NEWTON RAPHSON METHOD

PRACTICAL-4

QUE 1Find the roots of given function using NEWTON RAPHSON METHOD:f[x]=27 x^4+162 x^3-180 x^2+62 x -7.

In[17]:=
```
f[x_] := 27 x^4 + 162 x^3 - 180 x^2 + 62 x - 7
```

In[18]:=
```
x0 = 0;
```

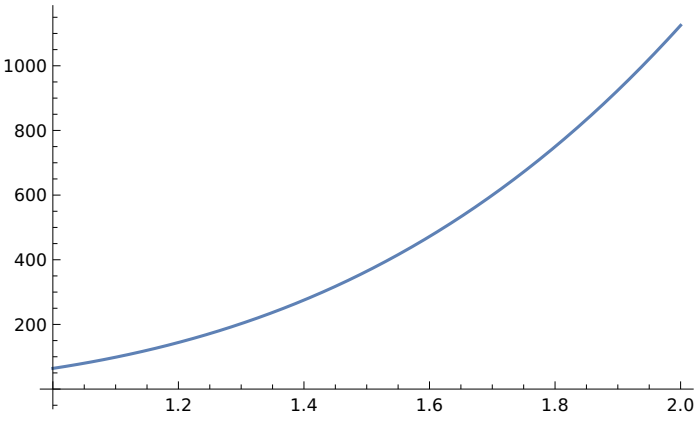
In[19]:=
```
ϵ=0.00005;
```

In[20]:=
```
Nmax = 10;
```

In[21]:=
```
For[n = 1, n ≤ Nmax, n++,
 x1 = N[x0 - f[x0] / f'[x0]];
   If[Abs[x1 - x0] < ϵ, Return[x1], x2 = x0; x0 = x1];
   Print[n, "th ITERATION VALUE IS ", x1];
   Print["ESTIMATED ERROR IS: ", Abs[x1 - x2]]];
   Print["THE FINAL APPROXIMATE ROOT IS ", x1];
   Print["FINAL ESTIMATED ERROR IS: ", Abs[x1 - x0]]
   Plot[f[x], {x, 1, 2}]
```

```
1th ITERATION VALUE IS 0.112903
ESTIMATED ERROR IS: 0.112903
2th ITERATION VALUE IS 0.187147
ESTIMATED ERROR IS: 0.0742436
3th ITERATION VALUE IS 0.236208
ESTIMATED ERROR IS: 0.0490615
4th ITERATION VALUE IS 0.268729
ESTIMATED ERROR IS: 0.0325205
5th ITERATION VALUE IS 0.290328
ESTIMATED ERROR IS: 0.0215988
6th ITERATION VALUE IS 0.304691
ESTIMATED ERROR IS: 0.0143635
7th ITERATION VALUE IS 0.314251
ESTIMATED ERROR IS: 0.0095599
8th ITERATION VALUE IS 0.320617
ESTIMATED ERROR IS: 0.00636631
9th ITERATION VALUE IS 0.324858
ESTIMATED ERROR IS: 0.00424112
10th ITERATION VALUE IS 0.327685
ESTIMATED ERROR IS: 0.00282605
THE FINAL APPROXIMATE ROOT IS 0.327685
FINAL ESTIMATED ERROR IS: 0.
```

Out[24]=



QUE 2 Find the roots of given function using NEWTON RAPHSON METHOD:f[x]=Exp[-x]-x.

