EEE F243: SIGNALS AND SYSTEMS
MATLAB-BASED ASSIGNMENT

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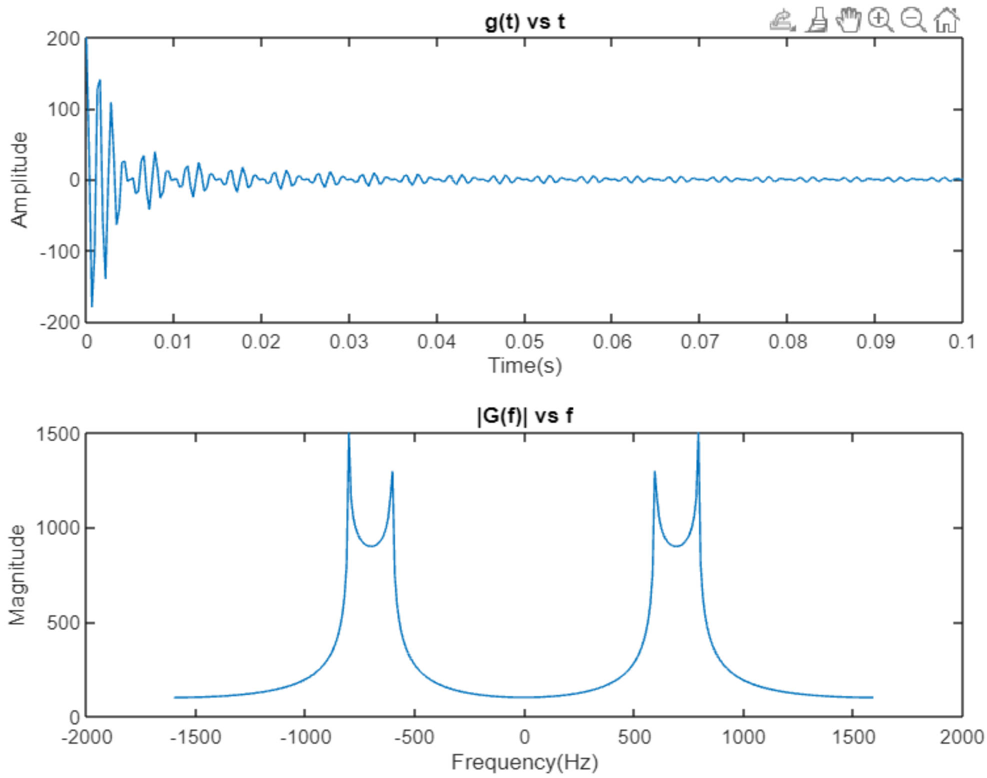
-2019B4A30618P
-TUTORIAL 3

Q1)

