MATLAB – 1

CODE:

```
clc
clear all
syms x1 x2 x3 x4
A = (2*x1)-(x3) == 0;
B = (4*x1)-(x4) == 0;
C = (2*x2)-(2*x3)-x4 == 0;
fprintf('20BCD7171 MAJJIGA JASWANTH \n')
[X,Y] = equationsToMatrix([A,B,C],[x1,x2,x3,x4])
z = linsolve(X,Y)
```

```
20BCD7171 MAJJIGA JASWANTH
X =
```

$$\begin{pmatrix} 2 & 0 & -1 & 0 \\ 4 & 0 & 0 & -1 \\ 0 & 2 & -2 & -1 \end{pmatrix}$$

```
Y =
```

$$\begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

```
Warning: Solution is not unique because the system is rank-deficient.
z =
```

$$\begin{pmatrix} 0 \\ 0 \\ 0 \\ 0 \end{pmatrix}$$

MATLAB

LAB 2

Code :

```
>> syms x1 x2 x3 x4
>> eq1 =x1 -x4 ==160

eq1 =

x1 - x4 == 160

>> eq2 = x1 - x2 ==240

eq2 =

x1 - x2 == 240

>> eq3 = x3-x2==600

eq3 =

x3 - x2 == 600

>> eq4 = x3-x2 == 520

eq4 =

x3 - x2 == 520

>> [A,B] = equationsToMatrix([eq1,eq2,eq3,eq4],[])

A =
```

```
Empty sym: 4-by-0



B =


x4 - x1 + 160
x2 - x1 + 240
x2 - x3 + 600
x2 - x3 + 520

>> [A,B] = equationsToMatrix([eq1,eq2,eq3,eq4],[x1,x2,x3,x4])

A =


[1, 0, 0, -1]
[1, -1, 0,  0]
[0, -1, 1,  0]
[0, -1, 1,  0]



B =


160
240
600
520

>> AB=[A,B]

AB =


[1, 0, 0, -1, 160]
```

```
[1, -1, 0,  0, 240]
[0, -1, 1,  0, 600]
[0, -1, 1,  0, 520]

>> alpha=A(2,1)/A(1,1)

alpha =

1

>> AB(2,:)

ans =

[1, -1, 0, 0, 240]

>> AB(1,:)

ans =

[1, 0, 0, -1, 160]

>> AB(2,:)=AB(2,:)-alpha*AB(1,:)

AB =

[1, 0, 0, -1, 160]
[0, -1, 0,  1, 80]
[0, -1, 1,  0, 600]
[0, -1, 1,  0, 520]

>> alp = A(3,2)/A(2,2)
```

```
alp =

1

>> AB(3,:)=AB(3,:)-alp*AB(2,:)

AB =

[1, 0, 0, -1, 160]
[0, -1, 0, 1, 80]
[0, 0, 1, -1, 520]
[0, -1, 1, 0, 520]

>> alp=A(4,3)/A(3,3)

alp =

1

>> AB(4,:)=AB(4,:)-alp*AB(3,:)

AB =

[1, 0, 0, -1, 160]
[0, -1, 0, 1, 80]
[0, 0, 1, -1, 520]
[0, -1, 0, 1,  0]
>> syms k
>> x4 = k
```

```
x4 =

k
x3 =

k + 520

>> x2 = -AB(2,5)+x4

x2 =

k - 80

>> x1=AB(1,5)+x4

x1 =

k + 160

>> x4=0

x4 =

    0

>> x3 =AB(3,5)+x4

x3 =

520

>> x2 = -AB(2,5)+x4
```

```
x2 =

-80

>> x1=AB(1,5)+x4

x1 =

160

>> x4 =10

x4 =

    10

>> x3=520+x4

x3 =

   530

>> x2=-80+x4

x2 =

   -70

>> x1=160+x4

x1 =
```

```
   170

>>
```

MATLAB-3

CODE:

```
%MATLAB-3
clc
clear all
fprintf("MAJJIGA JASWANTH \n20BCD7171")
X = [0 0 1 1;1 0 0 0;1 1 0 1;1 1 0 0]
a = 0.85;
delta = 0.0375;
z = sum(X,1)

for i = 1:4
    for j =1:4
        if z(j) == 0;
            Y(i,j) = delta;
        else
            Y(i,j) = ((a*X(i,j))/z(j))+delta;
        end
    end
end
disp(Y)
[B,D]=eigs(X);
p = B(:,1);
x = p/sum(p);
n=char(65:68);
for i = 1:1:4
    fprintf("page rank of"+x(i)+"is"+p(i)+"\n")
end
```

```
MAJJIGA JASWANTH
20BCD7171
X = 4x4
     0     0     1     1
     1     0     0     0
     1     1     0     1
     1     1     0     0

z = 1x4
     3     2     1     2

    0.0375    0.0375    0.8875    0.4625
    0.3208    0.0375    0.0375    0.0375
    0.3208    0.4625    0.0375    0.4625
    0.3208    0.4625    0.0375    0.0375

page rank of0.28879is0.55529
page rank of0.14812is0.2848
page rank of0.33901is0.65184
page rank of0.22408is0.43086
```

