REGULA FALSI METHOD OR CHORD METHOD

Ques. 01 Find the root of function Cos x using Chord method.

In[117]:=
```
FindRoot[Cos[x], {x, 0, 2}]
```

Out[117]=

{0.567143 → 1.5708}

In[118]:=
```
f[x_] := Cos[x]
```

In[119]:=
```
a = 0;
```

In[120]:=
```
b = 2;
```

In[121]:=
```
ϵ = 5 * 10^-4;
```

```
Nmax = 15;
```

In[123]:=
```
If[f[a] * f[b] > 0,
Print["These values do not satisfy the IVP so change the initial value"],
For[i = 1, i ≤ Nmax, i++,
x = N[(a * f[b] - b * f[a]) / (f[b] - f[a])];
If[f[x] * f[b] > 0, b = x, a = x];
If[Abs[(b - a)] < ϵ, Return[x],
Print["------------>  ", i, "th Iteration value is -> ", N[x]];
Print["--> Estimated Error in ", i, "th Iteration is -> ", N[b - a]];
Print["--> Exact Error in ", i, "th Iteration is -> ", 1.5708 - x]]];
Print["------------------------------>  The Approximate root is → ", N[x];
Print["Estimated Error is --> ", N[b - a];
Plot[f[x], {x, -1, 3}]
```

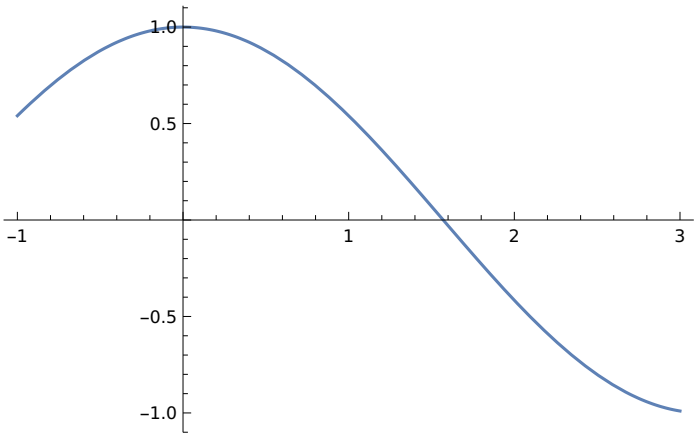
```
------------>  1th Iteration value is -> 1.41228
--> Estimated Error in 1th Iteration is -> 0.587717
--> Exact Error in 1th Iteration is -> 0.158517
------------>  2th Iteration value is -> 1.57391
--> Estimated Error in 2th Iteration is -> 0.161623
--> Exact Error in 2th Iteration is -> -0.00310632
------------>  3th Iteration value is -> 1.57078
--> Estimated Error in 3th Iteration is -> 0.0031228
--> Exact Error in 3th Iteration is -> 0.0000164781
```

Out[123]=
```
1.5708

------------------------------>  The Approximate root is → 1.5708

Estimated Error is --> 0.0000128049
```

Out[126]=



In[66]:=
```
ClearAll[a, b, x]
```

Ques. 02 Find the root of function Exp[-x]-x using Chord method.

In[107]:=
```
FindRoot[Exp[-x] - x, {x, 0, 2}]
```
Out[107]=
```
{0.567143 → 0.567143}
```