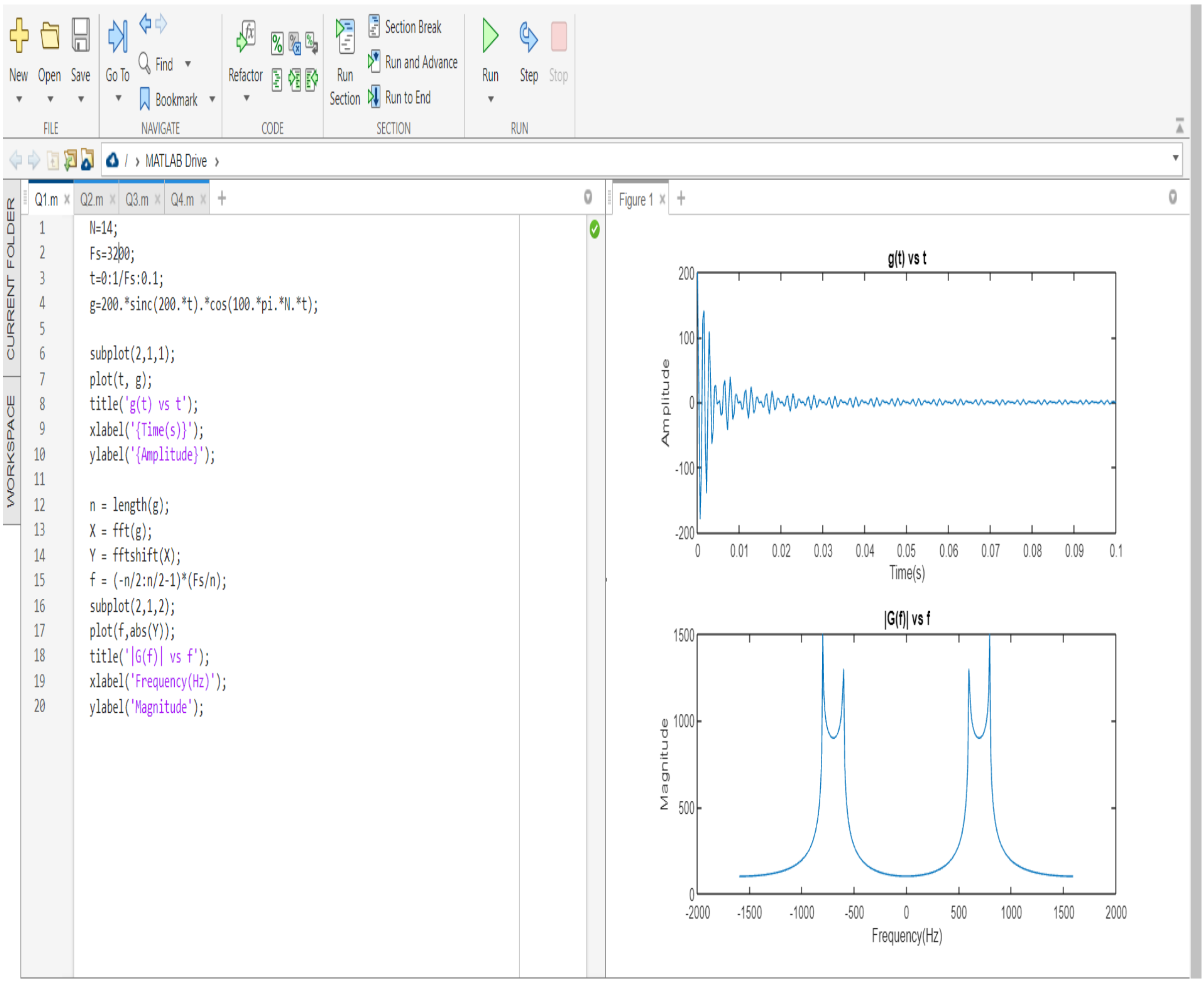
```
N=14;
Fs=3200;
t=0:1/Fs:0.1;
g=200.*sinc(200.*t).*cos(100.*pi.*N.*t);
subplot(2,1,1);
plot(t, g);
title('g(t) vs t');
xlabel('{Time(s)}');
ylabel('{Amplitude}');
n = length(g);
X = fft(g);
Y = fftshift(X);
f = (-n/2:n/2-1)*(Fs/n);
subplot(2,1,2);
plot(f,abs(Y));
title('|G(f)| vs f');
xlabel('Frequency(Hz)');
ylabel('Magnitude');

//N = 5 + 1 + 8 = 14 (5 for all dual degree students + last 2 digits of BITS ID)
//Nyquist rate=2*(200pi+1400pi)=3200pi(rad/sec)=1600(Hz)
//Fs=2*Fnq=3200(Hz)
```

Observations -

- g(t) is the product of two functions in time domain. G(f) is the convolution of those two functions in frequency domain. The plot obtained verifies that property.
- The plot obtained signifies that the rectangular function in theory had sharp edges but it is not true in practical cases.



g(t) vs t
Amplitude
Time(s)
200
100
0
-100
-200
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
|G(f)| vs f
Magnitude
Frequency(Hz)
1500
1000
500
0
-2000
-1500
-1000
-500
0
500
1000
1500
2000



New
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NAVIGATE
CODE
SECTION
RUN
MATLAB Drive
Q1.m
Q2.m
Q3.m
Q4.m
Figure 1
CURRENT FOLDER
WORKSPACE
N=14;
Fs=3200;
t=0:1/Fs:0.1;
g=200.*sinc(200.*t).*cos(100.*pi.*N.*t);
subplot(2,1,1);
plot(t, g);
title('g(t) vs t');
xlabel('{Time(s)}');
ylabel('{Amplitude}');
n = length(g);
X = fft(g);
Y = fftshift(X);
f = (-n/2:n/2-1)*(Fs/n);
subplot(2,1,2);
plot(f,abs(Y));
title('|G(f)| vs f');
xlabel('Frequency(Hz)');
ylabel('Magnitude');
g(t) vs t
Amplitude
Time(s)
|G(f)| vs f
Magnitude
Frequency(Hz)