In[25]:=
```
f[x_] := Exp[-x] - x
```

In[27]:=
```
x0 = 0.5;
```

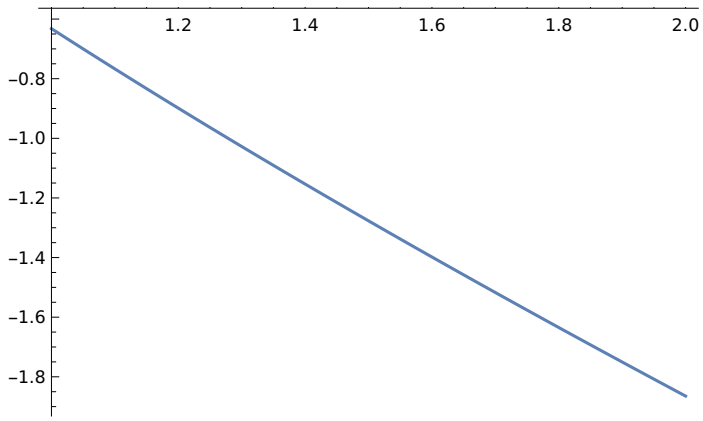
In[28]:=
```
ϵ = 0.00005;
```

In[29]:=
```
Nmax = 10;
```

In[30]:=
```
For[n = 1, n ≤ Nmax, n++,
 x1 = N[x0 – f[x0] / f '[x0]];
   If[Abs[x1 – x0] < ϵ, Return[x1], x2 = x0; x0 = x1];
   Print[n, "th ITERATION VALUE IS ", x1];
   Print["ESTIMATED ERROR IS: ", Abs[x1 – x2]]];
   Print["THE FINAL APPROXIMATE ROOT IS ", x1];
   Print["FINAL ESTIMATED ERROR IS: ", Abs[x1 – x0]]
   Plot[f[x], {x, 1, 2}]
```

```
1th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
2th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
3th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
4th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
5th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
6th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
7th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
8th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
9th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
10th ITERATION VALUE IS 0.566311
ESTIMATED ERROR IS: 0.241453
THE FINAL APPROXIMATE ROOT IS 0.566311
FINAL ESTIMATED ERROR IS: 0.066311
```

Out[33]=



QUE 3 Find the roots of given function using NEWTON RAPHSON METHOD : f[x] = x ^ 3 − 3 x + 1.

In[35]:=
```
f[x_] := x ^ 3 - 3 x + 1
```

In[44]:=
```
x0 = 2;
```

In[45]:=
```
ϵ = 0.00005;
```

In[46]:=
```
Nmax = 10;
```

In[47]:=
```
For[n = 1, n ≤ Nmax, n++,
 x1 = N[x0 - f[x0] / f'[x0]];
   If[Abs[x1 - x0] < ϵ, Return[x1], x2 = x0; x0 = x1];
   Print[n, "th ITERATION VALUE IS ", x1];
   Print["ESTIMATED ERROR IS: ", Abs[x1 - x2]]];
   Print["THE FINAL APPROXIMATE ROOT IS ", x1];
   Print["FINAL ESTIMATED ERROR IS: ", Abs[x1 - x0]]
   Plot[f[x], {x, 1, 2}]
```

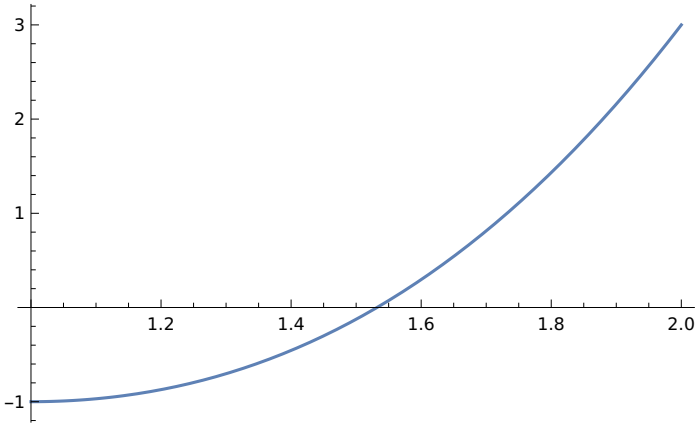
```
1th ITERATION VALUE IS 1.66667
ESTIMATED ERROR IS: 0.333333
2th ITERATION VALUE IS 1.54861
ESTIMATED ERROR IS: 0.118056
3th ITERATION VALUE IS 1.53239
ESTIMATED ERROR IS: 0.0162209
4th ITERATION VALUE IS 1.53209
ESTIMATED ERROR IS: 0.000301172
```

Out[47]= 1.53209

THE FINAL APPROXIMATE ROOT IS 1.53209

FINAL ESTIMATED ERROR IS: 1.03159×10^{-7}

Out[50]=



QUE 4 Find the roots of given function using NEWTON RAPHSON METHOD:f[x]=x^3-48.

In[51]:=
```
f[x_] := x^3 - 48
```

In[53]:=
```
x0 = 3;
```

In[54]:=
```
ϵ = 0.00005;
```

In[55]:=
```
Nmax = 10;
```

In[56]:=
```
For[n = 1, n ≤ Nmax, n++,
 x1 = N[x0 - f[x0] / f'[x0]];
   If[Abs[x1 - x0] < ϵ, Return[x1], x2 = x0; x0 = x1];
   Print[n, "th ITERATION VALUE IS ", x1];
   Print["ESTIMATED ERROR IS: ", Abs[x1 - x2]]];
   Print["THE FINAL APPROXIMATE ROOT IS ", x1];
   Print["FINAL ESTIMATED ERROR IS: ", Abs[x1 - x0]]
   Plot[f[x], {x, 1, 2}]
```

