Program-1:

1.Write a program to find the root of the equation x^3-2x-5=0 by Newton – Raphson method with initial value x0=1.5 upto 5 iterations.

```
clc;clear;
deff('y=f(x)','y=x^3-2*x-5');
deff('z=g(x)','z=3*x^2-2');
x0=1.5;
for i=1:5
   c=x0-f(x0)/g(x0);
   x0=c;
   disp([i,c]);
end
disp("The solution by Newton Raphson method after 5 iterations is: ",c)
```

Output:

```
1.   2.4736842
2.   2.156433
3.   2.0966046
4.   2.0945539
5.   2.0945515
 "The solution by Newton Raphson method after 5 iterations is: "
 2.0945515
```

2.Write a program to find the root of the equation x*sin(x)+cos(x)=0 by Newton – Raphson method with initial value x0=π upto 4 iterations

```
clc;clear;
deff('y=f(x)','y=x*sin(x)+cos(x)');
deff('z=g(x)','z=x*cos(x)');
x0=%pi;
for i=1:4
    c=x0-f(x0)/g(x0);
    x0=c;
    disp([i,c]);
end
disp("The solution by Newton Raphson method after 4 iterations is: ",c)
```

<u>Output:</u>

```
1.   2.8232828

2.   2.7985999

3.   2.7983861

4.   2.798386

"The solution by Newton Raphson method after 4 iterations is: "

 2.7983860
```

Program-2:

1.Write a program to find the root of the transcendental equation cos(x)-x*e^x =0 by Regula–Falsi method with initial value a=0 and b=1 upto 10 iterations

```
clc;clear;
deff('y=f(x)','y=cos(x)-x*%e^x')
a=0;b=1;
for i=1:10
    c=(a*f(b)-b*f(a))/(f(b)-f(a))
     if f(a)*f(c)<0
         then b=c
     else a=c
     disp([i,c]);
end
end
disp('The solution by Regula -falsi method after 10 iterations:
',c)
```

Output:

1. 0.3146653
2. 0.4467281
3. 0.4940153
4. 0.5099461
5. 0.515201
6. 0.5169222
7. 0.5174847
8. 0.5176683
9. 0.5177283
10. 0.5177479

"The solution by Regula -falsi method after 10 iterations: "

0.5177479

2.Write a program to find the root of the transcendental equation $x^3-5x-7=0$ by Regula –Falsi method with initial value (2,3) upto 5 iterations

```
clc;clear;
deff('y=f(x)','y=x^3-5*x-7')
a=2;b=3;
for i=1:5
    c=(a*f(b)-b*f(a))/(f(b)-f(a))
    if f(a)*f(c)<0
       then b=c
    else a=c
    disp([i,c]);
end
end
disp('The solution by Regula-falsi method after 5 iterations:
',c)
```

Output:

```
1.   2.6428571
2.   2.7356353
3.   2.7460718
4.   2.7472082
5.   2.7473315
"The solution by Regula-falsi method after 5 iterations: "
 2.7473315
```

Program-3:

1.Write a program on Newton's forward interpolation for the given set of values. Find f(34)

x	0	15	30	45	60	75	90
y	0	0.26	0.5	0.71	0.87	0.97	1

```
clc;clear;
x=[0,15,30,45,60,75,90];
y=[0,0.26,0.5,0.71,0.87,0.97,1];
n=length(x);
h=x(2)-x(1);
T=x';
for i=0:n-1
      T(1:(n-i),i+2)=diff(y',i)
end
disp("Forward difference table");
disp("x    y     y1    y2   y3     y4       y5     y6");
disp(T);
xi=input("Enter the value of xi:")
p=max(find(T( :,1)<xi));
u=(xi-x(p))/h;yi=y(p);q=u;
for j =1:n-1
    yi=yi+(q*T(p,j+2))/factorial(j);
    q=(q*(u-j));
    end
disp("Interpolated value yi is:",yi)
```

Output:

```
"Forward difference table"
 "x    y     y1     y2     y3     y4          y5    y6"
  0.   0.    0.26  -0.02  -0.01  -0.01        0.02  -0.03
  15.  0.26  0.24  -0.03  -0.02   0.01       -0.01   0.
  30.  0.5   0.21  -0.05  -0.01   2.220D-16   0.     0.
  45.  0.71  0.16  -0.06  -0.01   0.          0.     0.
  60.  0.87  0.1   -0.07   0.     0.          0.     0.
  75.  0.97  0.03   0.     0.     0.          0.     0.
  90.  1.    0.     0.     0.     0.          0.     0.
Enter the value of xi:34
"Interpolated value yi is:"
 0.5603240
```

