# Practical 1


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## 20211441 B.Sc(H) Computer Science

## 4th Semester


Bisection Method

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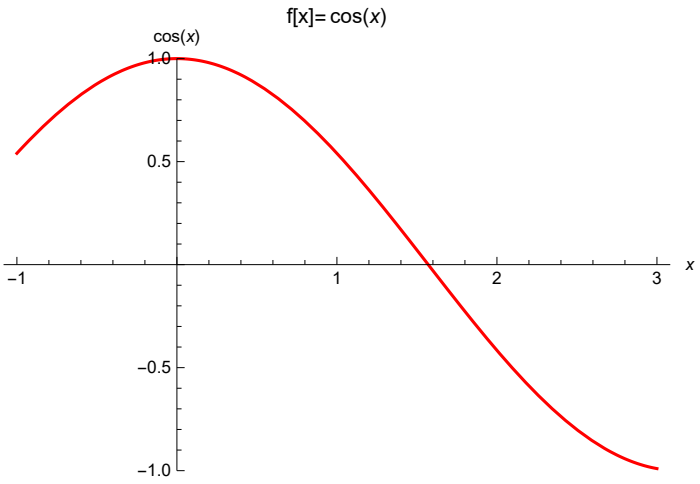
**Question 1**

```
x0 = 1.0;
x1 = 2.0;
NMax = 20;
eps = 0.0001;
f[x_] := Cos[x];
If[N[f[x0] * f[x1]] > 0,
 Print[
  "Yours values do  opt staisfy 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 ["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]}]
```

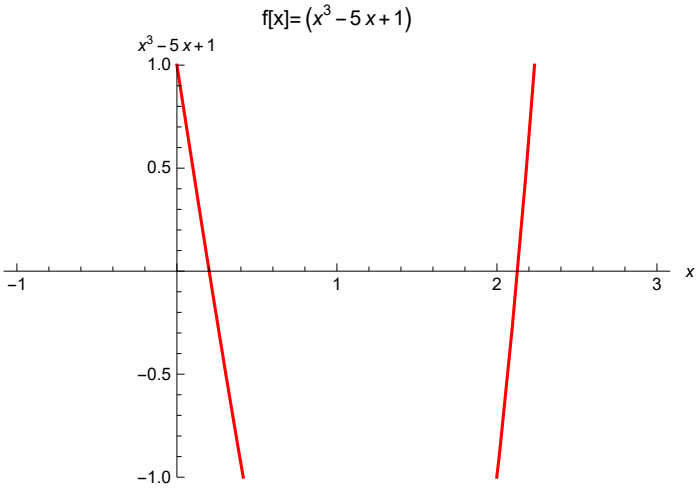
```
1th iteration value is :1.5
Estimated error in 1th iteration is:0.5
2th iteration value is :1.75
Estimated error in 2th iteration is:0.25
3th iteration value is :1.625
Estimated error in 3th iteration is:0.125
4th iteration value is :1.5625
Estimated error in 4th iteration is:0.0625
5th iteration value is :1.59375
Estimated error in 5th iteration is:0.03125
6th iteration value is :1.57813
Estimated error in 6th iteration is:0.015625
7th iteration value is :1.57031
Estimated error in 7th iteration is:0.0078125
8th iteration value is :1.57422
Estimated error in 8th iteration is:0.00390625
9th iteration value is :1.57227
Estimated error in 9th iteration is:0.00195313
10th iteration value is :1.57129
Estimated error in 10th iteration is:0.000976563
11th iteration value is :1.5708
Estimated error in 11th iteration is:0.000488281
12th iteration value is :1.57056
Estimated error in 12th iteration is:0.000244141
13th iteration value is :1.57068
Estimated error in 13th iteration is:0.00012207
Return[1.57074]
```




# Question 2

```
x0 = 0;
x1 = 1.0;
NMax = 20;
eps = 0.0001;
f[x_] := x^3 - 5 x + 1;
If[N[f[x0] * f[x1]] > 0,
 Print[
  "Yours values do  opt staisfy 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["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]}]
```

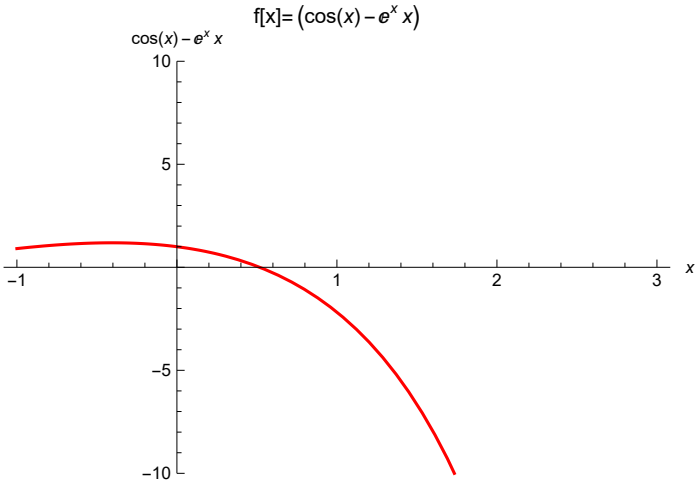
```
1th iteration value is :0.5
Estimated error in 1th iteration is:0.5
2th iteration value is :0.25
Estimated error in 2th iteration is:0.25
3th iteration value is :0.125
Estimated error in 3th iteration is:0.125
4th iteration value is :0.1875
Estimated error in 4th iteration is:0.0625
5th iteration value is :0.21875
Estimated error in 5th iteration is:0.03125
6th iteration value is :0.203125
Estimated error in 6th iteration is:0.015625
7th iteration value is :0.195313
Estimated error in 7th iteration is:0.0078125
8th iteration value is :0.199219
Estimated error in 8th iteration is:0.00390625
9th iteration value is :0.201172
Estimated error in 9th iteration is:0.00195313
10th iteration value is :0.202148
Estimated error in 10th iteration is:0.000976563
11th iteration value is :0.20166
Estimated error in 11th iteration is:0.000488281
12th iteration value is :0.201416
Estimated error in 12th iteration is:0.000244141
13th iteration value is :0.201538
Estimated error in 13th iteration is:0.00012207
Return[0.201599]
```




# Question 3 :

```
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  opt staisfy 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 ["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]
```


f[x]= (cos(x) − e^x x)
cos(x) − e^x x
10
5
−5
−10
−1
1
2
3
x