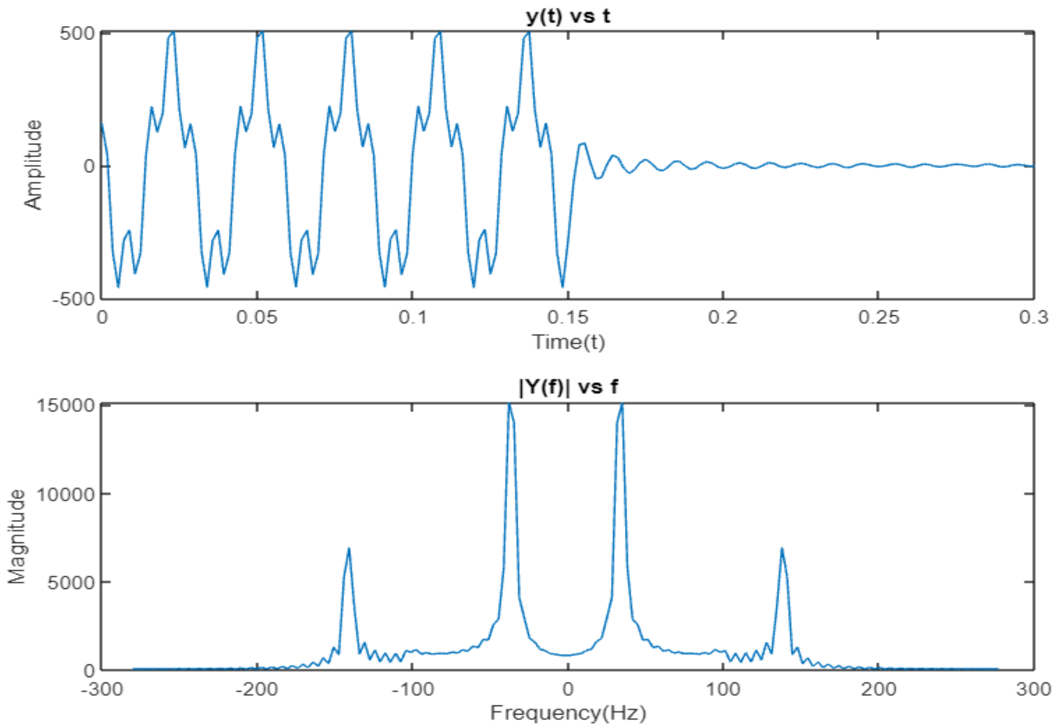
Q2)