MATLAB – 4

Question 1: Use the matrix [4 1;3 1] to obtain the Hill cipher encryption for the plain text message ‘UTES’

Code:

```
>> w = 'UTES'

w =

    'UTES'

>> x = double(w);
>> x = reshape(mssg,2,2);
>> x = mssg-65;
>> key = [4 1;3 1]

key =

     4     1
     3     1

>> encrypt = key*x

encrypt =

  -226  -291
  -181  -230

>> encrypt=mod(encrypt,26);
>> encrypt = encrypt +65;
>> encrypt = reshape(encrypt,1,4);
>> disp('The msg that encrypted is:')
The msg that encrypted is:
>> encrypt = char(encrypt)

encrypt =
```

```
encrypt =

    'IBVE'

>>
```

Question 2:

Use the matrix [4 1;3 1] to obtain the Hill cipher decryption the above decrypted message (VBIE).

```
>>  X ='VBIE'

X =

    'VBIE'

>> A=double(X);
A=reshape(A,2,2)

A =

    86    73
    66    69

>>  A=A-65;
key = [4 1;3 1];
d = inv(key);
d = mod(d,26)

d =

     1    25
    23     4

>>
>> decrypt = d*A;
decrypt = mod(decrypt,26);
decrypt = reshape(decrypt,1,4);
>> decrypt = decrypt +65;
>> decrypt = reshape(decrypt,1,4);
disp('THE MSG THAT DECRYPTED IS:')
```

```
disp('THE MSG THAT DECRYPTED IS:')
THE MSG THAT DECRYPTED IS:
>>
>> decrypt = char(decrypt)

decrypt =

    'UTES'

>>
```

MATLAB 5

CODE:

```
clc
clear all
syms y(x) x
for n = 1:6
    eqn = (1-x^2)*diff(y,2)-2*x*diff(y,1)+n*(n+1)*y==0
    s = dsolve(eqn)
end
```

OUTPUT:

EQN(X) =

$$-(x^2-1)\frac{\partial^2}{\partial x^2}\,y(x)-2\,x\frac{\partial}{\partial x}\,y(x)+2\,y(x)=0$$

S =

$$C_1\,x+C_2\left(\frac{x\log\left(-\frac{x+1}{x-1}\right)}{2}-1\right)$$

EQN(X) =

$$-(x^2-1)\frac{\partial^2}{\partial x^2}\,y(x)-2\,x\frac{\partial}{\partial x}\,y(x)+6\,y(x)=0$$

S =

$$C_1\left(\frac{3\,x^2}{2}-\frac{1}{2}\right)-C_2\left(\frac{3\,x}{2}-\frac{\log\left(-\frac{x+1}{x-1}\right)\left(\frac{3\,x^2}{2}-\frac{1}{2}\right)}{2}\right)$$

EQN(X) =

$$-(x^2-1)\frac{\partial^2}{\partial x^2}\,y(x)-2\,x\frac{\partial}{\partial x}\,y(x)+12\,y(x)=0$$

S =

$$-C_1\left(\frac{3\,x}{2}-\frac{5\,x^3}{2}\right)-C_2\left(\frac{\log\left(-\frac{x+1}{x-1}\right)\left(\frac{3\,x}{2}-\frac{5\,x^3}{2}\right)}{2}+\frac{5\,x^2}{2}-\frac{2}{3}\right)$$

EQN(X) =

$$-(x^2-1)\frac{\partial^2}{\partial x^2}\,y(x)-2\,x\frac{\partial}{\partial x}\,y(x)+20\,y(x)=0$$

S =

$$C_1\,\sigma_1 + C_2\left(\frac{15\,x}{8} + \frac{\log\left(-\frac{x+1}{x-1}\right)\,\sigma_1}{2} - \frac{5\,x\,\left(\frac{3\,x^2}{2} - \frac{1}{2}\right)}{6} - \frac{25\,x^3}{8}\right)$$

where

$$\sigma_1 = \frac{35\,x^4}{8} - \frac{15\,x^2}{4} + \frac{3}{8}$$

EQN(X) =

$$-(x^2-1)\,\frac{\partial^2}{\partial x^2}\,y(x) - 2\,x\,\frac{\partial}{\partial x}\,y(x) + 30\,y(x) = 0$$