In[108]:=
```
f[x_] := Exp[-x] - x;
```

In[109]:=
```
a = 0;
```

In[110]:=
```
b = 2;
```

In[111]:=
```
ϵ = 5 * 10^-4;
```

In[112]:=
```
Nmax = 15;
```

In[113]:=
```
If[f[a] * f[b] > 0,
Print["These values do not satisfy the IVP so change the initial value"],
For[i = 1, i ≤ Nmax, i++,
x = N[(a * f[b] - b * f[a]) / (f[b] - f[a])];
If[f[x] * f[b] > 0, b = x, a = x];
If[Abs[(b - a)] < ϵ, Return[x],
Print["------------>  ", i, "th Iteration value is -> ", N[x]];
Print["--> Estimated Error in ", i, "th Iteration is -> ", N[b - a]];
Print["--> Exact Error in ", i, "th Iteration is -> ", Abs[0.567143 - x]]]];
Print["------------------------------>  The Approximate root is → ", N[x]];
Print["Estimated Error is --> ", N[b - a]];
Plot[f[x], {x, 0, 2}]
```

```
------------>  1th Iteration value is -> 0.698162
--> Estimated Error in 1th Iteration is -> 0.698162
--> Exact Error in 1th Iteration is -> 0.131019
------------>  2th Iteration value is -> 0.58148
--> Estimated Error in 2th Iteration is -> 0.58148
--> Exact Error in 2th Iteration is -> 0.0143373
------------>  3th Iteration value is -> 0.568735
--> Estimated Error in 3th Iteration is -> 0.568735
--> Exact Error in 3th Iteration is -> 0.00159188
------------>  4th Iteration value is -> 0.56732
--> Estimated Error in 4th Iteration is -> 0.56732
--> Exact Error in 4th Iteration is -> 0.000177249
------------>  5th Iteration value is -> 0.567163
--> Estimated Error in 5th Iteration is -> 0.567163
```

--> Exact Error in 5th Iteration is -> 0.0000199687

------------> 6th Iteration value is -> 0.567145

--> Estimated Error in 6th Iteration is -> 0.567145

--> Exact Error in 6th Iteration is -> 2.47873×10^{-6}

------------> 7th Iteration value is -> 0.567144

--> Estimated Error in 7th Iteration is -> 0.567144

--> Exact Error in 7th Iteration is -> 5.33763×10^{-7}

------------> 8th Iteration value is -> 0.567143

--> Estimated Error in 8th Iteration is -> 0.567143

--> Exact Error in 8th Iteration is -> 3.17472×10^{-7}

------------> 9th Iteration value is -> 0.567143

--> Estimated Error in 9th Iteration is -> 0.567143

--> Exact Error in 9th Iteration is -> 2.93419×10^{-7}

------------> 10th Iteration value is -> 0.567143

--> Estimated Error in 10th Iteration is -> 0.567143

--> Exact Error in 10th Iteration is -> 2.90744×10^{-7}

------------> 11th Iteration value is -> 0.567143

--> Estimated Error in 11th Iteration is -> 0.567143

--> Exact Error in 11th Iteration is -> 2.90447×10^{-7}

------------> 12th Iteration value is -> 0.567143

--> Estimated Error in 12th Iteration is -> 0.567143

--> Exact Error in 12th Iteration is -> 2.90414×10^{-7}

------------> 13th Iteration value is -> 0.567143

--> Estimated Error in 13th Iteration is -> 0.567143

--> Exact Error in 13th Iteration is -> 2.9041×10^{-7}

------------> 14th Iteration value is -> 0.567143

--> Estimated Error in 14th Iteration is -> 0.567143

--> Exact Error in 14th Iteration is -> 2.9041×10^{-7}

------------> 15th Iteration value is -> 0.567143

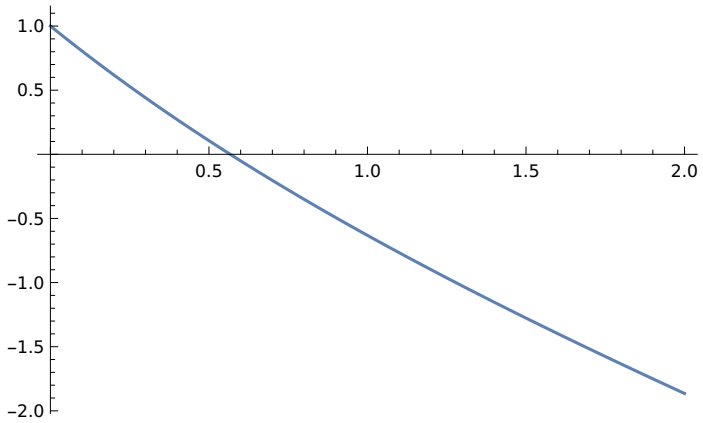
--> Estimated Error in 15th Iteration is -> 0.567143