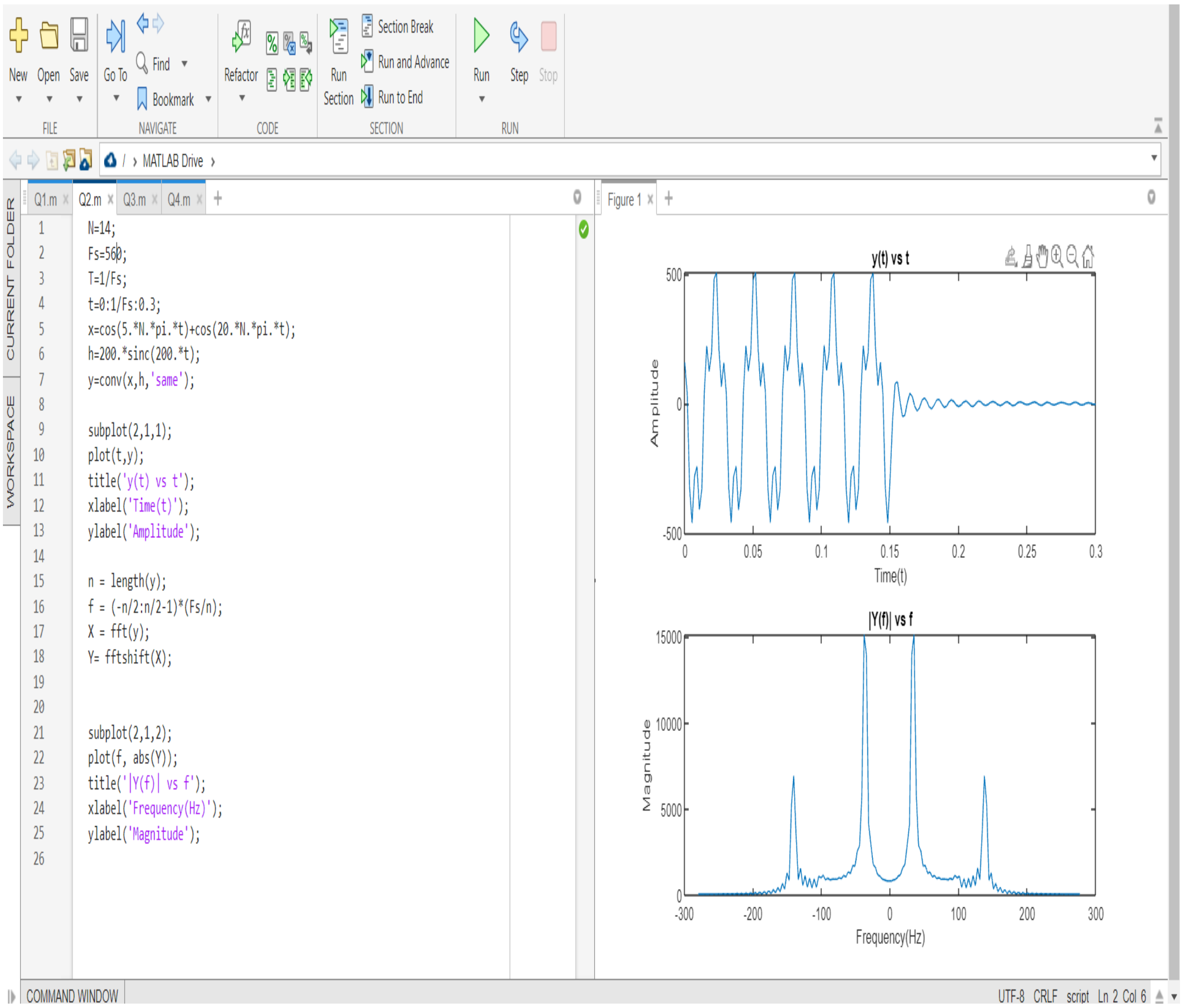
```
N=14;
Fs=560;
T=1/Fs;
t=0:1/Fs:0.3;
x=cos(5.*N.*pi.*t)+cos(20.*N.*pi.*t);
h=200.*sinc(200.*t);
y=conv(x,h,'same');
subplot(2,1,1);
plot(t,y);
title('y(t) vs t');
xlabel('Time(t)');
ylabel('Amplitude');
n = length(y);
f = (-n/2:n/2-1)*(Fs/n);
X = fft(y);
Y= fftshift(X);
subplot(2,1,2);
plot(f, abs(Y));
title('|Y(f)| vs f');
xlabel('Frequency(Hz)');
ylabel('Magnitude');

//N = 5 + 1 + 8 = 14 (5 for all dual degree students + last 2 digits of BITS ID)
//Nyquist rate=2*(20*14pi)=560pi(rad/sec)=280(Hz)
//Fs=2*Fnq=560(Hz)
```

Observations -

- **x(t) is the sum of two cos functions in time domain. Fourier transform of cos gives two impulses in frequency domain. We obtain four impulses when x(t) is convolved with h(t) and this verifies the linear property of convolution.**


y(t) vs t
Amplitude
Time(t)
500
0
-500
0
0.05
0.1
0.15
0.2
0.25
0.3
|Y(f)| vs f
Magnitude
Frequency(Hz)
15000
10000
5000
0
-300
-200
-100
0
100
200
300


