Regula – Falsi Method

Out[3]= Falsi Method Regulai

In[4]:=
```
Falsepositionmethod [a0_, b0_, n_, f_] :=
 Module[{a = N[a0], b = N[b0]}, c = (a * f[b] - b * f[a]) / (f[b] - f[a]);
 i = 0;
 If[f[a] * f[b] > 0,
  Print["we cannot find the roots in the given interval "];
  Return[]];
 OutputDetails = {{i, a, b, c, f[c]}};
 While[i < n,
  If[f[a] * f[c] < 0, b = c, a = c];
  c = (a * f[b] - b * f[a]) / (f[b] - f[a]);
  i++;
  OutputDetails = Append[OutputDetails , {i, a, b, c, f[c]}];];
 Print[NumberForm [
  TableForm[OutputDetails ,
   TableHeadings → {None , {"i", "ai", "bi", "ci", "f[ci]"}}], 7]];
 Print["root after ", n, "itteration is ", NumberForm[c, 6]];];
```

In[5]:=
```
Q .1 Use the Regula – Falsi method upto 20 iterations to
    obtain the root of the equation cos (x) – x = 0 in the interval (0, 1)
```

Syntax : "(" cannot be followed by "0, 1)".

In[5]:=
```
f[x_] := Cos[x] – x
Falsepositionmethod [0, 2, 20, f]
```

i	ai	bi	ci	f[ci]
0	0.	2.	0.5854549	0.2480059
1	0.5854549	2.	0.7171349	0.036557
2	0.7171349	2.	0.7362557	0.004732441
3	0.7362557	2.	0.7387261	0.000600825
4	0.7387261	2.	0.7390397	0.00007608751
5	0.7390397	2.	0.7390794	9.632509×10^{-6}
6	0.7390794	2.	0.7390844	1.219404×10^{-6}
7	0.7390844	2.	0.739085	1.543668×10^{-7}
8	0.739085	2.	0.7390851	1.954158×10^{-8}
9	0.7390851	2.	0.7390851	2.473806×10^{-9}
10	0.7390851	2.	0.7390851	3.131638×10^{-10}
11	0.7390851	2.	0.7390851	3.964384×10^{-11}
12	0.7390851	2.	0.7390851	5.01843×10^{-12}
13	0.7390851	2.	0.7390851	6.353806×10^{-13}
14	0.7390851	2.	0.7390851	8.060219×10^{-14}
15	0.7390851	2.	0.7390851	9.992007×10^{-15}
16	0.7390851	2.	0.7390851	1.221245×10^{-15}
17	0.7390851	2.	0.7390851	1.110223×10^{-16}
18	0.7390851	2.	0.7390851	0.
19	0.7390851	2.	0.7390851	0.
20	0.7390851	2.	0.7390851	0.

root after 20 itteration is 0.739085

In[7]:= **Q .2 Use Regula – Falsi method upto 20 iterations to obtain the root of the equation f(x) = $x^3 - 17 = 0$ in the interval (2, 3)**

Syntax : "(" cannot be followed by "2, 3)".

In[7]:=
```
f[x_] := x^3 - 17
Falsepositionmethod [2, 3, 20, f]
```

i	ai	bi	ci	f[ci]
0	2.	3.	2.473684	-1.863245
1	2.473684	3.	2.556348	-0.2944917
2	2.556348	3.	2.569039	-0.04444195
3	2.569039	3.	2.570946	-0.00665949
4	2.570946	3.	2.571231	-0.000996845
5	2.571231	3.	2.571274	-0.0001491919
6	2.571274	3.	2.57128	-0.00002232813
7	2.57128	3.	2.571281	-3.341628×10^{-6}
8	2.571281	3.	2.571282	-5.001077×10^{-7}
9	2.571282	3.	2.571282	-7.484606×10^{-8}
10	2.571282	3.	2.571282	-1.120146×10^{-8}
11	2.571282	3.	2.571282	-1.676412×10^{-9}
12	2.571282	3.	2.571282	$-2.508891 \times 10^{-10}$
13	2.571282	3.	2.571282	$-3.754508 \times 10^{-11}$
14	2.571282	3.	2.571282	$-5.613288 \times 10^{-12}$
15	2.571282	3.	2.571282	$-8.419931 \times 10^{-13}$
16	2.571282	3.	2.571282	$-1.207923 \times 10^{-13}$
17	2.571282	3.	2.571282	$-1.421085 \times 10^{-14}$
18	2.571282	3.	2.571282	$-3.552714 \times 10^{-15}$
19	2.571282	3.	2.571282	$-3.552714 \times 10^{-15}$
20	2.571282	3.	2.571282	$-3.552714 \times 10^{-15}$

root after 20 itteration is 2.57128

Q. 3 Use the Regula – Falsi method upto 20 iterations to obtain the root of the equation $f(x) = x^5 + 2x - 1 = 0$ in the interval (0, 1)