--> Exact Error in 15th Iteration is -> 2.9041×10^{-7}

------------------------------> The Approximate root is → 0.567143

Estimated Error is --> 0.567143

Out[116]=



Ques. 03 Find the root of function x^5+2x-1 using Chord method.

In[127]:=
```
FindRoot[x^5 + 2 x - 1, {x, 0, 1}]
```

Out[127]=

{1.5708 → 0.486389}

In[128]:=
```
f[x_] := x^5 + 2 x - 1;
```

In[129]:=
```
a = 0;
```

In[130]:=
```
b = 1;
```

In[131]:=
```
ϵ = 5 * 10^-4;
```

In[132]:=
```
Nmax = 15;
```

In[137]:=
```
If[f[a] * f[b] > 0,
Print["These values do not satisfy the IVP so change the initial value"],
For[i = 1, i ≤ Nmax, i++,
x = N[(a * f[b] - b * f[a]) / (f[b] - f[a])];
If[f[x] * f[b] > 0, b = x, a = x];
If[Abs[(b - a)] < ϵ, Return[x],
Print["------------>  ", i, "th Iteration value is -> ", N[x]];
Print["--> Estimated Error in ", i, "th Iteration is -> ", N[b - a]];
Print["--> Exact Error in ", i, "th Iteration is -> ", Abs[0.486389 - x]]]];
Print["------------------------------>  The Approximate root is → ", N[x]];
Print["Estimated Error is --> ", N[b - a]];
Plot[f[x], {x, -1, 2}]
```

```
------------>  1th Iteration value is -> 0.486389
```

