PRACTICAL-1

Bisection method

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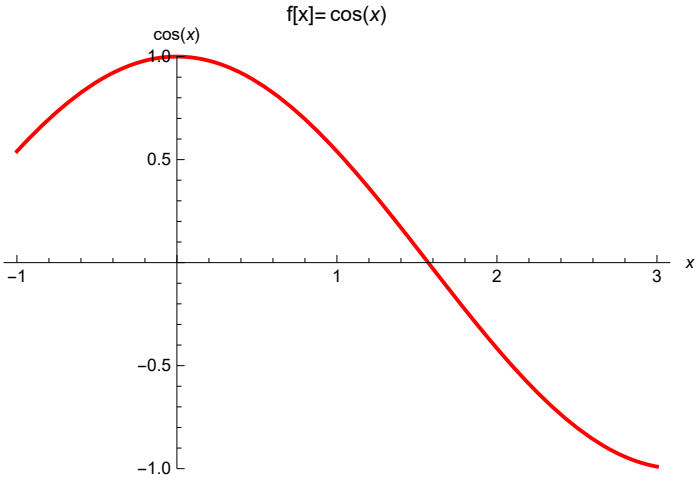
Ques:1

In[1]:=
```
x0 = 0;
x1 = 2.0;
Nmax = 20;
eps = 0.0001;
f[x_] := Cos[x];
If[N[f[x0] * f[x1]] > 0,
 Print["Your values do not satisfy the IVP, so change the values."],
 For[i = 1, i ≤ Nmax, i++, m = (x0 + x1) / 2;
  If[Abs[(x1 - x0) / 2] < eps, Return[m], Print[i, "th iteration value is :", m];
   Print["Estimated error in ", i, "th iteration is :", (x1 - x0) / 2];
   If[f[m] * f[x1] > 0, x1 = m, x0 = m]]];
 Print["Root is : ", m]
  Print["Estimated error in ", i, "th iteration is:", (x1 - x0) / 2]]
Plot[f[x], {x, -1, 3}, PlotRange → {-1, 1}, PlotStyle → {Red, Thick},
 PlotLabel → "f[x]=" f[x], AxesLabel → {x, f[x]}]
```

```
1th iteration value is :1.
Estimated error in 1th iteration is :1.
2th iteration value is :1.5
Estimated error in 2th iteration is :0.5
3th iteration value is :1.75
Estimated error in 3th iteration is :0.25
4th iteration value is :1.625
Estimated error in 4th iteration is :0.125
5th iteration value is :1.5625
Estimated error in 5th iteration is :0.0625
6th iteration value is :1.59375
Estimated error in 6th iteration is :0.03125
7th iteration value is :1.57813
Estimated error in 7th iteration is :0.015625
8th iteration value is :1.57031
Estimated error in 8th iteration is :0.0078125
9th iteration value is :1.57422
Estimated error in 9th iteration is :0.00390625
10th iteration value is :1.57227
Estimated error in 10th iteration is :0.00195313
11th iteration value is :1.57129
Estimated error in 11th iteration is :0.000976563
12th iteration value is :1.5708
Estimated error in 12th iteration is :0.000488281
13th iteration value is :1.57056
Estimated error in 13th iteration is :0.000244141
14th iteration value is :1.57068
Estimated error in 14th iteration is :0.00012207
```

Out[6]= `Return[1.57074]`

Out[7]=



Ques:2

In[8]:=

```
x0 = 0;
x1 = 2.0;
Nmax = 20;
eps = 0.00001;
f[x_] := Cos[x] - x * Exp[x];
If[N[f[x0] * f[x1]] > 0,
 Print["Your values do not satisfy the IVP, so change the values."],
 For[i = 1, i ≤ Nmax, i++, m = (x0 + x1) / 2;
  If[Abs[(x1 - x0) / 2] < eps, Return[m], Print[i, "th iteration value is :", m];
   Print["Estimated error in ", i, "th iteration is :", (x1 - x0) / 2];
   If[f[m] * f[x1] > 0, x1 = m, x0 = m]]];
 Print["Root is : ", m]
  Print["Estimated error in ", i, "th iteration is:", (x1 - x0) / 2]]
Plot[f[x], {x, -1, 3}, PlotRange → {-10, 10}, PlotStyle → {Green, Thick},
 PlotLabel → "f[x]=" f[x], AxesLabel → {x, f[x]}]
```

```
1th iteration value is :1.
Estimated error in 1th iteration is :1.
2th iteration value is :0.5
Estimated error in 2th iteration is :0.5
3th iteration value is :0.75
Estimated error in 3th iteration is :0.25
4th iteration value is :0.625
Estimated error in 4th iteration is :0.125
5th iteration value is :0.5625
Estimated error in 5th iteration is :0.0625
6th iteration value is :0.53125
Estimated error in 6th iteration is :0.03125
7th iteration value is :0.515625
Estimated error in 7th iteration is :0.015625
8th iteration value is :0.523438
Estimated error in 8th iteration is :0.0078125
9th iteration value is :0.519531
Estimated error in 9th iteration is :0.00390625
10th iteration value is :0.517578
Estimated error in 10th iteration is :0.00195313
11th iteration value is :0.518555
Estimated error in 11th iteration is :0.000976563
12th iteration value is :0.518066
Estimated error in 12th iteration is :0.000488281
13th iteration value is :0.517822
Estimated error in 13th iteration is :0.000244141
14th iteration value is :0.5177
Estimated error in 14th iteration is :0.00012207
15th iteration value is :0.517761
Estimated error in 15th iteration is :0.0000610352
16th iteration value is :0.517731
Estimated error in 16th iteration is :0.0000305176
17th iteration value is :0.517746
Estimated error in 17th iteration is :0.0000152588
```

Out[13]= `Return[0.517754]`

Out[14]=