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SEMESTER : 4

# BISECTION METHOD

# Practical 1:

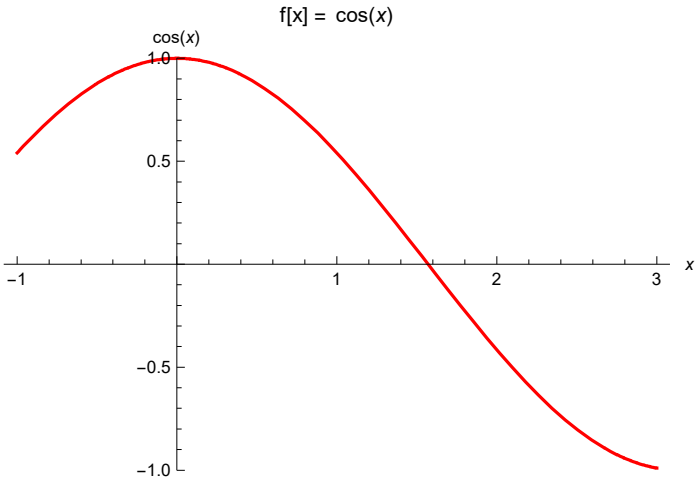
## Question 1:

In[6]:=
```
x0 = 1.0;
x1 = 2.0;
Nmax = 20;
eps = 0.0001;
f[x_] := Cos[x];
If[N[f[x0] * f[x1]] > 0,
 Print["Yours value 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["the estimated error in ", i, "th iteration value is:", (x1 - x0) / 2];
   If[f[m] * f[x1] > 0, x1 = m, x0 = m]]];
 Print["Root is :", m] *
  Print["the 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
the estimated error in 1th iteration value is:0.5
2th iteration value is:1.75
the estimated error in 2th iteration value is:0.25
3th iteration value is:1.625
the estimated error in 3th iteration value is:0.125
4th iteration value is:1.5625
the estimated error in 4th iteration value is:0.0625
5th iteration value is:1.59375
the estimated error in 5th iteration value is:0.03125
6th iteration value is:1.57813
the estimated error in 6th iteration value is:0.015625
7th iteration value is:1.57031
the estimated error in 7th iteration value is:0.0078125
8th iteration value is:1.57422
the estimated error in 8th iteration value is:0.00390625
9th iteration value is:1.57227
the estimated error in 9th iteration value is:0.00195313
10th iteration value is:1.57129
the estimated error in 10th iteration value is:0.000976563
11th iteration value is:1.5708
the estimated error in 11th iteration value is:0.000488281
12th iteration value is:1.57056
the estimated error in 12th iteration value is:0.000244141
13th iteration value is:1.57068
the estimated error in 13th iteration value is:0.00012207
```

Out[11]= `Return[1.57074]`

Out[12]=




**QUESTION 2**

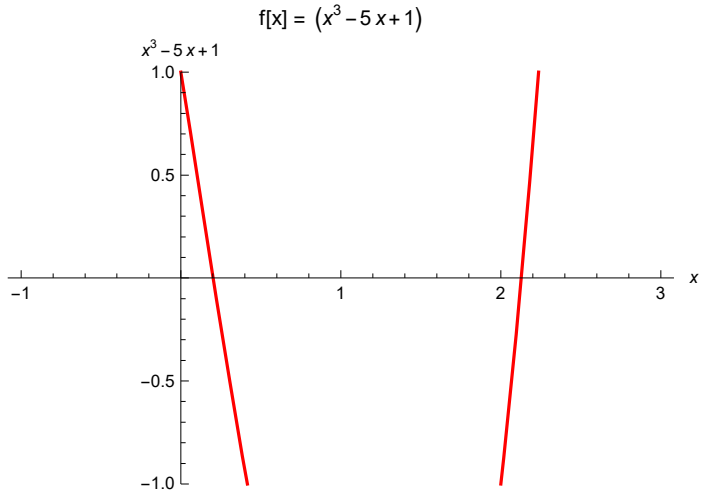
In[13]:=

```
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 value 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["the estimated error in", i, "th iteration value is:", (x1 - x0) / 2];
   If[f[m] * f[x1] > 0, x1 = m, x0 = m]]];
 Print["Root is :", m] *
  Print["the 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
the estimated error in1th iteration value is:0.5
2th iteration value is:0.25
the estimated error in2th iteration value is:0.25
3th iteration value is:0.125
the estimated error in3th iteration value is:0.125
4th iteration value is:0.1875
the estimated error in4th iteration value is:0.0625
5th iteration value is:0.21875
the estimated error in5th iteration value is:0.03125
6th iteration value is:0.203125
the estimated error in6th iteration value is:0.015625
7th iteration value is:0.195313
the estimated error in7th iteration value is:0.0078125
8th iteration value is:0.199219
the estimated error in8th iteration value is:0.00390625
9th iteration value is:0.201172
the estimated error in9th iteration value is:0.00195313
10th iteration value is:0.202148
the estimated error in10th iteration value is:0.000976563
11th iteration value is:0.20166
the estimated error in11th iteration value is:0.000488281
12th iteration value is:0.201416
the estimated error in12th iteration value is:0.000244141
13th iteration value is:0.201538
the estimated error in13th iteration value is:0.00012207
```

Out[18]= `Return[0.201599]`

Out[19]=




**QUESTION 3**

In[20]:=

```
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 value 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["the estimated error in", i, "th iteration value is:", (x1 - x0) / 2];
   If[f[m] * f[x1] > 0, x1 = m, x0 = m]]];
 Print["Root is :", m] *
  Print["the 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
the estimated error in1th iteration value is:0.5
2th iteration value is:0.75
the estimated error in2th iteration value is:0.25
3th iteration value is:0.625
the estimated error in3th iteration value is:0.125
4th iteration value is:0.5625
the estimated error in4th iteration value is:0.0625
5th iteration value is:0.53125
the estimated error in5th iteration value is:0.03125
6th iteration value is:0.515625
the estimated error in6th iteration value is:0.015625
7th iteration value is:0.523438
the estimated error in7th iteration value is:0.0078125
8th iteration value is:0.519531
the estimated error in8th iteration value is:0.00390625
9th iteration value is:0.517578
the estimated error in9th iteration value is:0.00195313
10th iteration value is:0.518555
the estimated error in10th iteration value is:0.000976563
11th iteration value is:0.518066
the estimated error in11th iteration value is:0.000488281
12th iteration value is:0.517822
the estimated error in12th iteration value is:0.000244141
13th iteration value is:0.5177
the estimated error in13th iteration value is:0.00012207
```

Out[25]= `Return[0.517761]`

Out[26]=