--> Estimated Error in 1th Iteration is -> 0.513611

--> Exact Error in 1th Iteration is -> 2.12977×10^{-7}

------------> 2th Iteration value is -> 0.486389

--> Estimated Error in 2th Iteration is -> 0.513611

--> Exact Error in 2th Iteration is -> 6.72458×10^{-8}

------------> 3th Iteration value is -> 0.486389

--> Estimated Error in 3th Iteration is -> 0.513611

--> Exact Error in 3th Iteration is -> 6.83631×10^{-9}

------------> 4th Iteration value is -> 0.486389

--> Estimated Error in 4th Iteration is -> 0.513611

--> Exact Error in 4th Iteration is -> 1.82049×10^{-8}

------------> 5th Iteration value is -> 0.486389

--> Estimated Error in 5th Iteration is -> 0.513611

--> Exact Error in 5th Iteration is -> 2.85852×10^{-8}

------------> 6th Iteration value is -> 0.486389

--> Estimated Error in 6th Iteration is -> 0.513611

--> Exact Error in 6th Iteration is -> 3.2888×10^{-8}

------------> 7th Iteration value is -> 0.486389

--> Estimated Error in 7th Iteration is -> 0.513611

--> Exact Error in 7th Iteration is -> 3.46717×10^{-8}

------------> 8th Iteration value is -> 0.486389

--> Estimated Error in 8th Iteration is -> 0.513611

--> Exact Error in 8th Iteration is -> 3.54111×10^{-8}

------------> 9th Iteration value is -> 0.486389

--> Estimated Error in 9th Iteration is -> 0.513611

--> Exact Error in 9th Iteration is -> 3.57175×10^{-8}

------------> 10th Iteration value is -> 0.486389

--> Estimated Error in 10th Iteration is -> 0.513611

--> Exact Error in 10th Iteration is -> 3.58446×10^{-8}

------------> 11th Iteration value is -> 0.486389

--> Estimated Error in 11th Iteration is -> 0.513611

--> Exact Error in 11th Iteration is -> 3.58973×10^{-8}

------------> 12th Iteration value is -> 0.486389

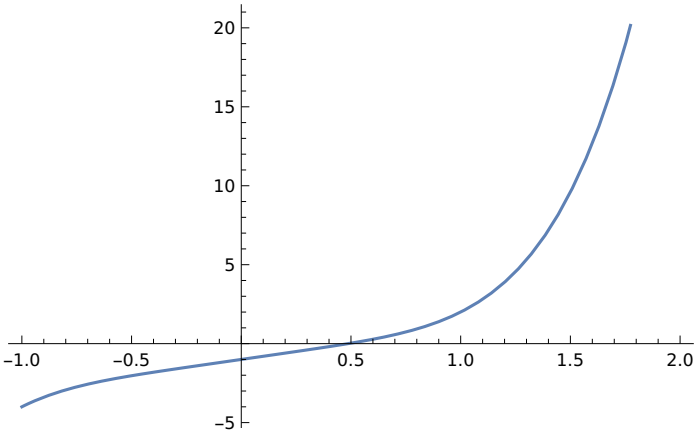
--> Estimated Error in 12th Iteration is -> 0.513611

--> Exact Error in 12th Iteration is -> 3.59191×10^{-8}

------------> 13th Iteration value is -> 0.486389

```
--> Estimated Error in 13th Iteration is -> 0.513611
--> Exact Error in 13th Iteration is -> 3.59281 × 10^-8
------------>  14th Iteration value is -> 0.486389
--> Estimated Error in 14th Iteration is -> 0.513611
--> Exact Error in 14th Iteration is -> 3.59319 × 10^-8
------------>  15th Iteration value is -> 0.486389
--> Estimated Error in 15th Iteration is -> 0.513611
--> Exact Error in 15th Iteration is -> 3.59334 × 10^-8
------------------------------>  The Approximate root is → 0.486389
Estimated Error is --> 0.513611
```

Out[140]=



Ques. 04 Find the root of function x^3+2x^2-3x-1 using Chord method.

In[141]:=
```
FindRoot[x^3 + 2 x^2 - 3 x - 1, {x, 0, 2}]
```

Out[141]=

```
{0.486389 → 1.19869}
```

In[142]:=
```
f[x_] := x^3 + 2 x^2 - 3 x - 1;
```

In[143]:=
```
a = 0;
```

In[144]:=
```
b = 2;
```

In[145]:=
```
ϵ = 5 * 10^-4;
```

In[146]:=
```
Nmax = 15;
```

In[151]:=
```
If[f[a] * f[b] > 0,
Print["These values do not satisfy the IVP so change the initial value"],
For[i = 1, i ≤ Nmax, i++,
x = N[(a * f[b] - b * f[a]) / (f[b] - f[a])];
If[f[x] * f[b] > 0, b = x, a = x];
If[Abs[(b - a)] < ϵ, Return[x],
Print["------------>  ", i, "th Iteration value is -> ", N[x]];
Print["--> Estimated Error in ", i, "th Iteration is -> ", N[b - a]];
Print["--> Exact Error in ", i, "th Iteration is -> ", Abs[1.19869 - x]]]];
Print["------------------------------>  The Approximate root is → ", N[x]];
Print["Estimated Error is --> ", N[b - a]];
Plot[f[x], {x, -1, 2}]
```

```
------------>  1th Iteration value is -> 1.19866
--> Estimated Error in 1th Iteration is -> 0.801336
--> Exact Error in 1th Iteration is -> 0.000026235
------------>  2th Iteration value is -> 1.19868
--> Estimated Error in 2th Iteration is -> 0.801321
--> Exact Error in 2th Iteration is -> 0.0000112982
------------>  3th Iteration value is -> 1.19869
--> Estimated Error in 3th Iteration is -> 0.801314
--> Exact Error in 3th Iteration is -> 4.48075 × 10^-6
------------>  4th Iteration value is -> 1.19869
--> Estimated Error in 4th Iteration is -> 0.801311
--> Exact Error in 4th Iteration is -> 1.36913 × 10^-6
------------>  5th Iteration value is -> 1.19869
--> Estimated Error in 5th Iteration is -> 0.80131
--> Exact Error in 5th Iteration is -> 5.10647 × 10^-8
------------>  6th Iteration value is -> 1.19869
--> Estimated Error in 6th Iteration is -> 0.801309
--> Exact Error in 6th Iteration is -> 6.99263 × 10^-7
------------>  7th Iteration value is -> 1.19869
--> Estimated Error in 7th Iteration is -> 0.801309
--> Exact Error in 7th Iteration is -> 9.95111 × 10^-7
------------>  8th Iteration value is -> 1.19869
--> Estimated Error in 8th Iteration is -> 0.801309
--> Exact Error in 8th Iteration is -> 1.13014 × 10^-6
------------>  9th Iteration value is -> 1.19869
```

