PRACTICAL-4

Regula-Falsi Method

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Ques-1

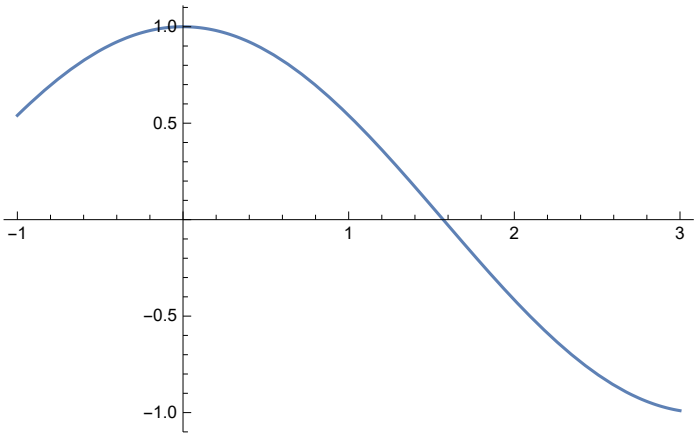
In[1]:=
```
x0 = Input["Enter first guess :"];
x1 = Input["Enter second guess :"];
Nmax = Input["Enter Maximum number of iterations :"];
eps = Input["Enter the value of convergence parameter :"];
Print["x0= ", x0];
Print["x1= ", x1];
Print["Nmax= ", Nmax];
Print["epsilon= ", eps];
f[x_] := Cos[x];
Print["f(x):=", f[x]];
If[N[f[x0] * f[x1]] > 0,
  Print["These values do not satisfy the IVP so change the values ."],
  For[i = 1, i ≤ Nmax, i++,
   x2 = N[x1 - f[x1] * (x1 - x0) / (f[x1] - f[x0])];
   If[Abs[x1 - x0] < eps, Return[N[x2]],
    Print[i, "th iterations value is: ", N[x2]];
    Print["estimated error is: ", N[x1 - x0]]];
   If[f[x2] * f[x1] > 0, x1 = x2, x0 = x2]]];
Print["root is: ", N[x2]];
Print["estimated error is: ", N[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0= 0
x1= 2
Nmax= 10
epsilon= 1.×10^-6
f(x):=Cos[x]
1th iterations value is: 1.41228
estimated error is: 2.
2th iterations value is: 1.57391
estimated error is: 0.587717
3th iterations value is: 1.57078
estimated error is: 0.161623
4th iterations value is: 1.5708
estimated error is: 0.0031228
5th iterations value is: 1.5708
estimated error is: 0.0000128049
```

Out[11]= `Return[1.5708]`

```
root is: 1.5708
estimated error is: 2.05567×10^-11
```

Out[14]=



Ques-2

In[15]:=
```
x0 = Input["Enter first guess :"];
x1 = Input["Enter second guess :"];
Nmax = Input["Enter Maximum number of iterations :"];
eps = Input["Enter the value of convergence parameter :"];
Print["x0= ", x0];
Print["x1= ", x1];
Print["Nmax= ", Nmax];
Print["epsilon= ", eps];
f[x_] := x^3 - 5 x + 1;
Print["f(x):=", f[x]];
If[N[f[x0] * f[x1]] > 0,
  Print["These values do not satisfy the IVP so change the values ."],
  For[i = 1, i ≤ Nmax, i++,
   x2 = N[x1 - f[x1] * (x1 - x0) / (f[x1] - f[x0])];
   If[Abs[x1 - x0] < eps, Return[N[x2]],
    Print[i, "th iterations value is: ", N[x2]];
    Print["estimated error is: ", N[x1 - x0]]];
   If[f[x2] * f[x1] > 0, x1 = x2, x0 = x2]]];
Print["root is: ", N[x2]];
Print["estimated error is: ", N[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

x0= 0

x1= 1

Nmax= 10

epsilon= $1.\times10^{-6}$

$f(x):=1-5x+x^3$

1th iterations value is: 0.25

estimated error is: 1.

2th iterations value is: 0.202532

estimated error is: 0.25

3th iterations value is: 0.201654

estimated error is: 0.202532

4th iterations value is: 0.20164

estimated error is: 0.201654

5th iterations value is: 0.20164

estimated error is: 0.20164

6th iterations value is: 0.20164

estimated error is: 0.20164

7th iterations value is: 0.20164

estimated error is: 0.20164

8th iterations value is: 0.20164

estimated error is: 0.20164

9th iterations value is: 0.20164

estimated error is: 0.20164

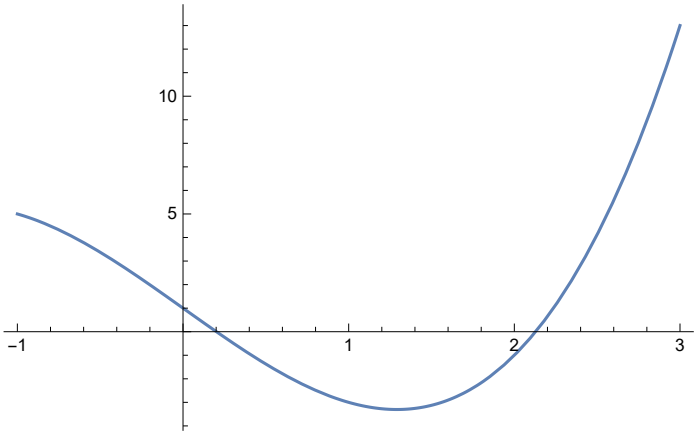
10th iterations value is: 0.20164

estimated error is: 0.20164

root is: 0.20164

estimated error is: 2.77556×10^{-16}

Out[28]=



Ques-3

In[29]:=

```
x0 = Input["Enter first guess :"];
x1 = Input["Enter second guess :"];
Nmax = Input["Enter Maximum number of iterations :"];
eps = Input["Enter the value of convergence parameter :"];
Print["x0= ", x0];
Print["x1= ", x1];
Print["Nmax= ", Nmax];
Print["epsilon= ", eps];
f[x_] := Cos[x] - x Exp[x];
Print["f(x):=", f[x]];
If[N[f[x0] * f[x1]] > 0,
  Print["These values do not satisfy the IVP so change the values ."],
  For[i = 1, i ≤ Nmax, i++,
   x2 = N[x1 - f[x1] * (x1 - x0) / (f[x1] - f[x0])];
   If[Abs[x1 - x0] < eps, Return[N[x2]],
    Print[i, "th iterations value is: ", N[x2]];
    Print["estimated error is: ", N[x1 - x0]]];
   If[f[x2] * f[x1] > 0, x1 = x2, x0 = x2]]];
Print["root is: ", N[x2]];
Print["estimated error is: ", N[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

```
x0= 0
x1= 1
Nmax= 10
epsilon= 1.×10^-6
f(x):=-ℯ^x x + Cos[x]
1th iterations value is: 0.314665
estimated error is: 1.
2th iterations value is: 0.446728
estimated error is: 0.685335
3th iterations value is: 0.494015
estimated error is: 0.553272
4th iterations value is: 0.509946
estimated error is: 0.505985
5th iterations value is: 0.515201
estimated error is: 0.490054
6th iterations value is: 0.516922
estimated error is: 0.484799
7th iterations value is: 0.517485
estimated error is: 0.483078
8th iterations value is: 0.517668
estimated error is: 0.482515
9th iterations value is: 0.517728
estimated error is: 0.482332
10th iterations value is: 0.517748
estimated error is: 0.482272
root is: 0.517748
estimated error is: 0.482252
```

Out[42]=