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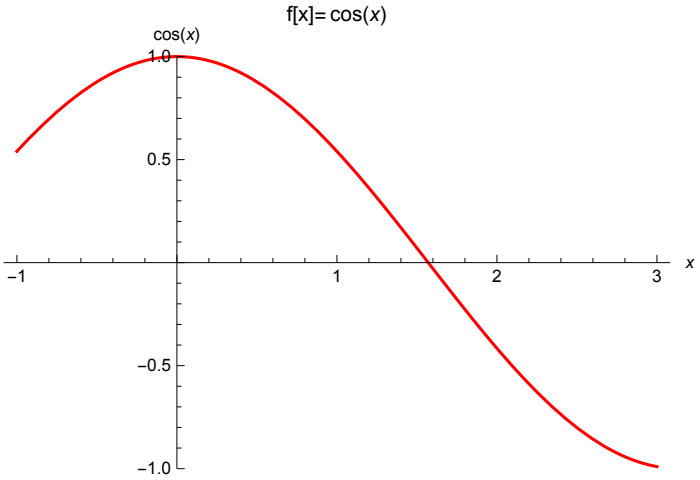
Roll No. : 20201430

Course: Bsc. (h) Computer Science

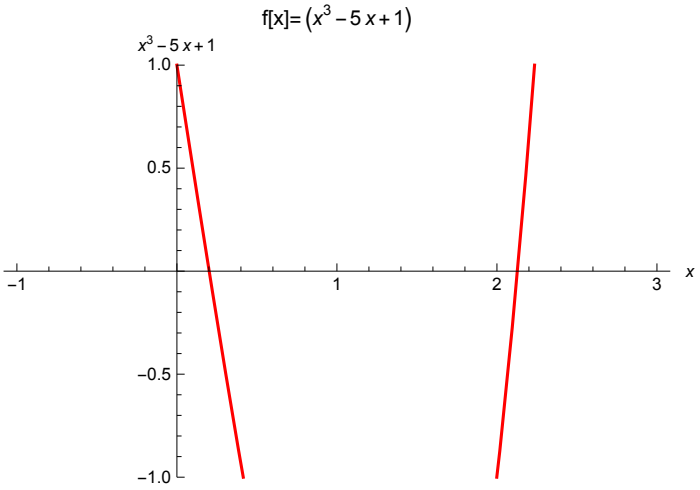
```
x0 = 0;
x1 = 2.0;
Nmax = 20;
eps = 0.0001;
f[x_] := Cos[x];
If[N[f[x0] 8 f[x1]] > 0,
 Print["Yours values do not satisfy the IVP so change the value."],
 For[i = 1, i ≤ Nmax, i++, m = (x0 + x1)/2;
  If[Abs[(x1 - x0)/2] < eps, Return[m],
   Print[i, "th iteration value is :", m];
   Print["Estimated 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, 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
Return[1.57074]
```



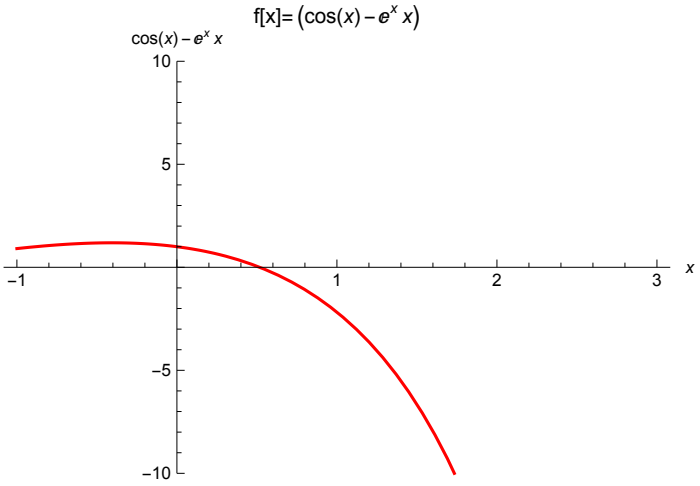

```
x0 = 0;
x1 = 2.0;
Nmax = 20;
eps = 0.0001;
f[x_] := x * x * x - 5 * x + 1;
If[N[f[x0] * f[x1]] > 0,
 Print["Yours values do not satisfy the IVP so change the value."],
 For[i = 1, i ≤ Nmax, i++, m = (x0 + x1)/2;
  If[Abs[(x1 - x0)/2] < eps, Return[m],
   Print[i, "th iteration value is :", m];
   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, 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 :0.25
Estimated error in 3th iteration is:0.25
4th iteration value is :0.125
Estimated error in 4th iteration is:0.125
5th iteration value is :0.1875
Estimated error in 5th iteration is:0.0625
6th iteration value is :0.21875
Estimated error in 6th iteration is:0.03125
7th iteration value is :0.203125
Estimated error in 7th iteration is:0.015625
8th iteration value is :0.195313
Estimated error in 8th iteration is:0.0078125
9th iteration value is :0.199219
Estimated error in 9th iteration is:0.00390625
10th iteration value is :0.201172
Estimated error in 10th iteration is:0.00195313
11th iteration value is :0.202148
Estimated error in 11th iteration is:0.000976563
12th iteration value is :0.20166
Estimated error in 12th iteration is:0.000488281
13th iteration value is :0.201416
Estimated error in 13th iteration is:0.000244141
14th iteration value is :0.201538
Estimated error in 14th iteration is:0.00012207
Return[0.201599]
```




```
x0 = 0;
x1 = 1.0;
Nmax = 20;
eps = 0.0001;
f[x_] := Cos[x] - x * Exp[x];
If[N[f[x0] * f[x1]] > 0,
 Print["Yours values do not satisfy the IVP so change the value."],
 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 → Red, PlotLabel → "f[x]=" f[x], AxesLabel → {x, f[x]}]
```

```
1th iteration value is :0.5
Estimated error in 1th iteration is:0.5
2th iteration value is :0.75
Estimated error in 2th iteration is:0.25
3th iteration value is :0.625
Estimated error in 3th iteration is:0.125
4th iteration value is :0.5625
Estimated error in 4th iteration is:0.0625
5th iteration value is :0.53125
Estimated error in 5th iteration is:0.03125
6th iteration value is :0.515625
Estimated error in 6th iteration is:0.015625
7th iteration value is :0.523438
Estimated error in 7th iteration is:0.0078125
8th iteration value is :0.519531
Estimated error in 8th iteration is:0.00390625
9th iteration value is :0.517578
Estimated error in 9th iteration is:0.00195313
10th iteration value is :0.518555
Estimated error in 10th iteration is:0.000976563
11th iteration value is :0.518066
Estimated error in 11th iteration is:0.000488281
12th iteration value is :0.517822
Estimated error in 12th iteration is:0.000244141
13th iteration value is :0.5177
Estimated error in 13th iteration is:0.00012207
Return[0.517761]
```