--> Estimated Error in 9th Iteration is -> 0.801309

--> Exact Error in 9th Iteration is -> 1.19177×10^{-6}

------------> 10th Iteration value is -> 1.19869

--> Estimated Error in 10th Iteration is -> 0.801309

--> Exact Error in 10th Iteration is -> 1.2199×10^{-6}

------------> 11th Iteration value is -> 1.19869

--> Estimated Error in 11th Iteration is -> 0.801309

--> Exact Error in 11th Iteration is -> 1.23274×10^{-6}

------------> 12th Iteration value is -> 1.19869

--> Estimated Error in 12th Iteration is -> 0.801309

--> Exact Error in 12th Iteration is -> 1.2386×10^{-6}

------------> 13th Iteration value is -> 1.19869

--> Estimated Error in 13th Iteration is -> 0.801309

--> Exact Error in 13th Iteration is -> 1.24127×10^{-6}

------------> 14th Iteration value is -> 1.19869

--> Estimated Error in 14th Iteration is -> 0.801309

--> Exact Error in 14th Iteration is -> 1.24249×10^{-6}

------------> 15th Iteration value is -> 1.19869

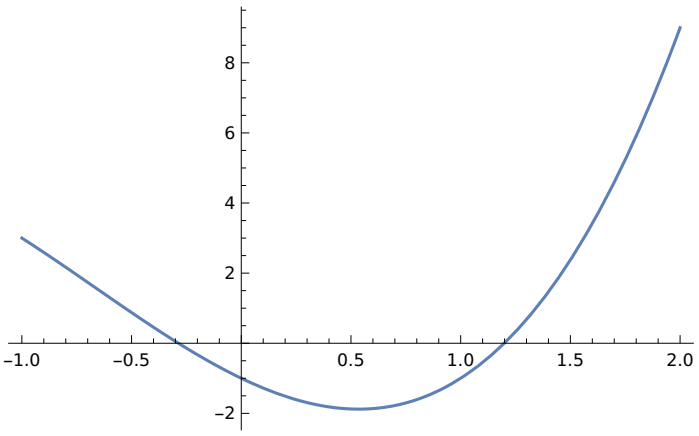
--> Estimated Error in 15th Iteration is -> 0.801309

--> Exact Error in 15th Iteration is -> 1.24305×10^{-6}

------------------------------> The Approximate root is → 1.19869

Estimated Error is --> 0.801309

Out[154]=



Ques. 05 Find the root of function Cos x-xExp[x] using Chord method.

