Practical 3

NAME : Naveen Kumar
ROLL NO : 20211437
COURSE : BSc(hons)Computer Science
SEMESTER : 4

Newton Raphson Method

Question 1 :

```
x0 = Input["Enter first guess:"];
Nmax = Input["Enter maximum number of iterations:"];
eps = Input["Enter the value of convergence parameter:"];
Print["x0=", x0];
Print["Nmax=", Nmax];
Print["epsilon=", eps];
f[x_] := Cos[x];
Print["f[x]:=", f[x]];
Print["f'[x]:=", D[f[x], x]];
For[i = 1, i ≤ Nmax, i++, x1 = N[x0 - (f[x] /. x → x0) / (D[f[x], x] /. x → x0)];
  If[Abs[x1 - x0] < eps, Return[x1], x0p = x0; x0 = x1;];
  Print["In ", i, "th number of iterations the root is:", x1];
  Print["Estimated error is:", Abs[x1 - x0p]]];
Print["The final approximation of root is:", x1];
Print["Estimated error is:", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0=1.5
```

```
Nmax=20
```

```
epsilon=1/1000000
```

```
f[x]:=Cos[x]
```

```
f'[x]:=-Sin[x]
```

```
In 1th number of iterations the root is:1.57091
```

```
Estimated error is:0.0709148
```

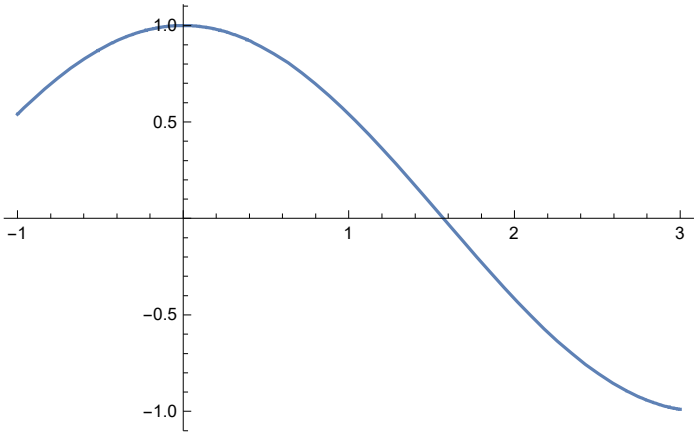
```
In 2th number of iterations the root is:1.5708
```

```
Estimated error is:0.000118518
```

```
Return[1.5708]
```

```
The final approximation of root is:1.5708
```

```
Estimated error is:5.54889×10^-13
```



Question 2 :

```
x0 = Input["Enter first guess:"];
Nmax = Input["Enter maximum number of iterations:"];
eps = Input["Enter the value of convergence parameter:"];
Print["x0=", x0];
Print["Nmax=", Nmax];
Print["epsilon=", eps];
f[x_] := x^3 - 5 x + 1;
Print["f[x]:=", f[x]];
Print["f'[x]:=", D[f[x], x]];
For[i = 1, i ≤ Nmax, i++, x1 = N[x0 - (f[x] /. x → x0) / (D[f[x], x] /. x → x0)];
  If[Abs[x1 - x0] < eps, Return[x1], x0p = x0; x0 = x1;];
  Print["In ", i, "th number of iterations the root is:", x1];
  Print["Estimated error is:", Abs[x1 - x0p]]];
Print["The final approximation of root is:", x1];
Print["Estimated error is:", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

x0=1.5

Nmax=20

$\text{epsilon}=\frac{1}{1\,000\,000}$

$\text{f[x]:=}1-5\,x+x^3$

$\text{f'[x]:=}-5+3\,x^2$

In 1th number of iterations the root is:3.28571

Estimated error is:1.78571

In 2th number of iterations the root is:2.55386

Estimated error is:0.73185

In 3th number of iterations the root is:2.21833

Estimated error is:0.33553

In 4th number of iterations the root is:2.13386

Estimated error is:0.0844789

In 5th number of iterations the root is:2.12844

Estimated error is:0.00541474

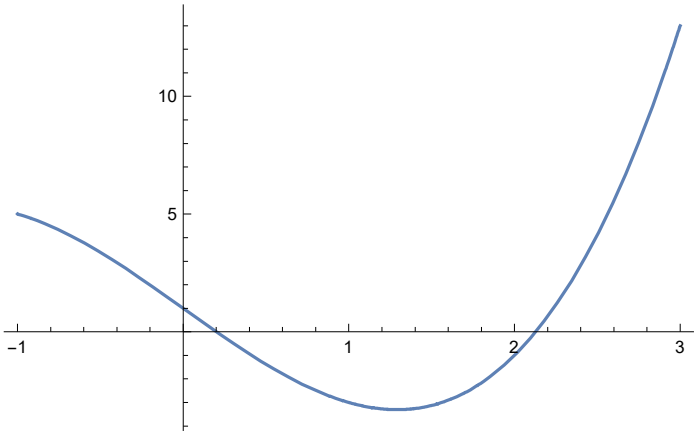
In 6th number of iterations the root is:2.12842

Estimated error is:0.0000218294

Return[2.12842]

The final approximation of root is:2.12842

Estimated error is:3.54197×10^{-10}



Question 3 :

```
x0 = Input["Enter first guess:"];
Nmax = Input["Enter maximum number of iterations:"];
eps = Input["Enter the value of convergence parameter:"];
Print["x0=", x0];
Print["Nmax=", Nmax];
Print["epsilon=", eps];
f[x_] := Cos[x] - x * Exp[x];
Print["f[x]:=", f[x]];
Print["f'[x]:=", D[f[x], x]];
For[i = 1, i ≤ Nmax, i++, x1 = N[x0 - (f[x] /. x → x0) / (D[f[x], x] /. x → x0)];
  If[Abs[x1 - x0] < eps, Return[x1], x0p = x0; x0 = x1;];
  Print["In ", i, "th number of iterations the root is:", x1];
  Print["Estimated error is:", Abs[x1 - x0p]]];
Print["The final approximation of root is:", x1];
Print["Estimated error is:", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0=1.5

Nmax=20

epsilon=1/1000000

f[x]:=-ℯ^x x+Cos[x]

f'[x]:=-ℯ^x-ℯ^x x-Sin[x]

In 1th number of iterations the root is:0.954848

Estimated error is:0.545152

In 2th number of iterations the root is:0.632019

Estimated error is:0.322829

In 3th number of iterations the root is:0.527616

Estimated error is:0.104403

In 4th number of iterations the root is:0.517838

Estimated error is:0.00977784

In 5th number of iterations the root is:0.517757

Estimated error is:0.0000806043

Return[0.517757]

The final approximation of root is:0.517757

Estimated error is:5.44033×10^-9
```