Practical 2(b)

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Regula Falsi Method

Question 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++, a = N[x1 - f[x1] * (x1 - x0) / (f[x1] - f[x0]), 16];
  If[Abs[(x1 - x0) / 2] < eps,
   Return[N[a, 16]], Print[i, "th iteration value is:", N[a, 16]];
   Print["In ", i, "th number of iterations the root is:", x2];
   Print["Estimated error is:", N[x1 - x0, 16]];
   If[f[a] * f[x1] > 0, x1 = a, x0 = a]]];
 Print["Root is:", N[a, 16]];
 Print["Estimated error is:", N[x1 - x0, 16]]];
Plot[f[x], {x, -1, 3}]
```

x0=1

x1=2

Nmax=10

epsilon=0.0001

f[x]:=Cos[x]

1th iteration value is:1.564904375891578

In 1th number of iterations the root is:1.5708

Estimated error is:1.000000000000000

2th iteration value is:1.570978574535018

In 2th number of iterations the root is:1.5708

Estimated error is:0.435095624108422

3th iteration value is:1.570796325773051

In 3th number of iterations the root is:1.5708

Estimated error is:0.006074198643440
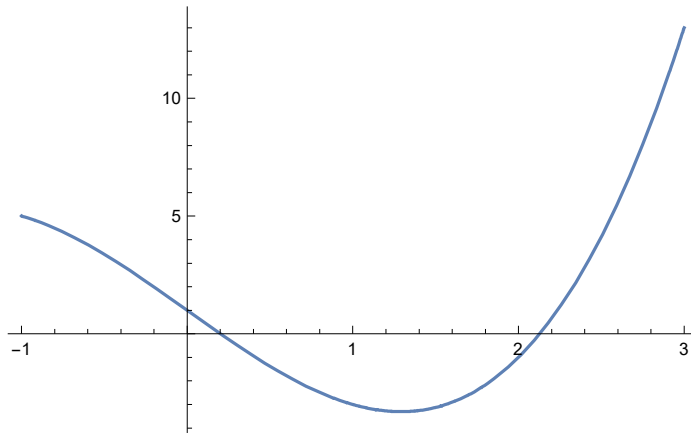
Return[1.57079632679490]
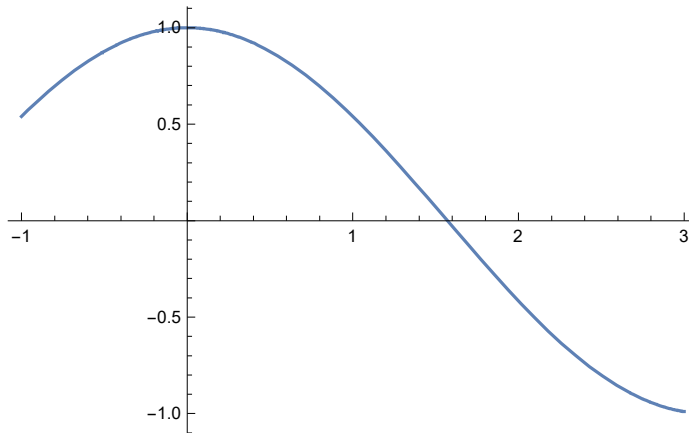
Question 2 :

```
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++, a = N[x1 - f[x1] * (x1 - x0) / (f[x1] - f[x0]), 16];
  If[Abs[(x1 - x0) / 2] < eps,
   Return[N[a, 16]], Print[i, "th iteration value is:", N[a, 16]];
   Print["In ", i, "th number of iterations the root is:", x2];
   Print["Estimated error is:", N[x1 - x0, 16]];
   If[f[a] * f[x1] > 0, x1 = a, x0 = a]]];
 Print["Root is:", N[a, 16]];
 Print["Estimated error is:", N[x1 - x0, 16]]];
Plot[f[x], {x, -1, 3}]
```

```
x0=0

x1=1

Nmax=10

epsilon=0.0001
```

$f[x]:=1 - 5 x + x^3$

```
1th iteration value is:0.2500000000000000

In 1th number of iterations the root is:0.517757

Estimated error is:1.000000000000000

2th iteration value is:0.2025316455696203

In 2th number of iterations the root is:0.517757

Estimated error is:0.2500000000000000

3th iteration value is:0.201654334550389

In 3th number of iterations the root is:0.517757

Estimated error is:0.2025316455696203

4th iteration value is:0.201639916089655

In 4th number of iterations the root is:0.517757

Estimated error is:0.201654334550389

5th iteration value is:0.201639679664634

In 5th number of iterations the root is:0.517757

Estimated error is:0.201639916089655

6th iteration value is:0.20163967578803

In 6th number of iterations the root is:0.517757

Estimated error is:0.201639679664634

7th iteration value is:0.20163967572446

In 7th number of iterations the root is:0.517757

Estimated error is:0.20163967578803

8th iteration value is:0.20163967572342

In 8th number of iterations the root is:0.517757

Estimated error is:0.20163967572446

9th iteration value is:0.20163967572340

In 9th number of iterations the root is:0.517757

Estimated error is:0.20163967572342

Return[0.2016396757234]
```

Question 3 :

```
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++, a = N[x1 - f[x1] * (x1 - x0) / (f[x1] - f[x0]), 16];
  If[Abs[(x1 - x0) / 2] < eps,
    Return[N[a, 16]], Print[i, "th iteration value is:", N[a, 16]];
    Print["In ", i, "th number of iterations the root is:", x2];
    Print["Estimated error is:", N[x1 - x0, 16]];
    If[f[a] * f[x1] > 0, x1 = a, x0 = a]]];
 Print["Root is:", N[a, 16]];
 Print["Estimated error is:", N[x1 - x0, 16]]];
Plot[f[x], {x, -1, 3}]
```

x0=0

x1=1

Nmax=10

epsilon=0.0001

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

1th iteration value is:0.3146653378007709

In 1th number of iterations the root is:0.517757

Estimated error is:1.000000000000000

```
2th iteration value is:0.4467281445913339

In 2th number of iterations the root is:0.517757

Estimated error is:0.6853346621992291

3th iteration value is:0.4940153365958987

In 3th number of iterations the root is:0.517757

Estimated error is:0.5532718554086661

4th iteration value is:0.509946140365247

In 4th number of iterations the root is:0.517757

Estimated error is:0.5059846634041013

5th iteration value is:0.515201009902250

In 5th number of iterations the root is:0.517757

Estimated error is:0.490053859634753

6th iteration value is:0.516922210010517

In 6th number of iterations the root is:0.517757

Estimated error is:0.484798990097750

7th iteration value is:0.517484676784512

In 7th number of iterations the root is:0.517757

Estimated error is:0.483077789989483

8th iteration value is:0.517668344977730

In 8th number of iterations the root is:0.517757

Estimated error is:0.482515323215488

9th iteration value is:0.51772830527141

In 9th number of iterations the root is:0.517757

Estimated error is:0.482331655022270

10th iteration value is:0.51774787832211

In 10th number of iterations the root is:0.517757

Estimated error is:0.48227169472859

Root is:0.51774787832211

Estimated error is:0.48225212167789
```