New
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NAVIGATE
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Section Break
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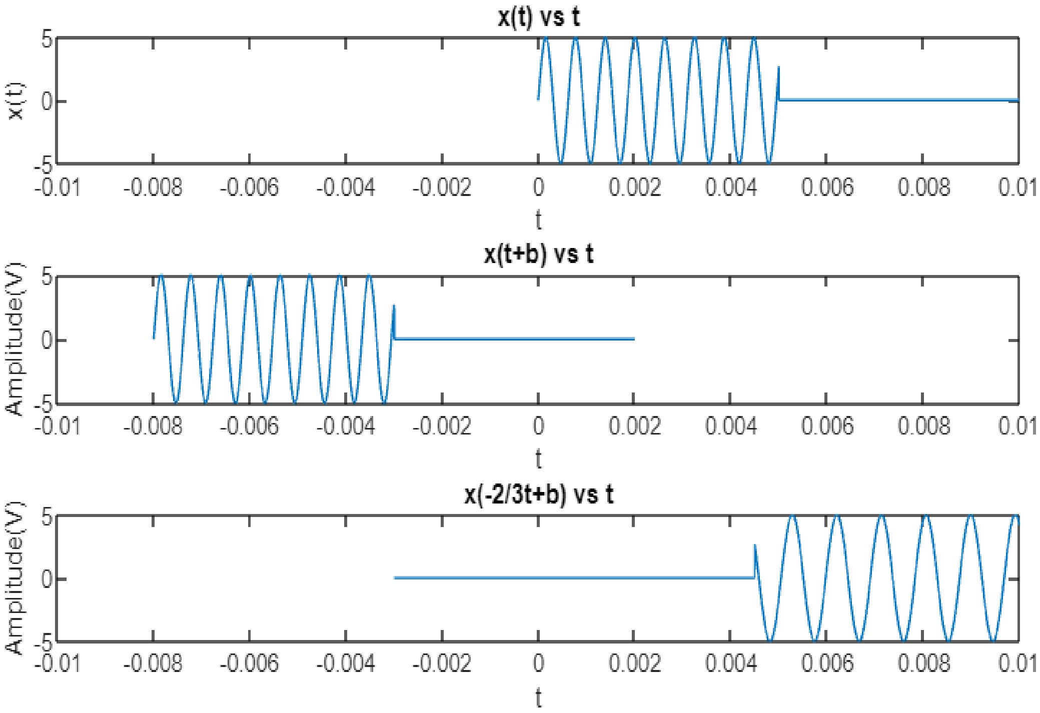
MATLAB Drive
Q1.m
Q2.m
Q3.m
Q4.m
Figure 1
CURRENT FOLDER
WORKSPACE
N=14;
Fs=560;
T=1/Fs;
t=0:1/Fs:0.3;
x=cos(5.*N.*pi.*t)+cos(20.*N.*pi.*t);
h=200.*sinc(200.*t);
y=conv(x,h,'same');
subplot(2,1,1);
plot(t,y);
title('y(t) vs t');
xlabel('Time(t)');
ylabel('Amplitude');
n = length(y);
f = (-n/2:n/2-1)*(Fs/n);
X = fft(y);
Y= fftshift(X);
subplot(2,1,2);
plot(f, abs(Y));
title('|Y(f)| vs f');
xlabel('Frequency(Hz)');
ylabel('Magnitude');
y(t) vs t
Amplitude
Time(t)
|Y(f)| vs f
Magnitude
Frequency(Hz)
COMMAND WINDOW
UTF-8 CRLF script Ln 2 Col 6