In[158]:=
```
FindRoot[Cos[x] - x Exp[x], {x, 0, 1}]
```

Out[158]=
```
{1.19869 → 0.517757}
```

In[159]:=
```
f[x_] := Cos[x] - x Exp[x];
```

In[160]:=
```
a = 0;
```

In[161]:=
```
b = 1;
```

In[162]:=
```
ϵ = 5 * 10^-4;
```

In[163]:=
```
Nmax = 15;
```

In[164]:=
```
If[f[a] * f[b] > 0,
Print["These values do not satisfy the IVP so change the initial value"],
For[i = 1, i ≤ Nmax, i++,
x = N[(a * f[b] - b * f[a]) / (f[b] - f[a])];
If[f[x] * f[b] > 0, b = x, a = x];
If[Abs[(b - a)] < ϵ, Return[x],
Print["------------>  ", i, "th Iteration value is -> ", N[x]];
Print["--> Estimated Error in ", i, "th Iteration is -> ", N[b - a]];
Print["--> Exact Error in ", i, "th Iteration is -> ", Abs[0.517757 - x]]]];
Print["------------------------------>  The Approximate root is → ", N[x]];
Print["Estimated Error is --> ", N[b - a]];
Plot[f[x], {x, -1, 2}]
```

```
------------>  1th Iteration value is -> 0.314665
--> Estimated Error in 1th Iteration is -> 0.685335
--> Exact Error in 1th Iteration is -> 0.203092
------------>  2th Iteration value is -> 0.446728
--> Estimated Error in 2th Iteration is -> 0.553272
--> Exact Error in 2th Iteration is -> 0.0710289
------------>  3th Iteration value is -> 0.494015
--> Estimated Error in 3th Iteration is -> 0.505985
--> Exact Error in 3th Iteration is -> 0.0237417
------------>  4th Iteration value is -> 0.509946
--> Estimated Error in 4th Iteration is -> 0.490054
--> Exact Error in 4th Iteration is -> 0.00781086
------------>  5th Iteration value is -> 0.515201
--> Estimated Error in 5th Iteration is -> 0.484799
--> Exact Error in 5th Iteration is -> 0.00255599
```

------------> 6th Iteration value is -> 0.516922

--> Estimated Error in 6th Iteration is -> 0.483078

--> Exact Error in 6th Iteration is -> 0.00083479

------------> 7th Iteration value is -> 0.517485

--> Estimated Error in 7th Iteration is -> 0.482515

--> Exact Error in 7th Iteration is -> 0.000272323

------------> 8th Iteration value is -> 0.517668

--> Estimated Error in 8th Iteration is -> 0.482332

--> Exact Error in 8th Iteration is -> 0.000088655

------------> 9th Iteration value is -> 0.517728

--> Estimated Error in 9th Iteration is -> 0.482272

--> Exact Error in 9th Iteration is -> 0.0000286947

------------> 10th Iteration value is -> 0.517748

--> Estimated Error in 10th Iteration is -> 0.482252

--> Exact Error in 10th Iteration is -> 9.12168×10^{-6}

------------> 11th Iteration value is -> 0.517754

--> Estimated Error in 11th Iteration is -> 0.482246

--> Exact Error in 11th Iteration is -> 2.73255×10^{-6}

------------> 12th Iteration value is -> 0.517756

--> Estimated Error in 12th Iteration is -> 0.482244

--> Exact Error in 12th Iteration is -> 6.46992×10^{-7}

------------> 13th Iteration value is -> 0.517757

--> Estimated Error in 13th Iteration is -> 0.482243

--> Exact Error in 13th Iteration is -> 3.37773×10^{-8}

------------> 14th Iteration value is -> 0.517757

--> Estimated Error in 14th Iteration is -> 0.482243

--> Exact Error in 14th Iteration is -> 2.55995×10^{-7}

------------> 15th Iteration value is -> 0.517757

--> Estimated Error in 15th Iteration is -> 0.482243

--> Exact Error in 15th Iteration is -> 3.28531×10^{-7}

------------------------------> The Approximate root is → 0.517757

Estimated Error is --> 0.482243

Out[167]=