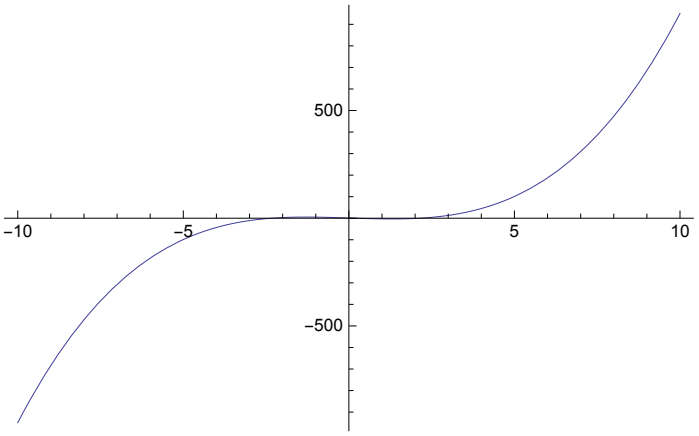
Practical 4
Regula Falsi Method

(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]
```



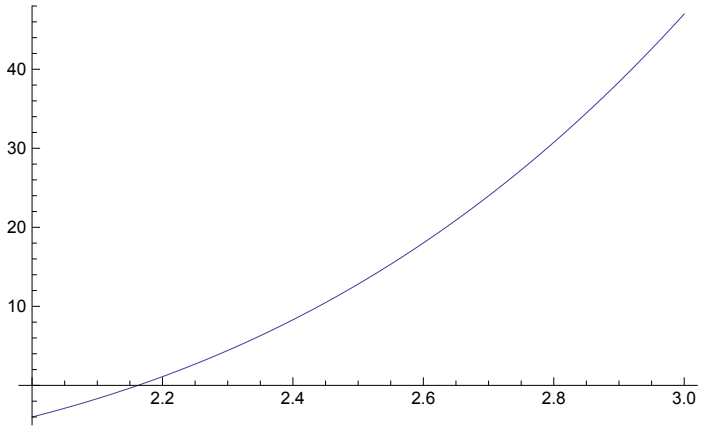
i	interval	xi	f[xi]
1	[-1.,1.]	0.25	-0.234375
2	[-1.,0.25]	0.19402985	0.037155501
3	[0.194029850746,0.25]	0.20168865	-0.00023892045
4	[0.194029850746,0.201688654959]	0.20163972	-2.2244344×10^{-7}
5	[0.194029850746,0.201639721325]	0.20163968	-2.0708324×10^{-10}
6	[0.194029850746,0.201639675766]	0.20163968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

Root after 10 iterations 0.20163968

Function value at approximated root,f[xi]= -2.220446×10^{-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