In[11]:=
```
f[x_] := x^5 + 2 x - 1
Falsepositionmethod [0, 1, 20, f]
```

i	ai	bi	ci	f[ci]
0	0.	1.	0.3333333	-0.3292181
1	0.3333333	1.	0.4275618	-0.1305876
2	0.4275618	1.	0.4626476	-0.0535089
3	0.4626476	1.	0.4766496	-0.02209743
4	0.4766496	1.	0.4823687	-0.009147218
5	0.4823687	1.	0.4847254	-0.003789678
6	0.4847254	1.	0.4856999	-0.001570569
7	0.4856999	1.	0.4861035	-0.0006509813
8	0.4861035	1.	0.4862707	-0.0002698381
9	0.4862707	1.	0.48634	-0.000111853
10	0.48634	1.	0.4863687	-0.0000463656
11	0.4863687	1.	0.4863806	-0.00001921967
12	0.4863806	1.	0.4863855	-7.96703×10^{-6}
13	0.4863855	1.	0.4863876	-3.302535×10^{-6}
14	0.4863876	1.	0.4863884	-1.368984×10^{-6}
15	0.4863884	1.	0.4863888	-5.674786×10^{-7}
16	0.4863888	1.	0.4863889	-2.352343×10^{-7}
17	0.4863889	1.	0.486389	-9.751057×10^{-8}
18	0.486389	1.	0.486389	-4.04206×10^{-8}
19	0.486389	1.	0.486389	-1.675536×10^{-8}
20	0.486389	1.	0.486389	-6.945524×10^{-9}

root after 20 itteration is 0.486389

Q. 4 Use the Regula – Falsi method upto 15 iterations to obtain the root of the equation log (1 + x) – cos (x) = 0 in the interval (0, 1)

In[13]:=
```
f[x_] := Log[1 + x] - Cos[x]
Falsepositionmethod [0, 1, 20, f]
```

i	ai	bi	ci	f[ci]
0	0.	1.	0.8674194	-0.02223936
1	0.8674194	1.	0.8842599	-0.0003269835
2	0.8842599	1.	0.884507	-4.746395×10^{-6}
3	0.884507	1.	0.8845106	-6.888423×10^{-8}
4	0.8845106	1.	0.8845106	$-9.997111 \times 10^{-10}$
5	0.8845106	1.	0.8845106	$-1.450884 \times 10^{-11}$
6	0.8845106	1.	0.8845106	$-2.104983 \times 10^{-13}$
7	0.8845106	1.	0.8845106	$-3.219647 \times 10^{-15}$
8	0.8845106	1.	0.8845106	1.110223×10^{-16}
9	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
10	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
11	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
12	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
13	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
14	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
15	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
16	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
17	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
18	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
19	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}
20	0.8845106	0.8845106	0.8845106	1.110223×10^{-16}

root after 20 itteration is 0.884511

Q. 5 Use the Regula - Falsi methodupto 20 iterations to obtain the root of the equation x^3 - 4 x - 9 = 0 in the interval (0, 4)

In[15]:=
```
f[x_] := x^3 - 4 x - 9
Falsepositionmethod [0, 4, 20, f]
```

i	ai	bi	ci	f[ci]
0	0.	4.	0.75	-11.57813
1	0.75	4.	1.493976	-11.6414
2	1.493976	4.	2.070059	-8.409738
3	2.070059	4.	2.4124	-4.610223
4	2.4124	4.	2.580232	-2.142787
5	2.580232	4.	2.654176	-0.9189676
6	2.654176	4.	2.685158	-0.3804511
7	2.685158	4.	2.69786	-0.1552001
8	2.69786	4.	2.703022	-0.06293054
9	2.703022	4.	2.705111	-0.02545455
10	2.705111	4.	2.705956	-0.0102858
11	2.705956	4.	2.706297	-0.004154667
12	2.706297	4.	2.706435	-0.001677892
13	2.706435	4.	2.70649	-0.0006775845
14	2.70649	4.	2.706513	-0.0002736222
15	2.706513	4.	2.706522	-0.000110493
16	2.706522	4.	2.706525	-0.00004461861
17	2.706525	4.	2.706527	-0.00001801759
18	2.706527	4.	2.706528	-7.275737×10^{-6}
19	2.706528	4.	2.706528	-2.938036×10^{-6}
20	2.706528	4.	2.706528	-1.186417×10^{-6}

root after 20 itteration is 2.70653