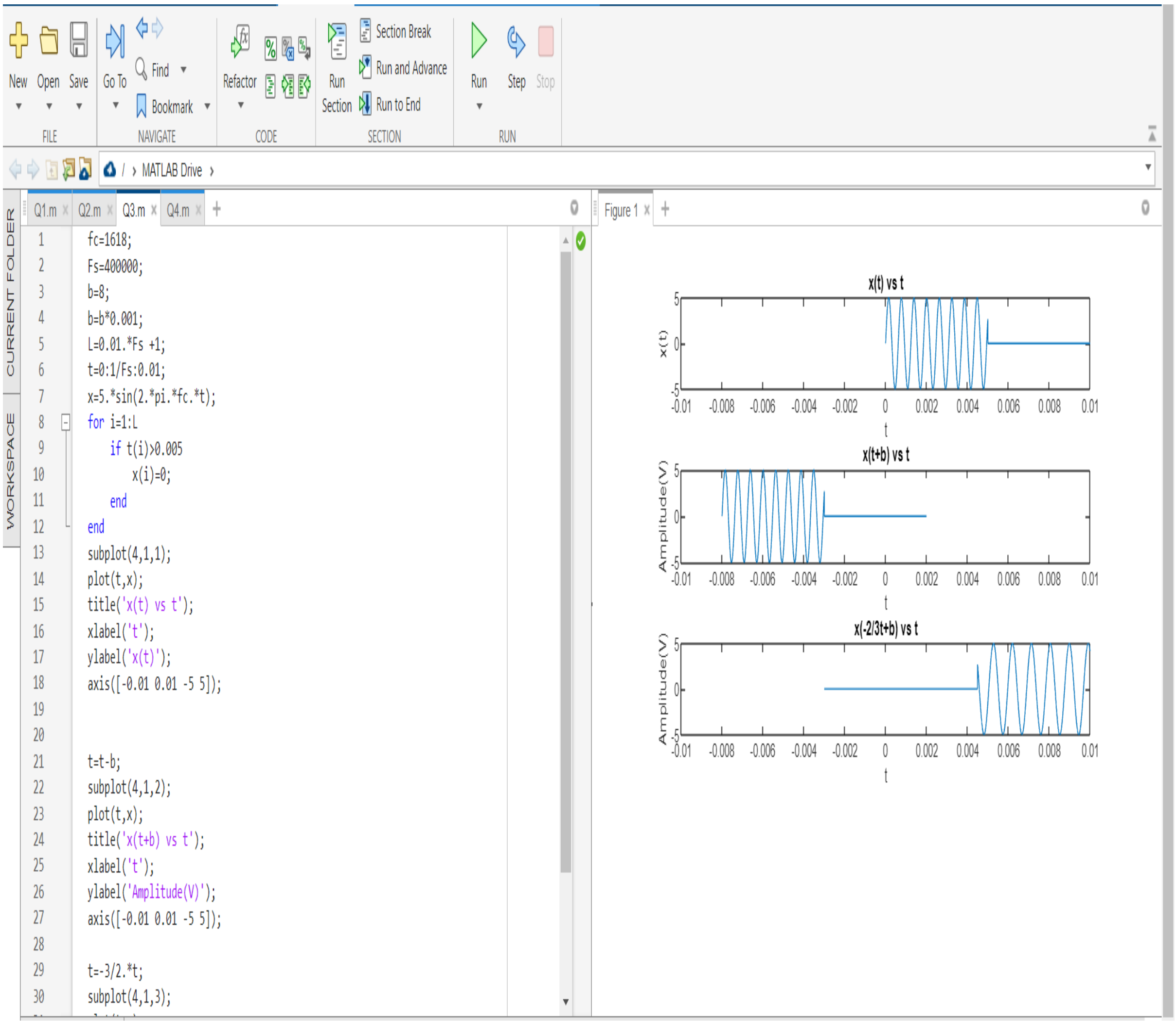
Q3)

```
fc=1618;
Fs=400000;
b=8;
b=b*0.001;
L=0.01.*Fs +1;
t=0:1/Fs:0.01;
x=5.*sin(2.*pi.*fc.*t);
for i=1:L
   if t(i)>0.005
       x(i)=0;
   end
end
subplot(4,1,1);
plot(t,x);
title('x(t) vs t');
xlabel('t');
ylabel('x(t)');
axis([-0.01 0.01 -5 5]);
t=t-b;
subplot(4,1,2);
plot(t,x);
title('x(t+b) vs t');
xlabel('t');
ylabel('Amplitude(V)');
axis([-0.01 0.01 -5 5]);
t=-3/2.*t;
subplot(4,1,3);
plot(t,x);
title('x(-2/3t+b) vs t');
xlabel('t');
ylabel('Amplitude(V)');
axis([-0.01 0.01 -5 5]);
```

Observations -

• The results and the following plots verify SCALING and SHIFTING properties.


x(t) vs t
x(t)
t
x(t+b) vs t
Amplitude(V)
t
x(-2/3t+b) vs t
Amplitude(V)
t


New
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NAVIGATE
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SECTION
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Q1.m
Q2.m
Q3.m
Q4.m
Figure 1
CURRENT FOLDER
WORKSPACE
fc=1618;
Fs=400000;
b=8;
b=b*0.001;
L=0.01.*Fs +1;
t=0:1/Fs:0.01;
x=5.*sin(2.*pi.*fc.*t);
for i=1:L
if t(i)>0.005
x(i)=0;
end
end
subplot(4,1,1);
plot(t,x);
title('x(t) vs t');
xlabel('t');
ylabel('x(t)');
axis([-0.01 0.01 -5 5]);
t=t-b;
subplot(4,1,2);
plot(t,x);
title('x(t+b) vs t');
xlabel('t');
ylabel('Amplitude(V)');
axis([-0.01 0.01 -5 5]);
t=-3/2.*t;
subplot(4,1,3);
x(t) vs t
x(t+b) vs t
x(-2/3t+b) vs t
Amplitude(V)

Q4)

```
a=6; //BITS ID - 2019B4A30618P -> a=6, b=1, c=8
b=1;
c=8;
x=[a b c];
y=[c b a];
zplane(x,y);
grid on;
title('Pole-Zero Plot');
legend('Zero','Pole','Unit Circle');
```

Observations -

• The system's poles and zeroes are obtained by solving the quadratic polynomial in s. These polynomials when plotted on the s-plane give us the pole-zero plot which helps us to determine the stability of the system. Since poles are present on left half of s-plane, the given system is stable.