 = 1:dt:3; %sampling times over the interval [1,3]
x1 = 3*ones(length(s1),1); %samples for first box
x2 = 4*ones(length(s2),1); %samples for second box
[y,t] = contconv(x1,x2,s1(1),s2(1),dt);
[y1,t1] = contconv(x1,x1,s2(1),s2(1),dt);
figure(1);
subplot(2,2,[3,4]);plot(t,y);xlabel({'Time','(In
Seconds)'});ylabel({'Amplitude','(In Units)'});
title('Convolution of 3I[-2,-1] and 4I[1,3]');
legend('conv(x1,x2)');
grid on;
subplot(2,2,1);plot(s1,x1);xlabel({'Time','(In
Seconds)'});ylabel({'Amplitude','(In Units)'});
title('3I[-2,-1]');
grid on;
legend('x1(t)');
subplot(2,2,2);plot(s2,x2);xlabel({'Time','(In
Seconds)'});ylabel({'Amplitude','(In Units)'});
title('4I[1,3]');
grid on;
legend('x2(t)');
figure(2);
subplot(2,1,2);plot(t1,y1);xlabel({'Time','(In
Seconds)'});ylabel({'Amplitude','(In Units)'});
title('Convolution of 3I[-2,-1] and 3I[-2,-1]');
grid on;
legend('conv(x1,x1)');
subplot(2,1,1);plot(s1,x1);xlabel({'Time','(In
Seconds)'});ylabel({'Amplitude','(In Units)'});
title('3I[-2,-1]');
grid on;
legend('x1(t)');

end
function [y,t] = contconv(x1,x2,s1,s2,dt)
y = conv(x1,x2)*dt;
s1_2 = s1 + (length(x1)-1)*dt;
s2_2 = s2 + (length(x2)-1)*dt;
t1 = s1+ s2;
t2 = s2_2 + s1_2;
t = t1:dt:t2;
end
```