Bisection Method : For Parameters Taken from user

```
x0 = Input["Enter first number:"];
x1 = Input["Enter Second number:"];
Nmax = Input["Enter maximum number of iterations:"];
eps = Input["Enter a value of convergence parameter:"];
Print["x0=", x0];
Print["x1=", x1];
Print["Nmax=", Nmax];
Print["epsilon=", eps];
f[x_] := Cos[x];
If[N[f[x0] 8 f[x1]] > 0,
 Print["Yours values do not satisfy the IVP so change the value."],
 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, PlotLabel → "f[x]=" f[x], AxesLabel → {x, f[x]}]
```

```
x0=0

x1=2

Nmax=20

epsilon=1.×10^-6

1th iteration value is :1
```

Estimated error in 1th iteration is:1

2th iteration value is : $\frac{3}{2}$

Estimated error in 2th iteration is: $\frac{1}{2}$

3th iteration value is : $\frac{7}{4}$

Estimated error in 3th iteration is: $\frac{1}{4}$

4th iteration value is : $\frac{13}{8}$

Estimated error in 4th iteration is: $\frac{1}{8}$

5th iteration value is : $\frac{25}{16}$

Estimated error in 5th iteration is: $\frac{1}{16}$

6th iteration value is : $\frac{51}{32}$

Estimated error in 6th iteration is: $\frac{1}{32}$

7th iteration value is : $\frac{101}{64}$

Estimated error in 7th iteration is: $\frac{1}{64}$

8th iteration value is : $\frac{201}{128}$

Estimated error in 8th iteration is: $\frac{1}{128}$

9th iteration value is : $\frac{403}{256}$

Estimated error in 9th iteration is: $\frac{1}{256}$

10th iteration value is : $\frac{805}{512}$

Estimated error in 10th iteration is: $\frac{1}{512}$

11th iteration value is : $\frac{1609}{1024}$

Estimated error in 11th iteration is: $\frac{1}{1024}$

12th iteration value is : $\frac{3217}{2048}$

Estimated error in 12th iteration is: $\frac{1}{2048}$

13th iteration value is : $\frac{6433}{4096}$

Estimated error in 13th iteration is: $\frac{1}{4096}$

14th iteration value is : $\frac{12\,867}{8192}$

Estimated error in 14th iteration is: $\frac{1}{8192}$

15th iteration value is : $\frac{25\,735}{16\,384}$

Estimated error in 15th iteration is: $\frac{1}{16\,384}$

16th iteration value is : $\frac{51\,471}{32\,768}$

Estimated error in 16th iteration is: $\frac{1}{32\,768}$

17th iteration value is : $\frac{102\,943}{65\,536}$

Estimated error in 17th iteration is: $\frac{1}{65\,536}$

18th iteration value is : $\frac{205\,887}{131\,072}$

Estimated error in 18th iteration is: $\frac{1}{131\,072}$

19th iteration value is : $\frac{411\,775}{262\,144}$

Estimated error in 19th iteration is: $\frac{1}{262\,144}$

20th iteration value is : $\frac{823\,549}{524\,288}$

Estimated error in 20th iteration is: $\frac{1}{524\,288}$

Root is: $\frac{823\,549}{524\,288}$

Estimated error in21th iteration is: $\frac{1}{1\,048\,576}$

Null^2