S =

$$C_1\,\sigma_1 + C_2\left(\frac{3\,x\,\left(\frac{3\,x}{2} - \frac{5\,x^3}{2}\right)}{4} + \frac{9\,x^2}{2} - \frac{21\,x^4}{4} + \frac{\log\left(-\frac{x+1}{x-1}\right)\,\sigma_1}{2} - \frac{\left(\frac{3\,x^2}{2} - \frac{1}{2}\right)^2}{3} - \frac{9}{20}\right)$$

where

$$\sigma_1 = \frac{63\,x^5}{8} - \frac{35\,x^3}{4} + \frac{15\,x}{8}$$

EQN(X) =

$$-(x^2-1)\,\frac{\partial^2}{\partial x^2}\,y(x) - 2\,x\,\frac{\partial}{\partial x}\,y(x) + 42\,y(x) = 0$$

S =

$$C_1\,\sigma_1 - C_2\left(\frac{35\,x}{16} - \frac{\log\left(-\frac{x+1}{x-1}\right)\,\sigma_1}{2} - \frac{7\,\left(\frac{3\,x}{2} - \frac{5\,x^3}{2}\right)\,\left(\frac{3\,x^2}{2} - \frac{1}{2}\right)}{12} + \frac{7\,x\,\left(\frac{35\,x^4}{8} - \frac{15\,x^2}{4} + \frac{3}{8}\right)}{10} - \frac{245\,x^3}{24} + \frac{147\,x^5}{16}\right)$$

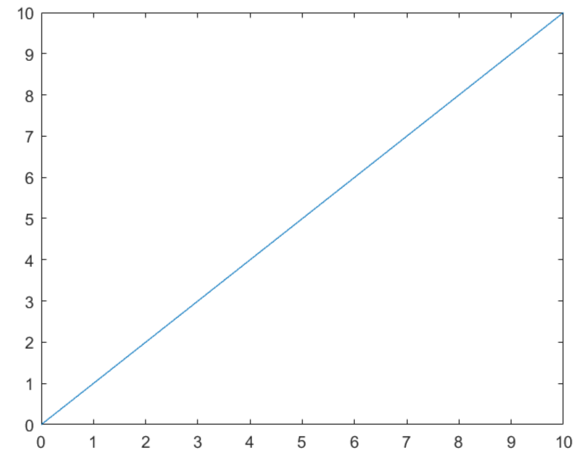
where

$$\sigma_1 = \frac{231\,x^6}{16} - \frac{315\,x^4}{16} + \frac{105\,x^2}{16} - \frac{5}{16}$$

GRAPHS

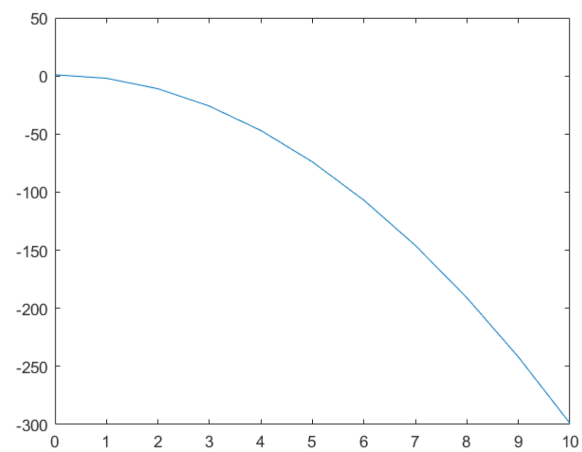
FOR N=1

```
syms y(x) x
Dy = diff(y);
eqn = (1-x.^2).*diff(y,2)-2.*x.*diff(y,1)+2*y==0;
cond = [y(0)==0 , Dy(0)==1];
s = dsolve(eqn,cond);
x = 0:10;
y = eval(vectorize(s));
plot(x,y)
```



