Practical-4
Newton-Raphson method

In[15]:=

In[59]:=
```mathematica
ClearAll;
x0 = Input["Enter initial 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 approximation to 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

Nmax=5

Epsilon =0.0001

f[x] :=Cos[x]

f[x]:=-Sin[x]

In1th Number of iterations the approximation to root is:1.64209

Estimated error is :0.642093

In2th Number of iterations the approximation to root is:1.57068
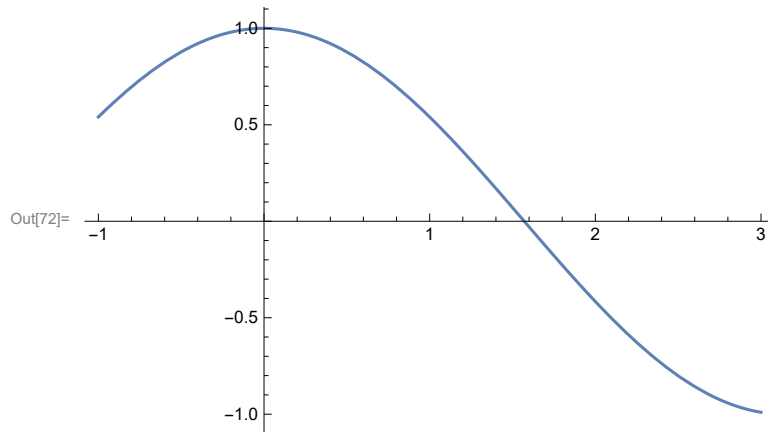
Estimated error is :0.0714173

In3th Number of iterations the approximation to root is:1.5708

Estimated error is :0.00012105

Out[69]= `Return[1.5708]`

the final approximation of root is:1.5708

Estimated error is :5.91305×10^{-13}

Out[72]=

In[87]:=
```
ClearAll;
x0 = Input["Enter initial 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 approximation to 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

Nmax=5

Epsilon =0.0001

f[x] :=-e^x x + Cos[x]

f[x]:=-e^x - e^x x - Sin[x]

In1th Number of iterations the approximation to root is:0.653079

Estimated error is :0.346921

In2th Number of iterations the approximation to root is:0.531343

Estimated error is :0.121736

In3th Number of iterations the approximation to root is:0.51791

Estimated error is :0.0134335

In4th Number of iterations the approximation to root is:0.517757

Estimated error is :0.00015253

Out[97]= Return[0.517757]

the final approximation of root is:0.517757

Estimated error is :1.94824×10^{-8}

Out[100]=