Practical -3

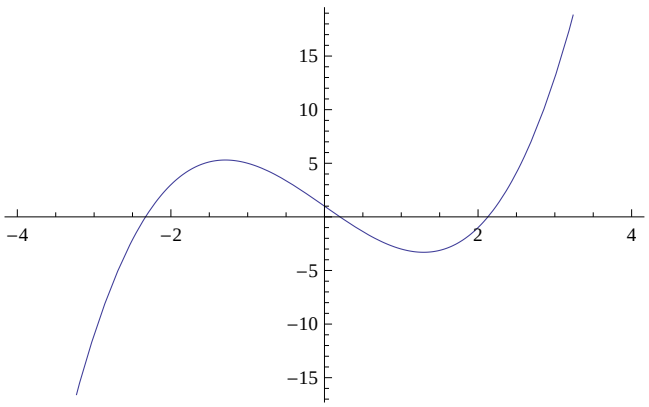
Secant Method

Secant Method

To find a root of an equation using secant method in given number of iterations.

(1) Find a real root of the equation $f(x) = x^3 - 5x + 1 = 0$ using secant method in six iterations.

```
Secant[x0_, x1_, n_, f_] :=
 Module[{xk, xk1, xk2}, xk = N[x0]; xk1 = N[x1]; i = 0;
  Output = { };
  While[i < n,
   xk2 = (xk * f[xk1] - xk1 * f[xk]) / (f[xk1] - f[xk]);
   interval = "[" <> ToString[NumberForm[xk, 12]] <>
     "," <> ToString[NumberForm[xk1, 12]] <> "]";
   xk = xk1; xk1 = xk2; i++;
   Output = Append[Output,
     {i, interval, xk2, f[xk2]}];];
  Print[NumberForm[TableForm[Output, TableHeadings →
     {None, {"i", "interval", "xi", "f[xi]"}}], 8]];
  Print[" Root after ", n, " iterrations ",
   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, -4, 4}]
Secant[0, 1, 6, g]
```



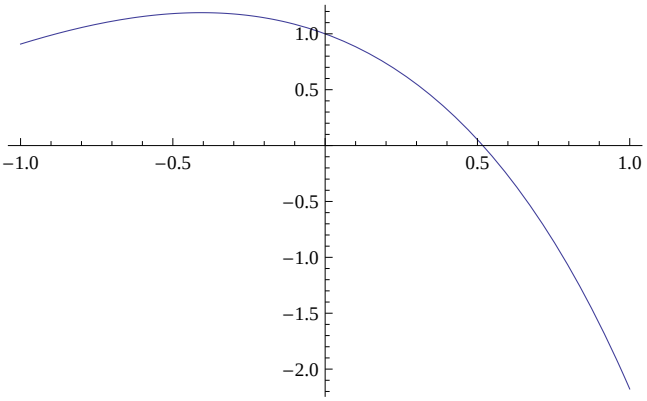
i	interval	xi	f[xi]
1	[0.,1.]	0.25	−0.234375
2	[1.,0.25]	0.18644068	0.074277312
3	[0.25,0.186440677966]	0.20173626	−0.00047111617
4	[0.186440677966,0.201736256179]	0.20163985	-8.642293×10^{-7}
5	[0.201736256179,0.201639852891]	0.20163968	$1.0352719 \times 10^{-11}$
6	[0.201639852891,0.201639675721]	0.20163968	$-2.220446 \times 10^{-16}$

Root after 6 iterrations 0.20163968

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

(2) Find a real root of the equation $f(x) = \text{Cosx} - \text{xe}^x$ using secant method in eight iterations

```
f[x_] := Cos[x] - x Exp[x];
Plot[f[x], {x, -1, 1}]
Secant[0, 1, 8, f]
```



i	interval	xi	f[xi]
1	[0.,1.]	0.31466534	0.51987117
2	[1.,0.314665337801]	0.44672814	0.20354478
3	[0.314665337801,0.446728144591]	0.53170586	−0.042931093
4	[0.446728144591,0.531705860645]	0.51690447	0.0025927631
5	[0.531705860645,0.516904467567]	0.51774747	0.000030111941
6	[0.516904467567,0.517747465271]	0.51775737	$-2.1513164 \times 10^{-8}$
7	[0.517747465271,0.517757370754]	0.51775736	$1.7841284 \times 10^{-13}$
8	[0.517757370754,0.517757363682]	0.51775736	$-3.3306691 \times 10^{-16}$

Root after 8 iterrations 0.51775736

Function value at approximated root,f[xi]= $-3.3306691 \times 10^{-16}$