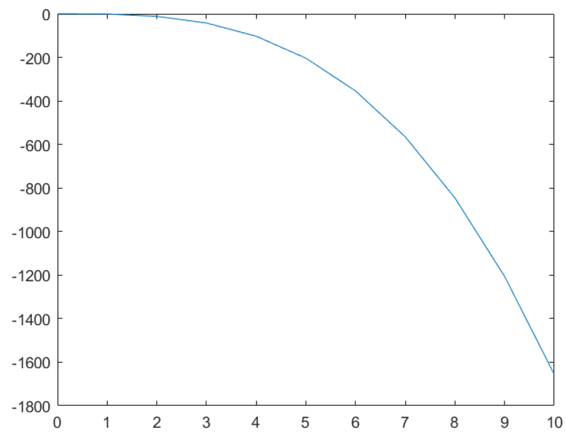
FOR N=2

```
syms y(x) x
Dy = diff(y);
eqn = (1-x.^2).*diff(y,2)-2.*x.*diff(y,1)+6*y==0;
cond = [y(0)==1 , Dy(0)==0];
s = dsolve(eqn,cond);
x = 0:10;
y = eval(vectorize(s));
plot(x,y)
```



FOR N=3

```
syms y(x) x
Dy = diff(y);
eqn = (1-x.^2).*diff(y,2)-2.*x.*diff(y,1)+12*y==0; cond = [y(0)==0 , Dy(0)==1];
s = dsolve(eqn,cond);
x = 0:10;
y = eval(vectorize(s));
plot(x,y)
```



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MATLAB 6

LAB 6

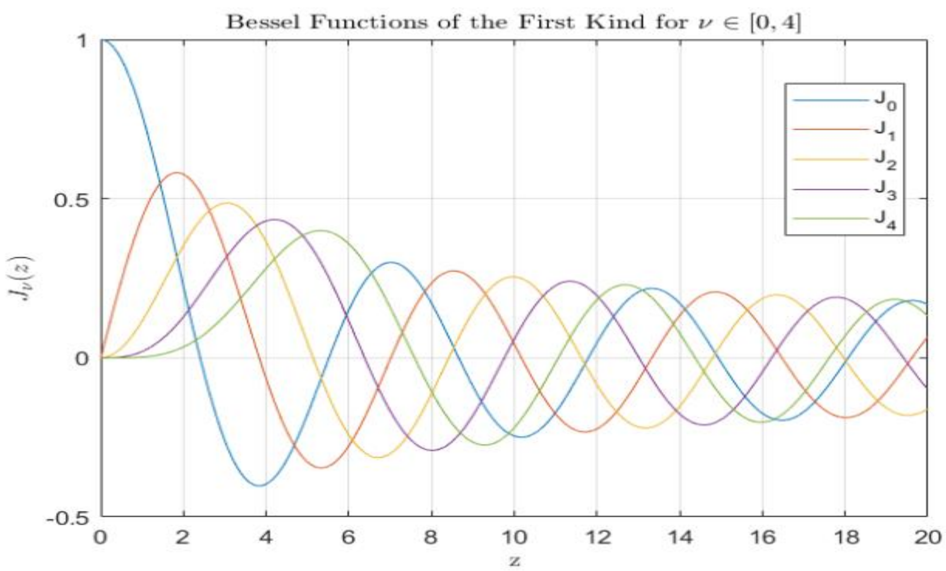
CODE:

```
%plot for besselj and bessely
J = besselj(2, x)
Y = bessely(2, x)
z = 0:0.1:20;
J = zeros(5,201) ;
Y = zeros(5,201) ;

for i = 0:4
J(i+1,:) = besselj(i,z) ;
end
for i = 0:4
Y(i+1,:) = bessely(i,z) ;
end

plot(z,J)
grid on
legend ('J_0','J_1','J_2','J_3','J_4','Location','Best')
title('Bessel Functions of the First Kind for $\nu \in [0,4]$','interpreter','latex')
xlabel('z','interpreter','latex')
ylabel('$J_\nu(z)$','interpreter','latex')
plot(z, Y)
axis([-0.1 20.2 -2 0.6])

grid on
legend('Y_0','Y_1','Y_2','Y_3','Y_4','Location','Best')
title('Bessel Functions of the Second Kind for $\nu \in [0,4]$','interpreter','latex')
xlabel('z','interpreter','latex')
ylabel('$Y_\nu(z)$','interpreter','latex')
```

Output:

J = $\mathbf{J}_2(x)$

Y = $\mathbf{Y}_2(x)$



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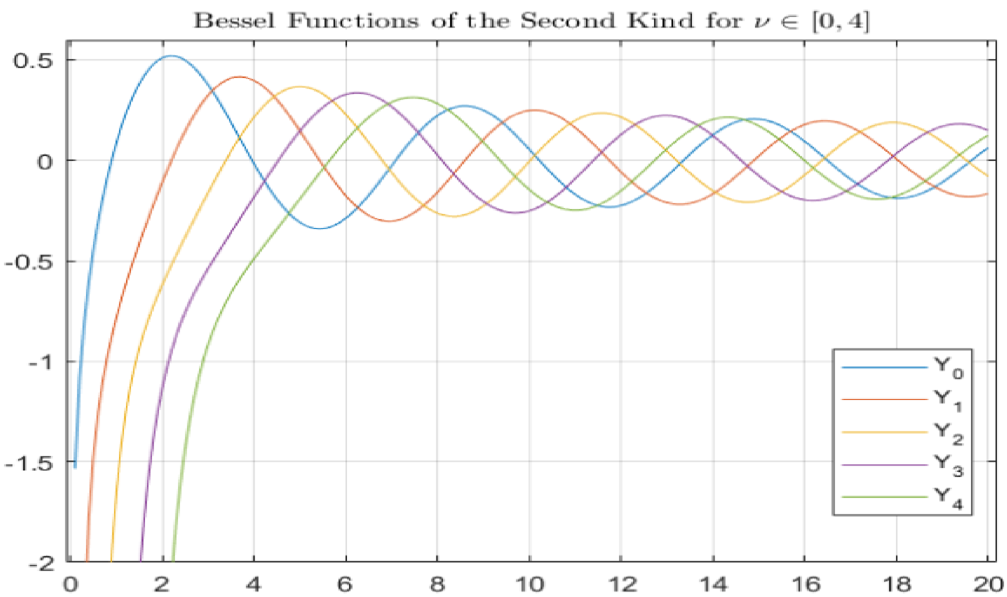
MATLAB 6



Matlab

Lab7

Question:-

Using matlab solve the equation with power series methods

$$x^2y'' + xy' + (3x^2 - 2)y = 0,$$
$$x^2y'' + 2xy' + (x^2 - 1)y = 0,$$
$$x^2y'' + xy' - (4x^2 + \frac{1}{2})y = 0,$$
$$t^2\ y'' - 3\ t\ y' + 4y = 0$$

Code in matlab:

```

fprintf('25.a')
syms y(x) x;
A = x^2*diff(y,x,2)+x*diff(y,x)+(3*x^2-2)*y ==0
dsolve (A)
fprintf ('25.b')
B = x^2*diff(y,x,2)+2*x*diff(y,x)+(x^2-1)*y ==0
fprintf('In terms of Y')
dsolve (B)
fprintf('In terms of Z')

syms z(x);
n = sqrt(5/4);
B = x^2*diff(z,x,2)+x*diff(z,x)+(x^2-n^2)*z ==0
B1 = dsolve(B)
fprintf ('25.c')
C = x^2*diff(y,x,2)+x*diff(y)-(4*x^2+(1/2))*y ==0

dsolve(C)
fprintf('25.d')
syms y(t) t;
D = t^2*diff(y,t,2)-(3*t*diff(y,t))+4*y ==0
dsolve (D)

```

Output:

```
>> bessel
25.a
A(x) =

x^2*diff(y(x), x, x) + x*diff(y(x), x) + y(x)*(3*x^2 - 2) == 0


ans =

C1*besselj(2^(1/2), 3^(1/2)*x) + C2*bessely(2^(1/2), 3^(1/2)*x)

25.b
B(x) =

x^2*diff(y(x), x, x) + y(x)*(x^2 - 1) + 2*x*diff(y(x), x) == 0

In terms of Y
ans =

(C1*besselj(5^(1/2)/2, x))/x^(1/2) + (C2*bessely(5^(1/2)/2, x))/x^(1/2)

In terms of Z
B(x) =

x^2*diff(z(x), x, x) + z(x)*(x^2 - 5/4) + x*diff(z(x), x) == 0


B1 =

C1*besselj(-5^(1/2)/2, x) + C2*bessely(-5^(1/2)/2, x)
```

```
25.c
C(x) =

x^2*diff(y(x), x, x) + x*diff(y(x), x) - y(x)*(4*x^2 + 1/2) == 0


ans =

C1*besselj(2^(1/2)/2, x*2i) + C2*bessely(2^(1/2)/2, x*2i)

25.d
D(t) =

4*y(t) + t^2*diff(y(t), t, t) - 3*t*diff(y(t), t) == 0


ans =

C2*t^2 + C1*t^2*log(t)
```

Matlab

Lab8

Question:-

2. **Forced Oscillations under a Nonsinusoidal Periodic Driving Force:** The forced oscillations of a body of mass m on a spring of modulus k are governed by the ODE

$$my'' + cy' + ky = r$$

Find the steady-state solution for $y(t)$, if $m = 1$ kg, $c == 0.05$g/sec and $k = 25\ g/sec^2$.Where,

$$f(x) = \begin{cases} t + \pi/2 & -\pi \leq t \leq 0 \\ t - \pi/2 & 0 \leq t \leq \pi \end{cases}$$

where, $r(t) = r(t + 2\pi)$.

