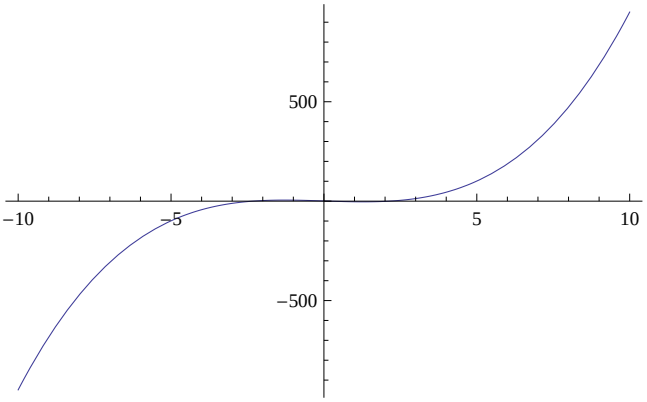
Practical -4

Regula Falsi Method

Regula-Falsi Method

(1) Find out the root of the function $g(x) = x^3 - 5x + 1$ after 10 iterations of the Regula Falsi method.

```
RegulaFalsi[x0_, x1_, n_, f_] := Module[{xk, xk1, xk2},
  xk = N[x0]; xk1 = N[x1]; If[f[xk] * f[xk1] > 0,
   Print["We cannot continue with Regula Falsi
     method as function values are not
     opposite sign at end points of interval"];
   Return[]]; i = 1; Output = { };
  While[i ≤ n, xk2 = (xk * f[xk1] - xk1 * f[xk]) /
    (f[xk1] - f[xk]);
   interval = "[" <> ToString[NumberForm[xk, 12]] <>
    "," <> ToString[NumberForm[xk1, 12]] <> "]";
   Output = Append[Output, {i, interval, xk2, f[xk2]}];
   If[Sign[f[xk1]] == Sign[f[xk2]],
    xk1 = xk2, xk = xk2]; i++;];
  Print[NumberForm[TableForm[Output, TableHeadings →
     {None, {"i", "interval", "xi", "f[xi]"}}], 8]];
  Print[" Root after ", n, " iterations ",
   NumberForm[xk2, 8]];
  Print[" Function value at approximated
    root,f[xi]= ", NumberForm[f[xk2], 8]];];
g[x_] := x^3 - 5 x + 1;
Plot[g[x], {x, -10, 10}]
RegulaFalsi[-1, 1, 10, g]
```



i	interval	xi	f[xi]
1	[-1.,1.]	0.25	-0.234375
2	[-1.,0.25]	0.19402985	0.037155501
3	[0.194029850746,0.25]	0.20168865	-0.00023892045
4	[0.194029850746,0.201688654959]	0.20163972	$-2.2244344 \times 10^{-7}$
5	[0.194029850746,0.201639721325]	0.20163968	$-2.0708324 \times 10^{-10}$
6	[0.194029850746,0.201639675766]	0.20163968	$-1.9273472 \times 10^{-13}$
7	[0.194029850746,0.201639675723]	0.20163968	$-4.4408921 \times 10^{-16}$
8	[0.194029850746,0.201639675723]	0.20163968	1.110223×10^{-16}
9	[0.201639675723,0.201639675723]	0.20163968	1.110223×10^{-16}
10	[0.201639675723,0.201639675723]	0.20163968	$-2.220446 \times 10^{-16}$

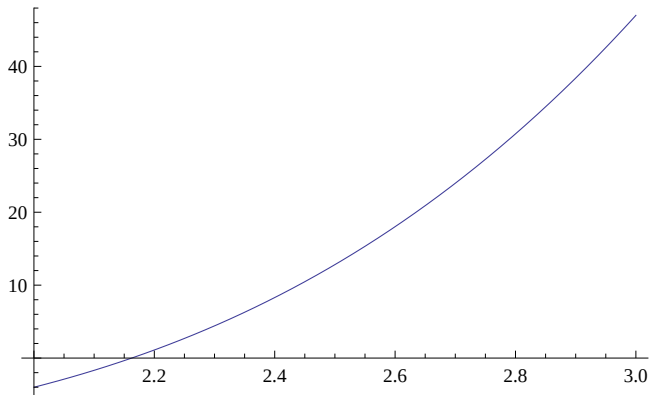
Root after 10 iterations 0.20163968

Function value at approximated root,f[xi]= $-2.220446 \times 10^{-16}$

---

(2) **Find out the root of the function $f(x) = x^4 - 3x^2 + x - 10$ over the interval [2, 3] after 7 iterations of the Regula Falsi method.**

```
f[x_] := x^4 - 3 x^2 + x - 10;
Plot[f[x], {x, 2, 3}]
RegulaFalsi[2, 3, 7, f]
```



i	interval	xi	f[xi]
1	[2.,3.]	2.0784314	-2.2198625
2	[2.07843137255,3.]	2.119995	-1.1637008
3	[2.11999499205,3.]	2.1412571	-0.59162874
4	[2.14125711528,3.]	2.1519325	-0.29607559
5	[2.15193245843,3.]	2.1572414	-0.1469951
6	[2.15724139986,3.]	2.159869	-0.072691406
7	[2.15986895617,3.]	2.1611663	-0.035876602

Root after 7 iterations 2.1611663

Function value at approximated root,f[xi]= -0.035876602