Prakhar Khugshal | BSC(hons) CS | 20211441 | IV semester

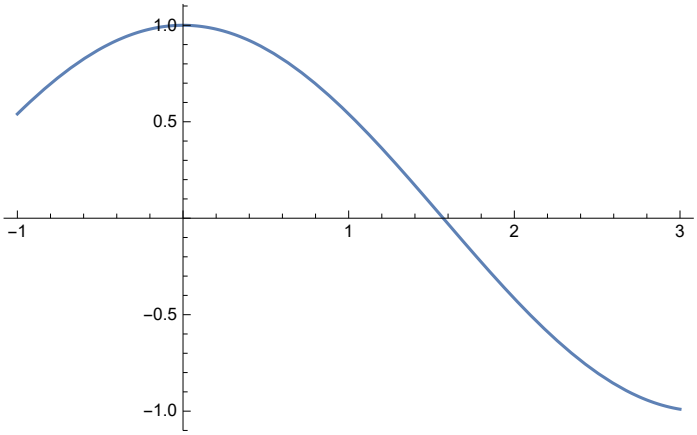
Newton Raphson Method

Q1

```
x0 = Input["Enter first guess: "];
Nmax = Input["Enter maximum of iterations : " ];
eps = Input["Enter the value of covergence 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 iteration the root is :", x1];
  Print["estimated error is:", Abs[x1 - x0p]]];
Print["The final approximationof the root is :", x1];
Print["estimated error is :", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0=1

Nmax=2

epsilon=10

f[x]:=Cos[x]

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

Return[1.64209]
```

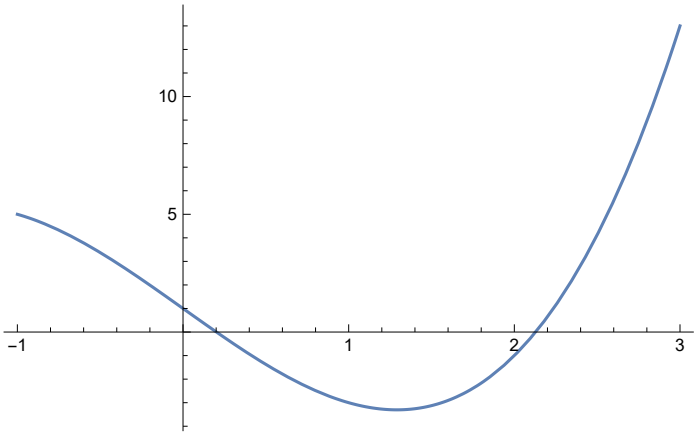
```
The final approximationof the root is :1.64209

estimated error is :0.642093
```



Q2

```
x0 = Input["Enter first guess: "];
Nmax = Input["Enter maximum of iterations : " ];
eps = Input["Enter the value of covergence 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 iteration the root is :", x1];
  Print["estimated error is:", Abs[x1 - x0p]]];
Print["The final approximationof the root is :", x1];
Print["estimated error is :", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0=1
Nmax=20
epsilon=1/1000000
f[x]:=1 - 5 x + x^3
f'[x]:=-5 + 3 x^2
In1Th number of iteration the root is :-0.5
estimated error is:1.5
In2Th number of iteration the root is :0.294118
estimated error is:0.794118
In3Th number of iteration the root is :0.200215
estimated error is:0.093903
In4Th number of iteration the root is :0.201639
estimated error is:0.00142474
Return[0.20164]
The final approximationof the root is :0.20164
estimated error is :2.50538×10^-7
```



Q3

```
x0 = Input["Enter first guess: "];
Nmax = Input["Enter maximum of iterations : "];
eps = Input["Enter the value of covergence 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 iteration the root is :", x1];
  Print["estimated error is:", Abs[x1 - x0p]]];
Print["The final approximationof the root is :", x1];
Print["estimated error is :", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0=1
```

```
Nmax=20
```

```
epsilon=1.×10^-6
```

```
f[x]:=-ℯ^x x + Cos[x]
```

```
f'[x]:=-ℯ^x - ℯ^x x - Sin[x]
```

```
In1Th number of iteration the root is :0.653079
```

```
estimated error is:0.346921
```

```
In2Th number of iteration the root is :0.531343
```

```
estimated error is:0.121736
```

```
In3Th number of iteration the root is :0.51791
```

```
estimated error is:0.0134335
```

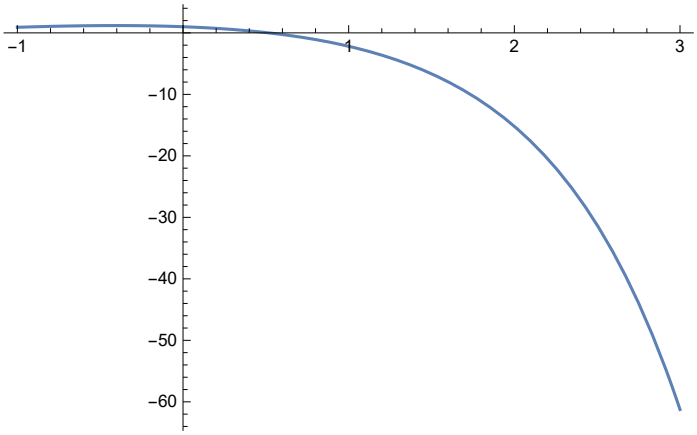
```
In4Th number of iteration the root is :0.517757
```

```
estimated error is:0.00015253
```

```
Return[0.517757]
```

```
The final approximationof the root is :0.517757
```

```
estimated error is :1.94824×10^-8
```


−1
1
2
3
−10
−20
−30
−40
−50
−60