Code in matlab:

```
clc
clear all
syms x k L U n
f=input('Enter function:');
L=input('Enter lower limit:');
U=input('Enter upper limit:');
l=(U-L)/2;
n=input('Enter no of elements required:');
ak= @ (f,x,k) int(f*cos(k*pi*x/l)/l,x,L,U);
bk= @ (f,x,k) int(f*sin(k*pi*x/l)/l,x,L,U);
fs= @ (f,x,n) ak(f,x,0)/2 + ...
symsum(ak(f,x,k)*cos(k*pi*x/l) + bk(f,x,k)*sin(k*pi*x/l),k,1,n);
pretty(fs(f,x,n))
fst=ak(f,x,0)/2;
for i = 1:n
fst=fst + ak(f,x,i)*cos(i*pi*x/l) + bk(f,x,i)*sin(i*pi*x/l);
disp(['harmonics upto:',num2str(i)]);
disp(fst);
figure(i);
h=ezplot(f,[L,U]);
set(h,'LineWidth',1.5);
hold on
h=ezplot(fst,[L,U]);
set(h,'LineStyle','-','Color',[i/n,1/n,1/n],'LineWidth',1.5);
title(['Partial sums up to n=',num2str(i)])
end
```

Output:

Enter function:x^2-5*x+6

Enter lower limit:0

Enter upper limit:2

Enter no of elements required:2

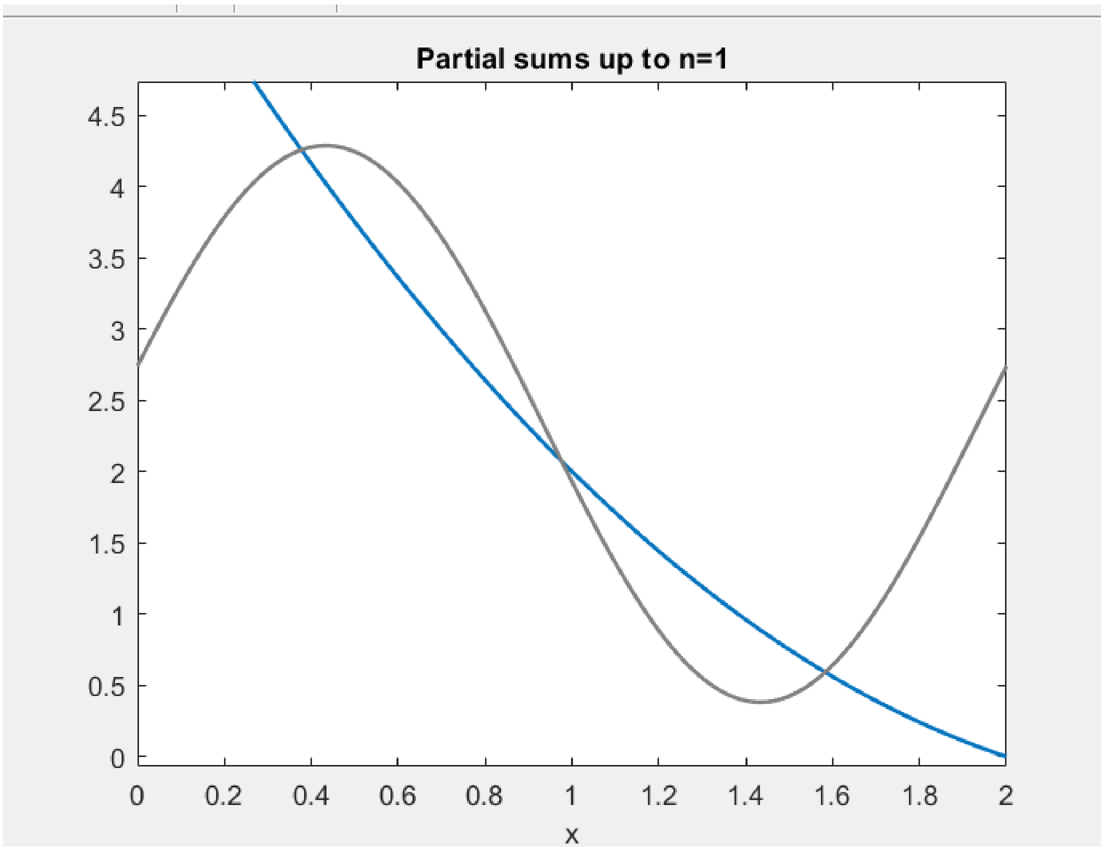
```
4 cos(pi x)   cos(2 pi x)   6 sin(pi x)   sin(2 pi x) 3   7
----------- + ----------- + ----------- + ------------- + -
      2             2            pi             pi       3
    pi            pi
```

