

PRACTICAL-2

Newton Raphson Method

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B.Sc. (H) Mathematics

Ques-1

```
In[138]:= ClearAll;
x0 = Input["Enter initial guess :"];
Nmax = Input["Enter maximum number of iterations :"];
eps = Input["Enter the value of convergence parameter :"];
Print["x0=", x0];
Print["Nmax=", Nmax];
Print["Epsilon =", eps];
f[x_] := Cos[x];
Print["f[x] :=", f[x]];
Print["f' [x] :=", D[f[x], x]];
For[i = 1, i ≤ Nmax, i++, x1 = N[x0 - (f[x] /. x → x0) / (D[f[x], x] /. x → x0)];
  If[Abs[x1 - x0] < eps, Return[x1], x0p = x0; x0 = x1];
  Print["In ", i, "th Number of iterations the approximation to root is :", x1];
  Print["Estimated error is :", Abs[x1 - x0p]];
Print["The final approximation of root is:", x1];
Print["Estimated error is :", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]
```

`x0=1`

`Nmax=20`

`Epsilon =1.×10-6`

`f[x]:=Cos[x]`

`f'[x]:=-Sin[x]`

In 1th Number of iterations the approximation to root is :1.64209

Estimated error is :0.642093

In 2th Number of iterations the approximation to root is :1.57068

Estimated error is :0.0714173

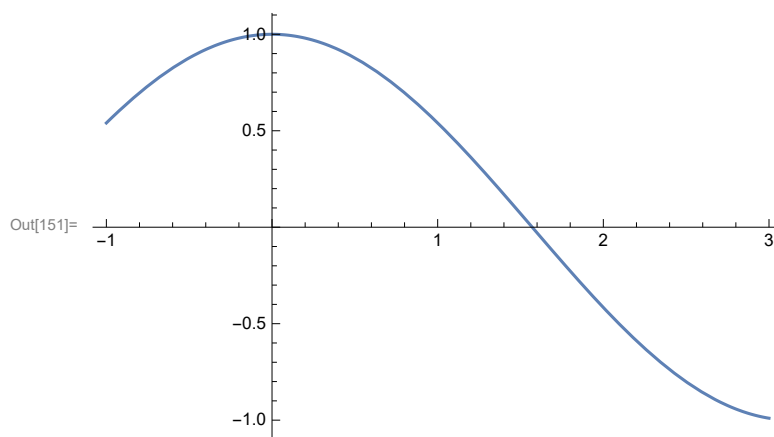
In 3th Number of iterations the approximation to root is :1.5708

Estimated error is :0.00012105

Out[148]= `Return[1.5708]`

The final approximation of root is:1.5708

Estimated error is :5.91305×10⁻¹³



Ques-2

```

In[152]:= ClearAll;
x0 = Input["Enter initial guess :"];
Nmax = Input["Enter maximum number of iterations :"];
eps = Input["Enter the value of convergence parameter :"];
Print["x0=", x0];
Print["Nmax=", Nmax];
Print["Epsilon =", eps];
f[x_] := x^3 - 5 x + 1;
Print["f[x] :=", f[x]];
Print["f'[x] :=", D[f[x], x]];
For[i = 1, i ≤ Nmax, i++, x1 = N[x0 - (f[x] /. x → x0) / (D[f[x], x] /. x → x0)];
  If[Abs[x1 - x0] < eps, Return[x1], x0p = x0; x0 = x1];
  Print["In ", i, "th Number of iterations the approximation to root is :", x1];
  Print["Estimated error is :", Abs[x1 - x0p]]];
Print["The final approximation of root is:", x1];
Print["Estimated error is :", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]

x0=0.5

Nmax=20

Epsilon =1.×10-6

f[x] :=1 - 5 x + x3

f'[x] :=-5 + 3 x2

In 1th Number of iterations the approximation to root is :0.176471
Estimated error is :0.323529

In 2th Number of iterations the approximation to root is :0.201568
Estimated error is :0.0250975

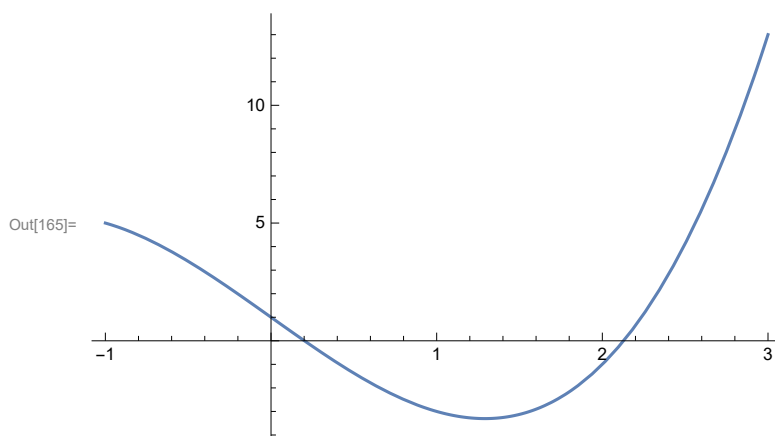
In 3th Number of iterations the approximation to root is :0.20164
Estimated error is :0.0000716007

```

Out[162]= Return[0.20164]

The final approximation of root is:0.20164

Estimated error is :6.35602×10⁻¹⁰



Ques-3

```

In[166]:= ClearAll;
x0 = Input["Enter initial guess :"];
Nmax = Input["Enter maximum number of iterations :"];
eps = Input["Enter the value of convergence parameter :"];
Print["x0=", x0];
Print["Nmax=", Nmax];
Print["Epsilon =", eps];
f[x_] := Cos[x] - x Exp[x];
Print["f[x] :=", f[x]];
Print["f'[x] :=", D[f[x], x]];
For[i = 1, i ≤ Nmax, i++, x1 = N[x0 - (f[x] /. x → x0) / (D[f[x], x] /. x → x0)];
  If[Abs[x1 - x0] < eps, Return[x1], x0p = x0; x0 = x1];
  Print["In ", i, "th Number of iterations the approximation to root is :", x1];
  Print["Estimated error is :", Abs[x1 - x0p]]];
Print["The final approximation of root is:", x1];
Print["Estimated error is :", Abs[x1 - x0]];
Plot[f[x], {x, -1, 3}]

x0=1.5
Nmax=20
Epsilon =1.×10-6
f[x] := -ex x + Cos[x]
f'[x] := -ex - ex x - Sin[x]

In 1th Number of iterations the approximation to root is :0.954848
Estimated error is :0.545152

In 2th Number of iterations the approximation to root is :0.632019
Estimated error is :0.322829

In 3th Number of iterations the approximation to root is :0.527616
Estimated error is :0.104403

In 4th Number of iterations the approximation to root is :0.517838
Estimated error is :0.00977784

In 5th Number of iterations the approximation to root is :0.517757
Estimated error is :0.0000806043

Out[176]= Return[0.517757]

The final approximation of root is:0.517757
Estimated error is :5.44033×10-9

```

Out[179]=