2.Write a program on Newton’s backward interpolation for the given set of values. Find f(3.5)

x	0	1	2	3	4
y	1	3	5	7	9

```
clc;clear;
x=[0,1,2,3,4];
y=[1,3,5,7,9];
n=length(x);
h=x(2)-x(1);
T=x';
for i=0:n-1
      T(i+1:n,i+2)=diff(y',i)
end
disp("Backward difference table");
disp("x  y  y1  y2  y3  y4  y5    y6");
disp(T);
xi=input("Enter the value of xi:");
p=max(find(T( :,1)>xi));
u=(xi-x(p))/h;yi=y(p);q=u;
for j =1:n-1
    yi=yi+(q*T(p,j+2))/factorial(j);
    q=(q*(u + j));
    end
disp("Interpolated value yi is:",yi)
```

Output:

```
"Backward difference table"
"x     y     y1    y2    y3    y4"
 0.    1.    0.    0.    0.    0.
 1.    3.    2.    0.    0.    0.
 2.    5.    2.    0.    0.    0.
 3.    7.    2.    0.    0.    0.
 4.    9.    2.    0.    0.    0.
Enter the value of xi:3.5
"Interpolated value yi is:"
 8.
```

Program-4:

1.Write a program to compute the area using Trapezoidal rule :

x	0	0.1	0.2	0.3	0.4
y	1	1.2	1.4	1.6	1.8

```
clc;clear;
x=[0,0.1,0.2,0.3,0.4]
y=[1,1.2,1.4,1.6,1.8]
n=length(x);
h=x(2)-x(1);
I=y(1)+y(n);
for i=2:1:n-1
    I=I+2*y(i)
end
I=(h/2)*I
disp("The area of integral using trapezoidal rule is :",I)
```

Output:

"The area of integral using trapezoidal rule is :"

0.5600000

2.Write a program to compute the area using Trapezoidal rule:

X	0	1	2	3	4	5	6
Y	1	0.5	0.2	0.1	0.0588	0.0384	0.027

```
clc;clear;
x=[0,1,2,3,4,5,6]
y=[1,0.5,0.2,0.1,0.0588,0.0384,0.027]
n=length(x);
h=x(2)-x(1);
I=y(1)+y(n);
for i=2:1:n-1
    I=I+2*y(i)
end
I=(h/2)*I
disp("The area of integral using trapezoidal rule is :",I)
```

<u>Output:</u>

"The area of integral using trapezoidal rule is :"

1.4107

Program-5:

1.Write a program to compute the area using Simpson's 1/3 rd rule:

x	-3	-2	-1	0	1	2	3
y	81	16	1	0	1	16	81

```
clc;clear;
x=[-3,-2,-1,0,1,2,3]
y=[81,16,1,0,1,16,81]
n=length(x);
h=x(2)-x(1);
I=y(1)+y(n);
for i=2:2:n-1
    I=I+4*y(i)
end
for i=3:2:n-1
    I=I+2*y(i)
end
I=(h/3)*I
disp("The area of integral using Simpsons 1/3 rd rule is :",I)
```

Output:

"The area of integral using Simpsons 1/3 rd rule is :"
 98

2.Write a program to compute the area using Simpson's 1/3 rd rule:

x	0	0.1	0.2	0.3	0.4	0.5	0.6
y	1	0.99	0.96	0.913	0.8521	0.778	0.697

```
clc;clear;
x=[0,0.1,0.2,0.3,0.4,0.5,0.6]
y=[1,0.99,0.96,0.913,0.8521,0.778,0.697]
n=length(x);
h=x(2)-x(1);
I=y(1)+y(n);
for i=2:2:n-1
    I=I+4*y(i)
end
for i=3:2:n-1
    I=I+2*y(i)
end
I=(h/3)*I
disp("The area of integral using Simpsons 1/3 rd rule is :",I)
```

Output:

```
"The area of integral using Simpsons 1/3 rd rule is :"
  0.53484
```

Program-6:

1.Write a program to compute the area using Simpson's 3/8 th rule:

x	0	0.1	0.2	0.3	0.4
y	1	0.9975	0.99	0.9776	0.8604

```
clc;clear;
x=[0,0.1,0.2,0.3,0.4]
y=[1,0.9975,0.99,0.9776,0.8604]
n=length(x);
h=x(2)-x(1);
I=y(1)+y(n);
for i=2:3:n-1
    I=I+3*y(i)
end
for i=3:3:n-1
    I=I+3*y(i)
end
for i=4:3:n-1
    I=I+2*y(i)
end
I=(3*h/8)*I
disp("The area of integral using Simpsons 3/8 th rule is :",I)
```

Output:

"The area of integral using Simpsons 3/8 th rule is :"
  0.3666788

2.Write a program to compute the area using Simpson's 3/8 th rule:

x	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
y	1	1.2	1.4	1.6	1.8	2	2.2	2.4	2.6	2.8	3

```
clc;clear;
x=[0,0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9,1]
y=[1,1.2,1.4,1.6,1.8,2,2.2,2.4,2.6,2.8,3]
n=length(x);
h=x(2)-x(1);
I=y(1)+y(n);
for i=2:3:n-1
    I=I+3*y(i)
end
for i=3:3:n-1
    I=I+3*y(i)
end
for i=4:3:n-1
    I=I+2*y(i)
end
I=(3*h/8)*I
disp("The area of integral using Simpsons 3/8 th rule is :",I)
```

<u>Output:</u>

"The area of integral using Simpsons 3/8 th rule is :"

1.9275000

Program-7:

1.Write a program on Taylor series for $y'=x+y$ with $y(0)=1$. Find at x=0,0.2,0.4,0.6,0.8,1 upto 3rd degree.

```
clc;clear;
deff('F=f(x,y)','F=x+y');
deff('G=g(x,y)','G=1+f(x,y)');
deff('H=h(x,y)','H=g(x,y)');
deff('Y=y(x)','Y=1+f(0,1)*x+g(0,1)*x^2/2+h(0,1)*x^3/6');
disp(y(0))
disp(y(0.2))
disp(y(0.4))
disp(y(0.6))
disp(y(0.8))
disp(y(1))
```

Output:

```
1.
1.2426667
1.5813333
2.032
2.6106667
3.3333333
```

2.Write a program on Taylor series for $y^{'}=e^{x}$ with y(0)=1. Find at x=5 until 2^{nd} degree.

```
clc;clear;
deff('F=f(x,y)','F=%e^x');
deff('G=g(x,y)','G=%e^x');
deff('Y=y(x)','Y=1+f(0,1)*x+g(0,1)*x^2/2');
disp(y(1))
```

<u>Output:</u>

18.5

3.Write a program on Taylor series for y'=x^2+y^2 with y(0)=1. Find at x=0.1 upto 3rd degree.

```
clc;clear;
deff('F=f(x,y)','F=x^2+y^2');
deff('G=g(x,y)','G=2*x+2*y*f(x,y)');
deff('H=h(x,y)','H=2+2*[f(x,y)*f(x,y)+y*g(x,y)]');
deff('Y=y(x)','Y=1+f(0,1)*x+g(0,1)*x^2/2+h(0,1)*x^3/6');
disp(y(0.1))
```

Output:

1.1113333

Program-8

1.Write a program on modified Euler's method for
y-2*x^2+1=0 where y=5 at x=0, find y at x=1 with h=0.1

```
clc;clear;
function dy=f(x, y)
    dy=y-2*x^2+1
endfunction;
x0=0;xf=1;h=0.1;y0=5;
x=x0:h:xf
n=length(x);
y(1)=y0;
disp("x        y");
disp([x0      y0]);
for i =1:n-1
    yp(i+1)=y(i)+h*f(x(i),y(i));
    y(i+1)=y(i)+(h/2)*(f(x(i),y(i))+f(x(i+1),yp(i+1)));
    disp([x(i+1)y(i+1)]);
end
```

Output:

```
 "x    y"
  0.    5.
  0.1   5.629
  0.2   6.319945
  0.3   7.0751392
  0.4   7.8971288
  0.5   8.7887274
  0.6   9.7530437
  0.7   10.793513
  0.8   11.913932
  0.9   13.118495
  1.   14.411837
```

2. Write a program on modified Euler's method for x-y^2=0 where y=1 at x=0, find y at x=0.1 with h=0.1

```
clc;clear;
function dy=f(x, y);
    dy=x-y^2;
endfunction;
x0=0;xf=0.1;h=0.1;y0=1;
x=x0:h:xf
n=length(x);
y(1)=y0;
disp("x        y");
disp([x0      y0]);
for i =1:n-1
    yp(i+1)=y(i)+h*f(x(i),y(i));
    y(i+1)=y(i)+(h/2)*(f(x(i),y(i))+f(x(i+1),yp(i+1)));
    disp([x(i+1)y(i+1)]);
end
```