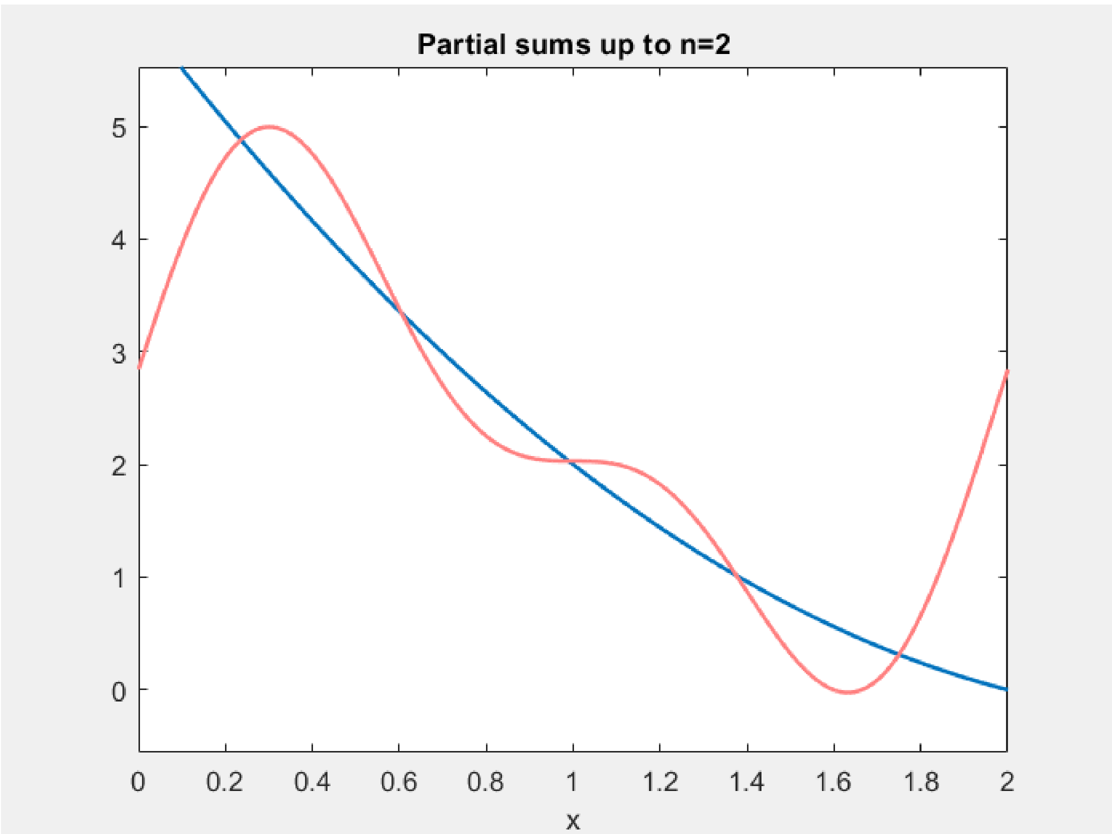
harmonics upto:1

(4*cos(pi*x))/pi^2 + (6*sin(pi*x))/pi + 7/3

harmonics upto:2

(4*cos(pi*x))/pi^2 + cos(2*pi*x)/pi^2 + (6*sin(pi*x))/pi + (3*sin(2*pi*x))/pi + 7/3


Partial sums up to n=1
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2
x


Partial sums up to n=2
5
4
3
2
1
0
0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2
x

MATLAB

ASSIGNMENT -9

Example The turning moment T on the crankshaft of a steam engine for the crank angle θ degrees is given as follows:

x^o	0	15	30	45	60	75	90	105	120	135	150	165	180
T	0	2.7	5.2	7.0	8.1	8.3	7.9	6.8	5.5	4.1	2.6	1.2	0

Express T in a Fourier series neglecting the harmonic above third.