1th ITERATION VALUE IS 3.77778

ESTIMATED ERROR IS: 0.777778

2th ITERATION VALUE IS 3.63963

ESTIMATED ERROR IS: 0.138152

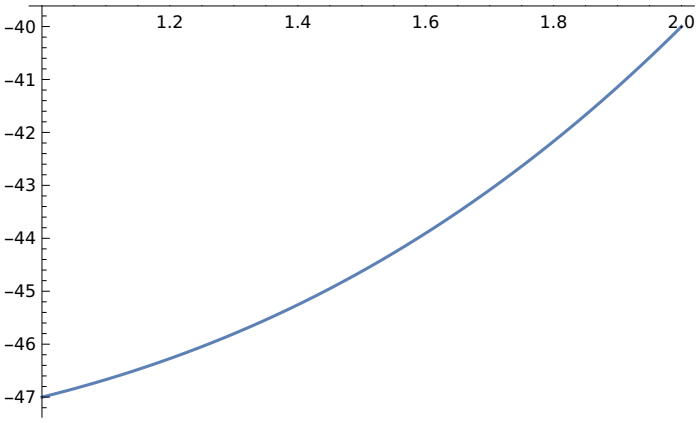
3th ITERATION VALUE IS 3.63425

ESTIMATED ERROR IS: 0.00537664

Out[56]= 3.63424

```
THE FINAL APPROXIMATE ROOT IS 3.63424

FINAL ESTIMATED ERROR IS: 7.96223 × 10^-6
```

Out[59]=



QUE 5 Find the roots of given function using NEWTON RAPHSON METHOD:f[x]=:Log[1+x]-Cos[x]

In[8]:=
```
f[x_] := Log[1 + x] - Cos[x]
```

In[9]:=
```
x0 = 0.8;
```

In[10]:=
```
ϵ=0.00005;
```

In[11]:=
```
Nmax = 10;
```

In[12]:=
```
For[n = 1, n ≤ Nmax, n++,
 x1 = N[x0 - f[x0] / f'[x0]];
   If[Abs[x1 - x0] < ϵ, Return[x1], x2 = x0; x0 = x1];
   Print[n, "th ITERATION VALUE IS ", x1];
   Print["ESTIMATED ERROR IS: ", Abs[x1 - x2]]];
   Print["THE FINAL APPROXIMATE ROOT IS ", x1];
   Print["FINAL ESTIMATED ERROR IS: ", Abs[x1 - x0]]
   Plot[f[x], {x, 1, 2}]
```

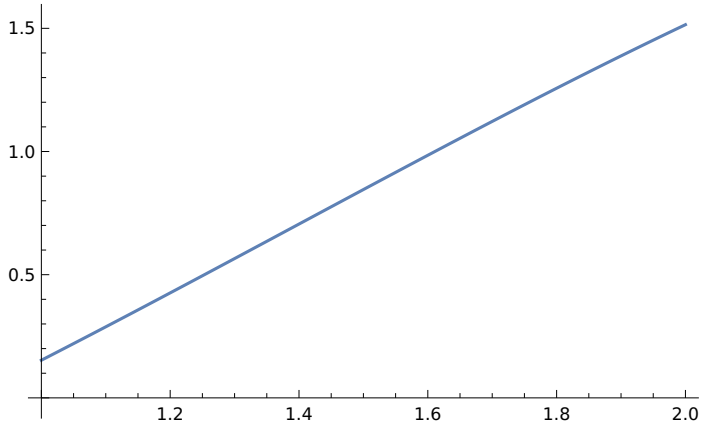
```
1th ITERATION VALUE IS 0.885568

ESTIMATED ERROR IS: 0.0855676

2th ITERATION VALUE IS 0.884511

ESTIMATED ERROR IS: 0.00105687
```

Out[12]=
```
0.884511
```

THE FINAL APPROXIMATE ROOT IS 0.884511

FINAL ESTIMATED ERROR IS: 1.50623×10^{-7}

Out[15]=



QUE 6 Find the roots of given function using NEWTON RAPHSON METHOD:f[x]=1/(1+x)+Sin[x]

In[16]:=
```
f[x_] := 1 / (1 + x) + Sin[x]
```

In[19]:=
```
x0 = 70;
```

In[20]:=
```
ϵ=0.00005;
```

In[21]:=
```
Nmax = 10;
```

In[22]:=
```
For[n = 1, n ≤ Nmax, n++,
 x1 = N[x0 - f[x0] / f'[x0]];
   If[Abs[x1 - x0] < ϵ, Return[x1], x2 = x0; x0 = x1];
   Print[n, "th ITERATION VALUE IS ", x1];
   Print["ESTIMATED ERROR IS: ", Abs[x1 - x2]]];
   Print["THE FINAL APPROXIMATE ROOT IS ", x1];
   Print["FINAL ESTIMATED ERROR IS: ", Abs[x1 - x0]]
   Plot[f[x], {x, 1, 2}]
```

1th ITERATION VALUE IS 68.7554

ESTIMATED ERROR IS: 1.24459

2th ITERATION VALUE IS 69.1162

ESTIMATED ERROR IS: 0.360741

3th ITERATION VALUE IS 69.1008

ESTIMATED ERROR IS: 0.0153789

Out[22]= 69.1008

THE FINAL APPROXIMATE ROOT IS 69.1008

FINAL ESTIMATED ERROR IS: 4.75335×10^{-7}

Out[25]=