<u>Output:</u>

```
"x       y"

 0.      1.

 0.1     0.9145
```

Program-9:

1.Write a program to solve ODE of first order and first degree by Runge-kutta 4th order for f=x^2+y^2 , y=1.2 at x=1 find y at x=1.1 with h=0.01.

```
clc;clear;
function dy=f(x, y)
    dy=(x^2+y^2)
endfunction
x0=1;y0=1.2;xf=1.1;h=0.01;
x(1)=x0;
y(1)=y0;
n=(xf-x0)/h;
for i=1:n+1
    x(i+1)=x(i)+h;
    k1=h*f(x(i),y(i));
    k2=h*f((x(i)+h/2),(y(i)+k1/2));
    k3=h*f((x(i)+h/2),(y(i)+k2/2));
    k4=h*f(x(i)+h,y(i)+k3);
    y(i+1)=y(i)+(k1+2*k2+2*k3+k4)/6
    disp([x(i),y(i)])
end
```

Output:

1.	1.2
1.01	1.2247983
1.02	1.2504162
1.03	1.2768895
1.04	1.3042563
1.05	1.3325571
1.06	1.3618353
1.07	1.3921369
1.08	1.4235112
1.09	1.4560107
1.1	1.4896919

2.Write a program to solve ODE of first order and first degree by Runge-kutta 4th order for f=3*x+y/2, y=1 at x=0 find y at x=1 with h=0.2

```
clc;clear;
function dy=f(x, y)
    dy=3*x+y/2
endfunction
x0=0;y0=1;xf=1;h=0.2;
x(1)=x0;
y(1)=y0;
n=(xf-x0)/h;
for i=1:n+1
    x(i+1)=x(i)+h;
    k1=h*f(x(i),y(i));
    k2=h*f((x(i)+h/2),(y(i)+k1/2));
    k3=h*f((x(i)+h/2),(y(i)+k2/2));
    k4=h*f(x(i)+h,y(i)+k3);
    y(i+1)=y(i)+(k1+2*k2+2*k3+k4)/6
    disp([x(i),y(i)])
end
```

<u>Output:</u>

```
0.     1.
0.2    1.1672208
0.4    1.4782334
0.6    1.9481605
0.8    2.5937151
1.     3.4333683
```

Program-10:

1.Write a program to solve ODE of first order and first degree by Milne's predictor and corrector method for f=x-y^2, with h=0.2 for y(0)=0,y(0.2)=0.02,y(0.4)=0.0795,y(0.6)=0.1762 find y(0.8)

```
clc;clear;
function dy=f(x, y)
  dy=x-y^2
endfunction
h=0.2
x(1)=0;x(2)=0.2;x(3)=0.4;x(4)=0.6;x(5)=0.8;
y(1)=0;y(2)=0.02;y(3)=0.0795;y(4)=0.1762;
yp(5)=y(1)+(4*h/3)*(2*f(x(2),y(2))-f(x(3),y(3))+2*f(x(4),y(4)))
y(5)=y(3)+(h/3)*(f(x(3),y(3))+4*f(x(4),y(4))+f(x(5),yp(5)))
disp([x(5),y(5)])
```

Output:

```
0.8       0.3046014
```

2.Write a program to solve ODE of first order and first degree by Milne's predictor and corrector method for f=x^2+y^2, with h=0.1 for y(0)=1,y(0.1)=1.1113,y(0.2)=1.2507,y(0.3)=1.426 find y(0.4).

```
clc;clear;
function dy=f(x, y)
   dy=x^2+y^2
endfunction
h=0.1
x(1)=0;x(2)=0.1;x(3)=0.2;x(4)=0.3;x(5)=0.4;
y(1)=1;y(2)=1.1113;y(3)=1.2507;y(4)=1.426;
yp(5)=y(1)+(4*h/3)*(2*f(x(2),y(2))-f(x(3),y(3))+2*f(x(4),y(4)))
y(5)=y(3)+(h/3)*(f(x(3),y(3))+4*f(x(4),y(4))+f(x(5),yp(5)))
disp([x(5),y(5)])
```

Output:

```
0.4       1.6872071
```