Code:

```
clc
clear all
syms x
p=input('enter the period:');
l=p/2;
X=input('enter the X-vector:');
Y=input('enter the Y-vector:');
N=length(X);
r=input('enter the number of terms in series:');
a_0=(2/N)*sum(Y);
for n=1:r
a(n)=(2/N)*sum(Y.*cos(n*pi*X/l));
b(n)=(2/N)*sum(Y.*sin(n*pi*X/l));
end
for n=1:r
```

H(n)=a(n)*cos(n*pi*x/l)+b(n)*sin(n*pi*x/l);

end

HS=(a_0)/2+sum(H);

disp('Harmonic series is given by')

disp(HS)

plot(X,Y,'r')

hold on

ezplot(HS,[0,p])

OUTPUT:

enter the period:

pi/12

enter the X-vector:

[0 pi/12 pi/6 pi/4 pi/3 5*pi/12 pi/2 7*pi/12 2*pi/3 3*pi/4 5*pi/6 11*pi/12 pi]

enter the Y-vector:

[0 2.7 5.2 7.0 8.1 8.3 7.9 6.8 5.5 4.1 2.6 1.2 0]

enter the number of terms in series:

5

Harmonic series is given by

(594*cos(24*x))/65 + (594*cos(48*x))/65 + (594*cos(72*x))/65 +

(594*cos(96*x))/65 + (594*cos(120*x))/65 -

(8245035216728501*sin(24*x))/507060240091291760598681 2821504

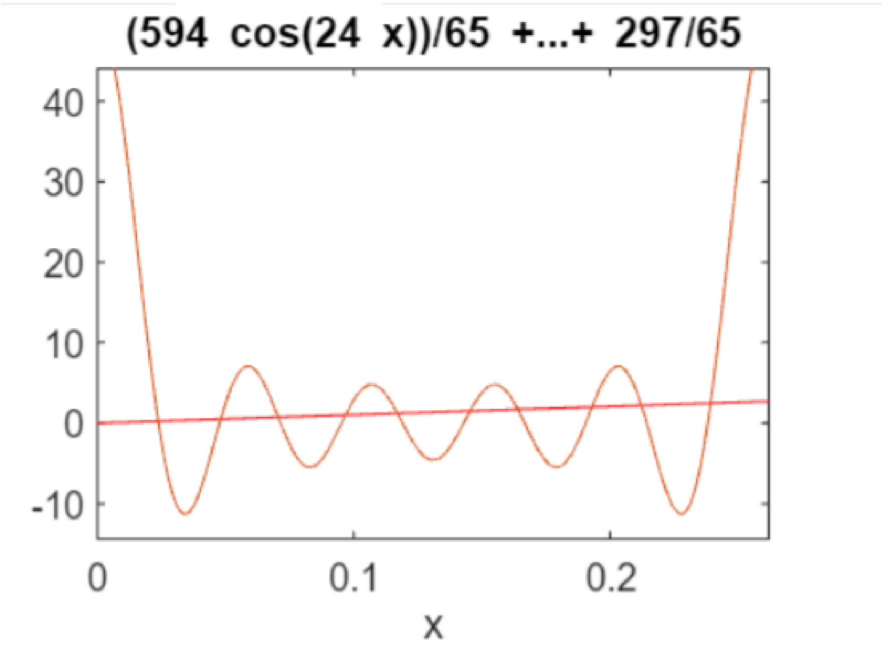
(8245035216728501*sin(48*x))/253530120045645880299340 6410752 +

(8693247934423919*sin(72*x))/158456325028528675187087 900672 -

(8245035216728501*sin(96*x))/126765060022822940149670 3205376 +

(3111383652586581*sin(120*x))/15845632502852867518708 7900672 + 297/65

Graph for the example code:



MATLAB

ASSIGNMENT -10

Code:

Code:

```
%MATLAB_10
syms y(k) z F T
assume(k>=0 & in(k,'integer'))
eq = y(k+3) + 2*y(k+2) + 3*y(k+1) - y(k) == exp(-
k);
Zt = ztrans(eq,k,z)
Zt = subs(Zt,ztrans(y(k),k,z),F)
F = solve(Zt,F)
pSol = iztrans(F,z,k); % Inverse Z-transform
pSol = simplify(pSol)
pSol = subs(pSol,[y(0) y(1) y(2)],[0 1 0]) %
Initial conditions
kvalues = 1:10;
pSolValues = subs(pSol,k,kvalues);
pSolValues = double(pSolValues);
pSolValues = real(pSolValues);
plot(kvalues,pSolValues)
```

output:

pSol =

(exp(3 - k)*(exp(k)*symsum(-(exp(-3)*root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l)^k*root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l)*(3*exp(1) + 4*exp(2) - 2*exp(3) + 2) - root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l)^k + exp(-3)*root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l)^k*root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l)^2*(2*exp(1) + 2*exp(2) - exp(3) + 1))/(2*root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l)^2 + 6*root(z5^3 + 2*z5^2 + 3*z5 - 1, z5, l) - 3), l, 1, 3) + 1))/(2*exp(1) + 3*exp(2) - exp(3) + 1)

Graph for the code: