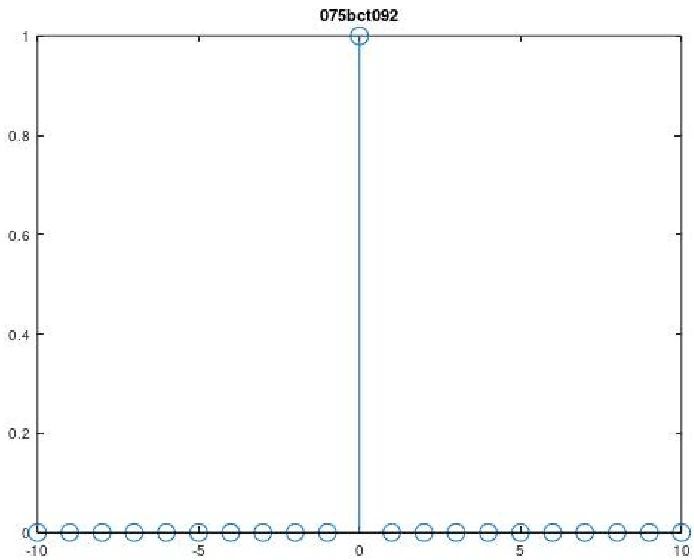
1. Plot the basic signal using Matlab
   a) Impulse response
   b) Unit step
   c) Ramp
   d) Rectangular

a) Code:

```
t=-10:10;
s = (t==0);
stem(t,s);
title('075bct092');
```

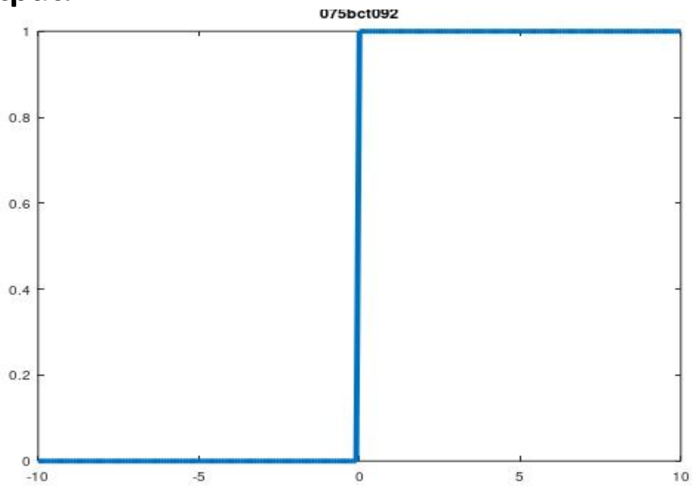
Output:



b) Code:

```
t=-10:0.1:10;
s = (t>=0);
plot(t,s,'LineWidth',2);
title('075bct092');
```

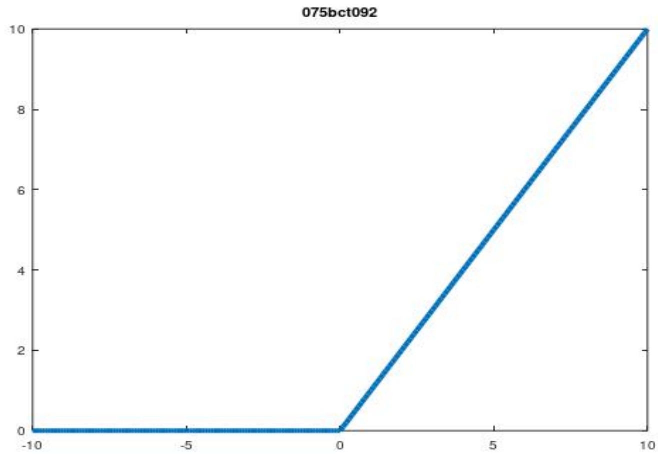
Output:



C) **Code:**

```
t=-10:0.1:10;
a=1;
s = a*t.*(t>=0);
plot(t,s,'LineWidth',2);
title('075bct092');
```

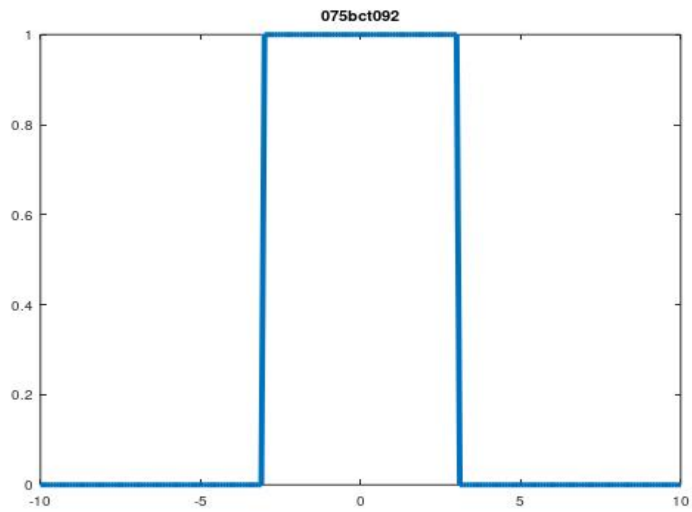
Output:



D) **Code:**

```
t=-10:0.1:10;
a=3;
s = (abs(t)<=a);
plot(t,s,'LineWidth',2);
title('075bct092');
```

Output:



2. Plot the following continuous-time signals.

a) $x(t)=Ce^{at}$ where **C** and **a** are real numbers and choose **C** and **a** both positive and negative.

b) Plot the same signal taking **a** as pure imaginary number.

c) Consider complex exponential signal as specified in **b)** where **C** is expressed in polar form i.e., ($C=|C|e^{j\theta}$) & **a** in rectangular form i.e., ($a=r+j\omega_o$). Then your function $x(t)$, on simplification, becomes

$$x(t)= |C|e^{rt}[cos(\omega_o t+\theta)+jsin(\omega_o t+\theta)]$$

Now, plot the signal for different values of **r** and comment on the results.

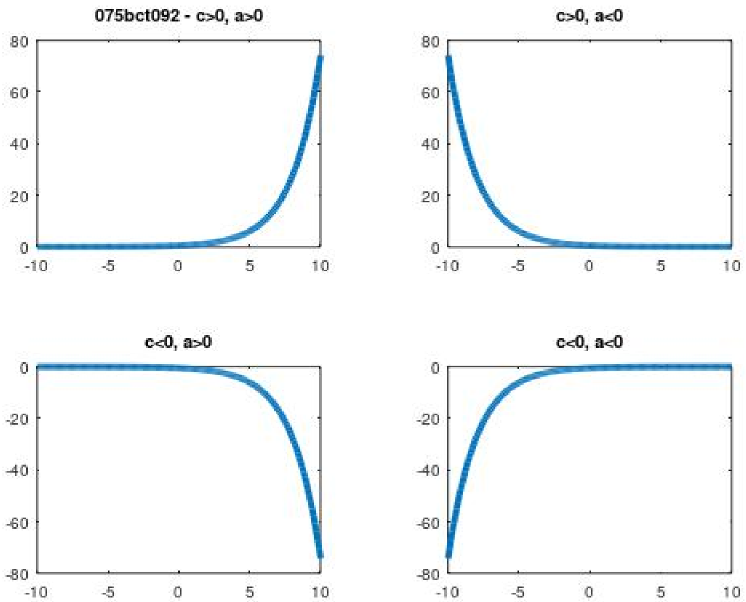
i $r=0$
ii. $r<0$
iii $r>0$

A) Code:

```
t = -10:0.1:10;
c = .5;
a = .5;
x = c*exp(a*t);
subplot(2,2,1);
plot(t,x,'LineWidth',2);
title('075bct092 - c>0, a>0');
a = -.5;
x = c*exp(a*t);
subplot(2,2,2);
plot(t,x,'LineWidth',2);
title('c>0, a<0');
```

```
c = -.5;
a = .5;
x = c*exp(a*t);
subplot(2,2,3);
plot(t,x,'LineWidth',2);
title('c<0, a>0');
a = -.5;
x = c*exp(a*t);
subplot(2,2,4);
plot(t,x,'LineWidth',2);
title('c<0, a<0');
```

Output:

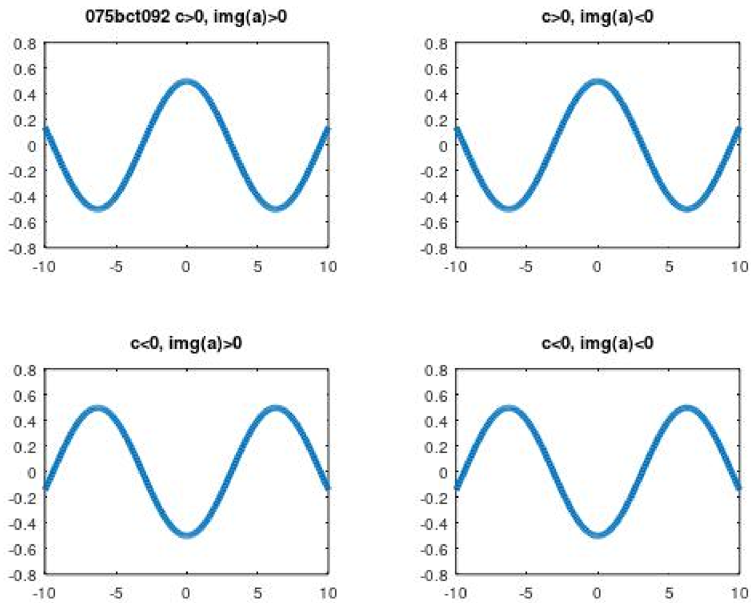


B) **Code:**

```
t = -10:0.1:10;
c = .5;
a = .5i;
x = c*exp(a*t);
subplot(2,2,1);
plot(t,x,'LineWidth',2);
title('075bct092 c>0, img(a)>0');
a = -.5i;
x = c*exp(a*t);
subplot(2,2,2);
plot(t,x,'LineWidth',2);
```

```
title('c>0, img(a)<0');
c = -.5;
a = .5i;
x = c*exp(a*t);
subplot(2,2,3);
plot(t,x,'LineWidth',2);
title('c<0, img(a)>0');
a = -.5i;
x = c*exp(a*t);
subplot(2,2,4);
plot(t,x,'LineWidth',2);
title('c<0, img(a)<0');
```

Output:

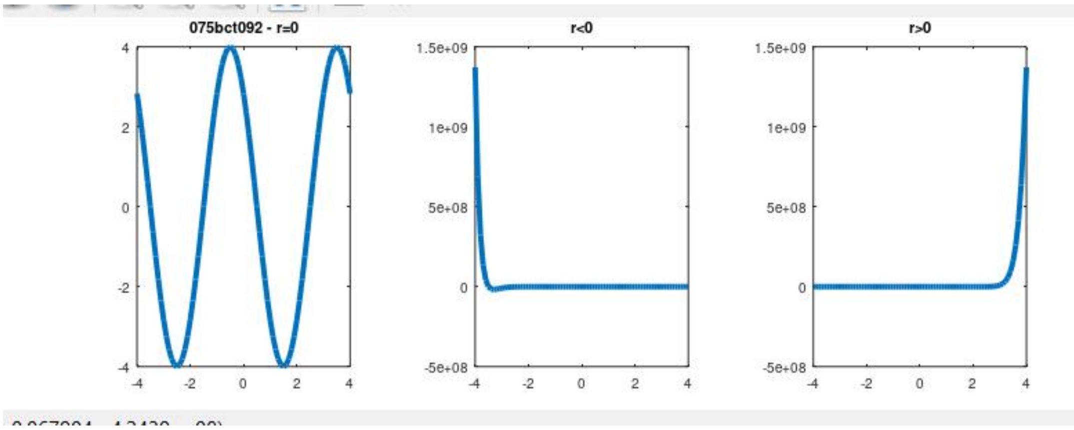


c) Code:

```
t = -4:0.1:4;
c = 4;
r = 0;
w0 = 2*pi/4;
theta = pi/4;
x = abs(c)*exp(r*t).*(cos(w0*t+theta)+1i*sin(w0*t+theta));
subplot(1,3,1);
plot(t,x,'LineWidth',2);
title('075bct092 - r=0');
```

```
r = -5;
x = abs(c)*exp(r*t).*(cos(w0*t+theta)+1i*sin(w0*t+theta));
subplot(1,3,2);
plot(t,x,'LineWidth',2);
title('r<0');
r = 5;
x = abs(c)*exp(r*t).*(cos(w0*t+theta)+1i*sin(w0*t+theta));
subplot(1,3,3);
plot(t,x,'LineWidth',2);
title('r>0');
```

Output:



3. Plot the DT exponential function

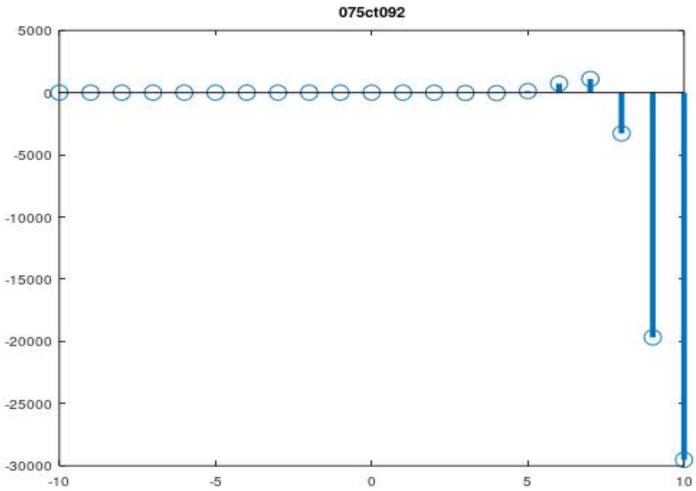
$x[n] = a^n, a = |a|e^{j\theta}$

Choose the suitable value of $|a|$ and θ, then plot the function $x[n]$.

Code:

```
n= -10:10;
a= 3;
theta = pi/3;
func = power(abs(a)*exp(i*theta),n);
stem(n,func,'LineWidth',2);
title('075ct092');
```

Output:

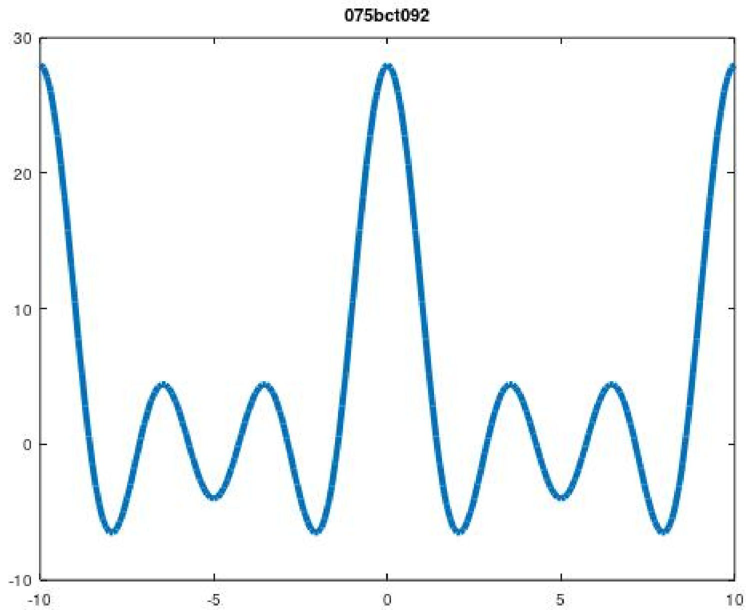


4. Synthesize the signal from the FS Coefficients as $C_0=1,\ C_1=C_{-1}=1/4,\ C_2=C_{-2}=1/2,\ C_3=C_{-3}=1/3$.

Code:

```
C = [1/3, 1/2, 1/4, 1, 1/4, 1/2, 1/3];
n= -10:0.1:10;
w= 2*pi/10;
x=zeros(size(n));
for k = -3:3
        x = x + (k+4)*exp(i*k*w*n);
end
plot(n,x,'LineWidth',2);
title('075bct092');
```

Output:

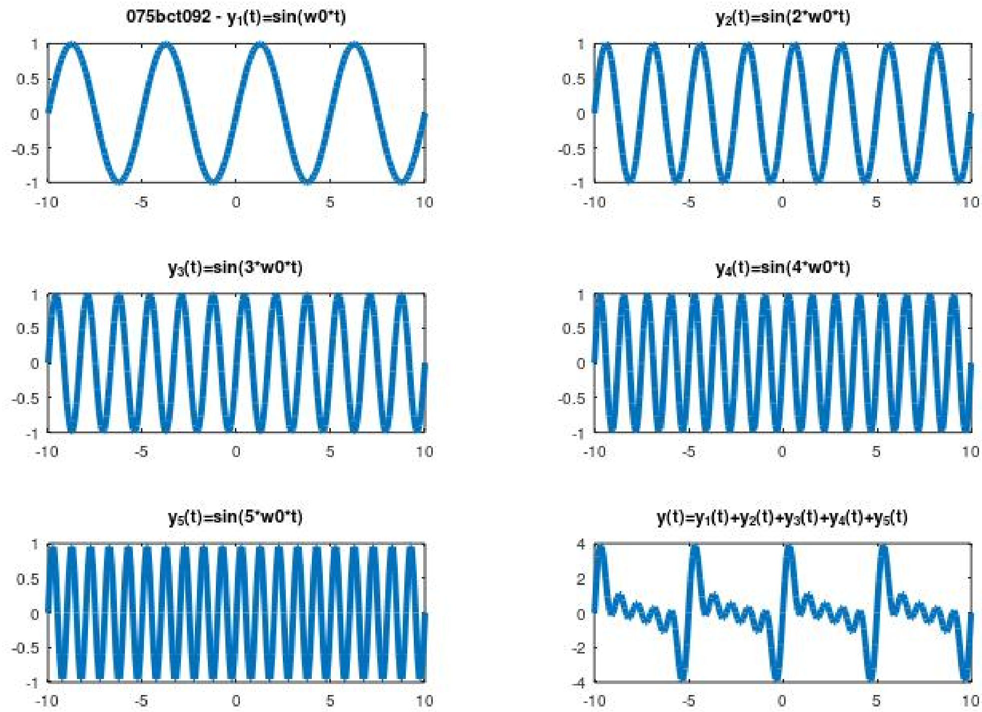


5. Plot fundamental sinusoidal signal, its higher harmonics up to 5th harmonics and add all of them to see the result. Comment on the result.

Code:

```
t=-10:0.1:10;
w0=2*pi/5;
y1=sin(w0*t);
subplot(3,2,1);
plot(t,y1,'LineWidth',2);
title('075bct092 - y_1(t)=sin(w0*t)');
y2=sin(2*w0*t);
subplot(3,2,2);
plot(t,y2,'LineWidth',2);
title('y_2(t)=sin(2*w0*t)');
y3=sin(3*w0*t);
subplot(3,2,3);
plot(t,y3,'LineWidth',2);
title('y_3(t)=sin(3*w0*t)');
y4=sin(4*w0*t);
subplot(3,2,4);
plot(t,y4,'LineWidth',2);
title('y_4(t)=sin(4*w0*t)');
y5=sin(5*w0*t);
subplot(3,2,5);
plot(t,y5,'LineWidth',2);
title('y_5(t)=sin(5*w0*t)');
y=y1+y2+y3+y4+y5;
subplot(3,2,6);
plot(t,y,'LineWidth',2);
title('y(t)=y_1(t)+y_2(t)+y_3(t)+y_4(t)+y_5(t)');
```

Output:


075bct092 - y1(t)=sin(w0*t)
y2(t)=sin(2*w0*t)
y3(t)=sin(3*w0*t)
y4(t)=sin(4*w0*t)
y5(t)=sin(5*w0*t)
y(t)=y1(t)+y2(t)+y3(t)+y4(t)+y5(t)