Name:Eeshan Pandey

Reg no-18BIT0389

Assignment: 1

Course Code: MAT2002

Slot: L11+L12

Ques. 1 Find the Fourier series for the function defined by:

$$f(x) = x^2 - 2, \; -2 < x < 2.$$

Also find the first 3 harmonics of the same.

Ans 1.

MATLAB Code:

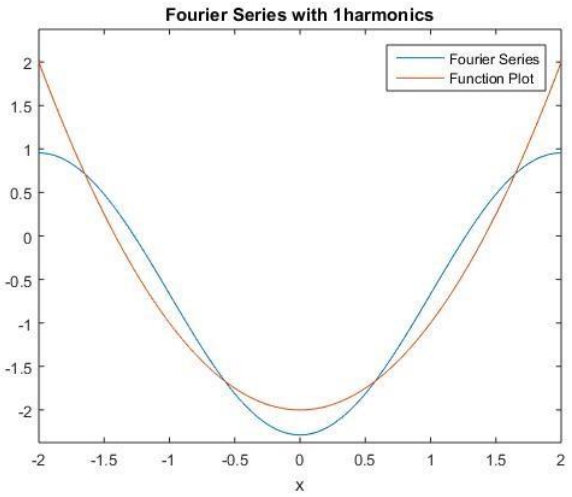
```
clear all
close all
clc syms
x
f =input('Enter the function of x: ');
I=input('Enter the interval of [a,b]: ');
m=input('Enter the number of Harmonics required: ');
a=I(1);b=I(2); L=(b-a)/2; a0=(1/L)*int(f,a,b);
Fx=a0/2; for n=1:m figure;
an(n)=(1/L)*int(f*cos(n*pi*x/L),a,b);
bn(n)=(1/L)*int(f*sin(n*pi*x/L),a,b);
Fx=Fx+an(n)*cos(n*pi*x/L)+bn(n)*sin(n*pi*x/L);
Fx=vpa(Fx,4); ezplot(Fx,[a,b]); hold on
ezplot(f,[a,b]);
title(['Fourier Series with ',num2str( n ),'harmonics']);
legend('Fourier Series', 'Function Plot'); hold off end
disp(strcat('Fourier series with', num2str(n),'harmonics is:',char(Fx)))
```

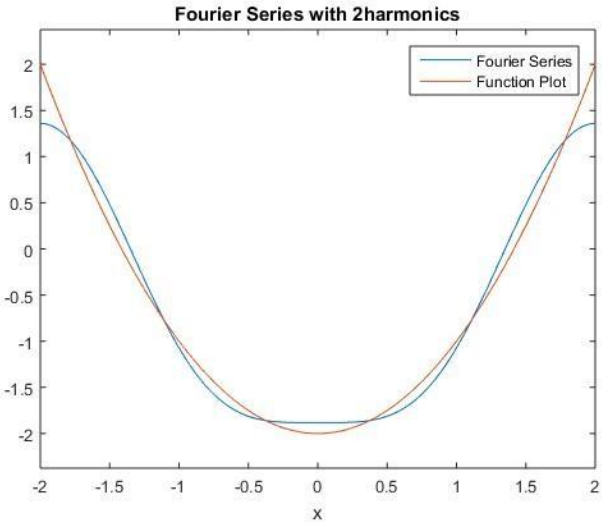
Input:

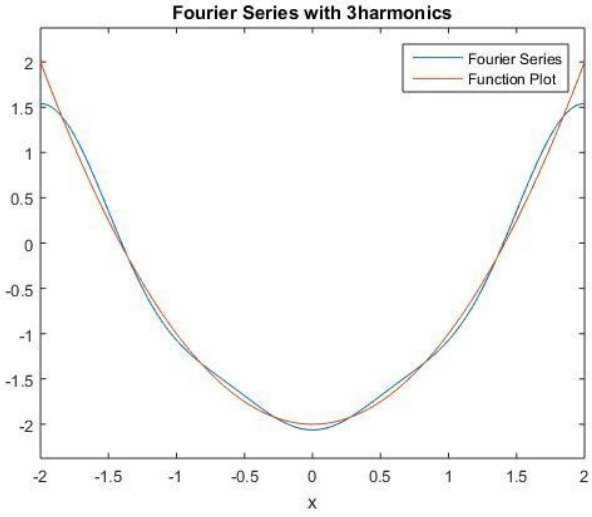
```
Enter the function of x: x^(2)-2
Enter the interval of [a,b]: [-2,2]
Enter the number of Harmonics required: 3
```

Output:

```
Fourier series with3harmonics is:0.4053*cos(3.142*x) - 1.621*cos(1.571*x) -
0.1801*cos(4.712*x) - 0.6667
```


Fourier Series with 1harmonics
Fourier Series
Function Plot
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
x


Fourier Series with 2harmonics
Fourier Series
Function Plot
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
x


Fourier Series with 3harmonics
Fourier Series
Function Plot
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
x

Ques 2. Find the first two harmonics of the Fouries series for function y given by the data

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
y	1.0	1.4	1.9	1.7	1.5	1.2	1.0

Ans. 2

MATLAB Code:

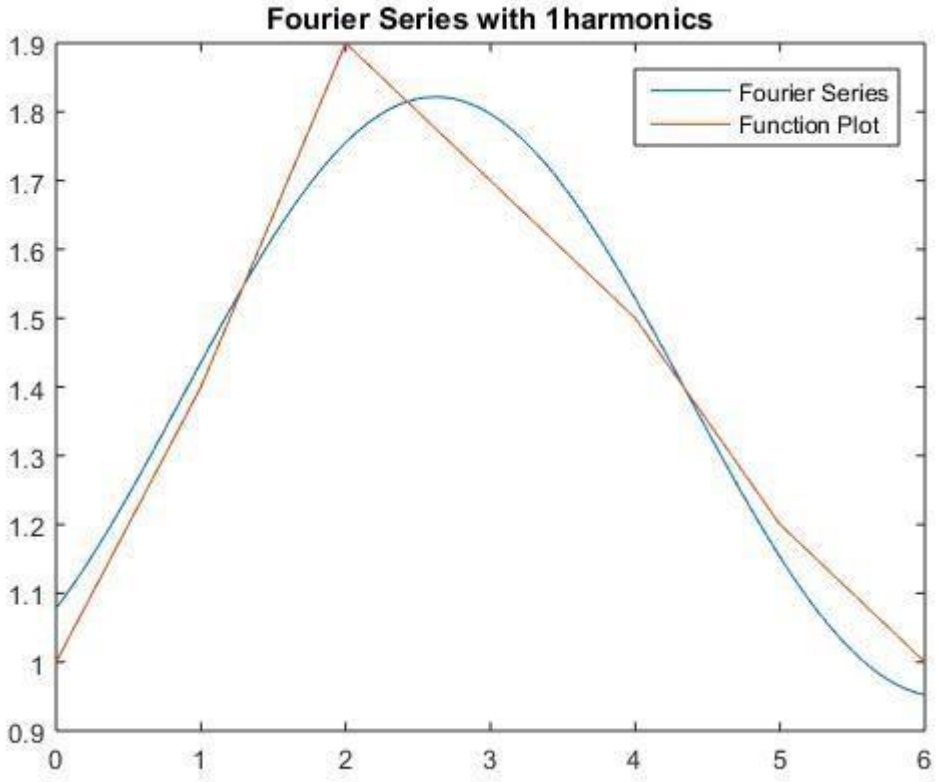
```
clear all
clc syms
t
x=input('Enter the equally spaced values of x:');
y=input('Enter the values of y=f(x):');
m=input('Enter the number of harmonics required:');
n=length(x);a=x(1);b=x(n); h=x(2)-x(1); L=(b-
a+h)/2; theta=pi*x/L; a0=(2/n)*sum(y);
Fx=a0/2; x1=linspace(a,b,100);
for i=1:m figure
an=(2/n)*sum(y.*cos(i*theta)); bn=(2/n)*sum(y.*sin(i*theta));
Fx=Fx+an*cos(i*pi*t/L)+bn*sin(i*pi*t/L) ;
Fx=vpa(Fx,4);
Fx1=subs(Fx,t,x1);
plot(x1,Fx1); hold
on plot(x,y);
title(['Fourier Series with ',num2str( i ),'harmonics']) legend('Fourier
Series', 'Function Plot') hold off; end disp(strcat('Fourier series
with', num2str(i),'harmonicsis:',char(Fx)));
```

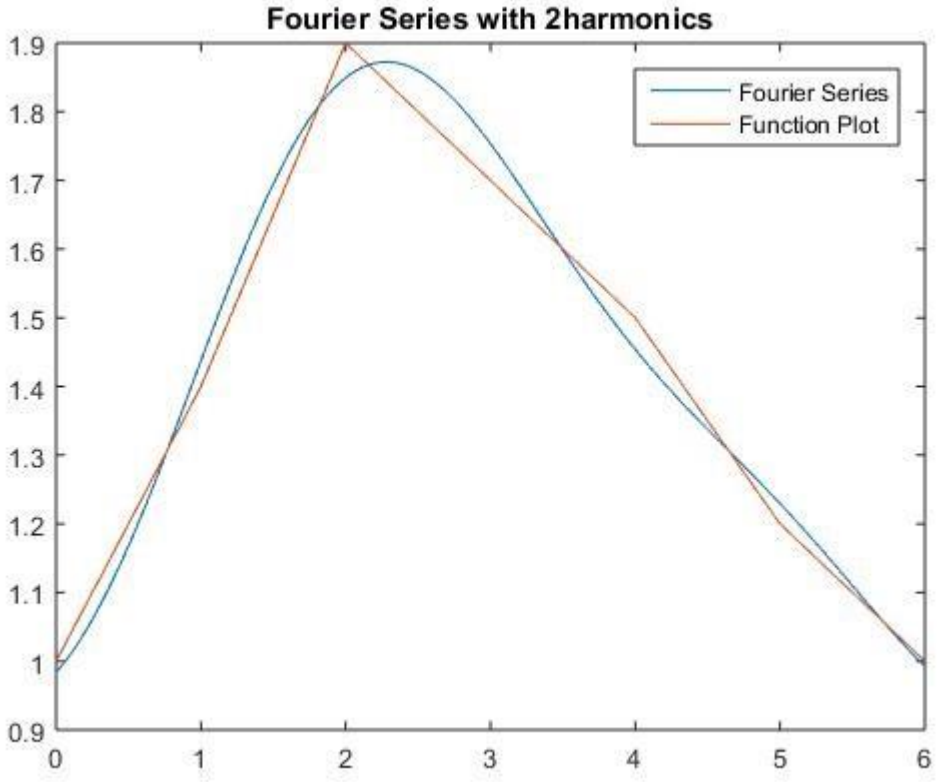
Input:

```
Enter the equally spaced values of x:0:2*pi
Enter the values of y=f(x):[1.0 1.4 1.9 1.7 1.5 1.2 1.0]
Enter the number of harmonics required:2
```

Output:

```
Fourier series with2harmonicsis:0.3091*sin(0.8976*t) - 0.09482*cos(1.795*t) -
0.3076*cos(0.8976*t) - 0.02003*sin(1.795*t)
```


Fourier Series with 1harmonics
Fourier Series
Function Plot
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0
1
2
3
4
5
6


Fourier Series with 2harmonics
Fourier Series
Function Plot
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0
1
2
3
4
5
6