# Practical 2(a): Secant method

Theory:
This is same as Regula falsi with following formula to find x(n+1):

$$x(n+1)=x(n)-f(x(n))[x(n)-x(n-1)]/[f(x(n))-f(x(n-1))]$$
$$=$$
$$f(x(n))x(n-1)-x(n)f(x(n-1))/f(x(n))-f(x(n-1)).$$

However, in this case we dont have to choose intervals (an,bn) having $f(an)f(bn)<0$. The approximate root xn is the x-intercept of the line joining (xn,f(xn)) and (x(n-1),f(x(n-1))).

Q1 Perform 6 iterations of the Secant method to obtain a real root of the following equation in the interval(0,1):

$$f(x) = x^3-5x+1=0.$$

Solution:

```
(%i6) kill(all)$
      'x0=x0:0.0;
      'x1=x1:1.0;
      f(x):=x^3-5·x+1;
      for i:1 thru 6 do (
          if(equal(f(x0),f(x1)))
             then return()
          else
          x2:(x0·f(x1)-x1·f(x0))/(f(x1)-f(x0)),
          x0:x1, x1:x2,
      print("iteration",i,", root =",x2))$
      print("Root is: ",x2)$
      wxplot2d(f(x),[x,0,1]);
```

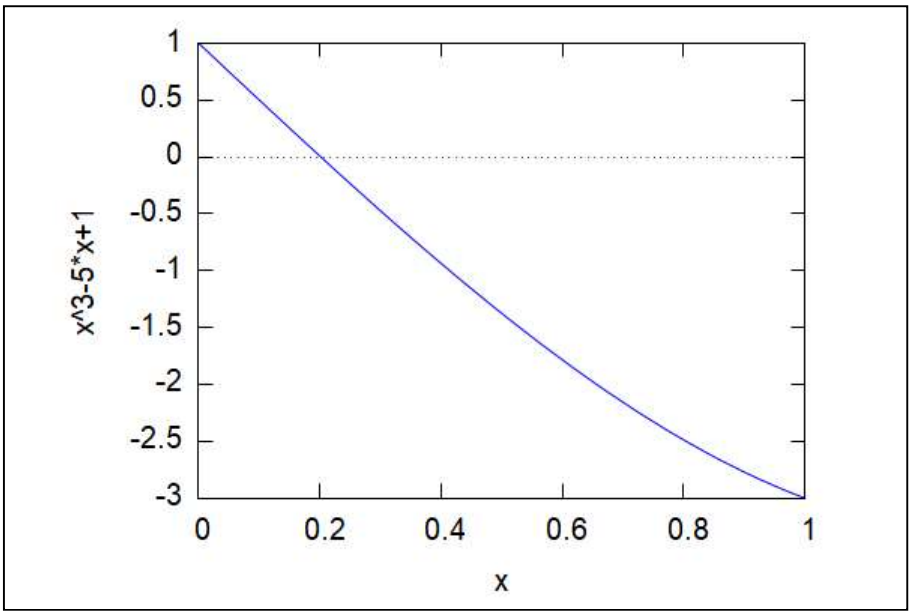
(%o1) $x0=0.0$

(%o2) $x1=1.0$

(%o3) $f(x):=x^3-5x+1$

```
iteration 1 , root = 0.25
iteration 2 , root = 0.1864406779661017
iteration 3 , root = 0.2017362561791272
iteration 4 , root = 0.2016398528913041
iteration 5 , root = 0.2016396757212824
iteration 6 , root = 0.2016396757234047
Root is:  0.2016396757234047
```

(%t6)




(%o6)

Note: In the above code, x0 and x1 is used to find x2, then x1, x2 is used to find x3 and so on.....

Q2 Perform 6 iterations of the Secant method to obtain a real root of the following equation in the interval(-1,1):

$$f(x) = x^2-1=0.$$

Solution:

(%i6)
```
kill(all)$
'x0=x0:-1.0;
'x1=x1:1.0;
f(x):=x^2-1;
for i:1 thru 6 do (
    if(equal(f(x0),f(x1)))
       then return()
    else
    x2:(x0·f(x1)-x1·f(x0))/(f(x1)-f(x0)),
    x0:x1, x1:x2,
print("iteration",i,", root =",x2))$
print("Root is: ",x2)$
wxplot2d(f(x),[x,0,1]);
```

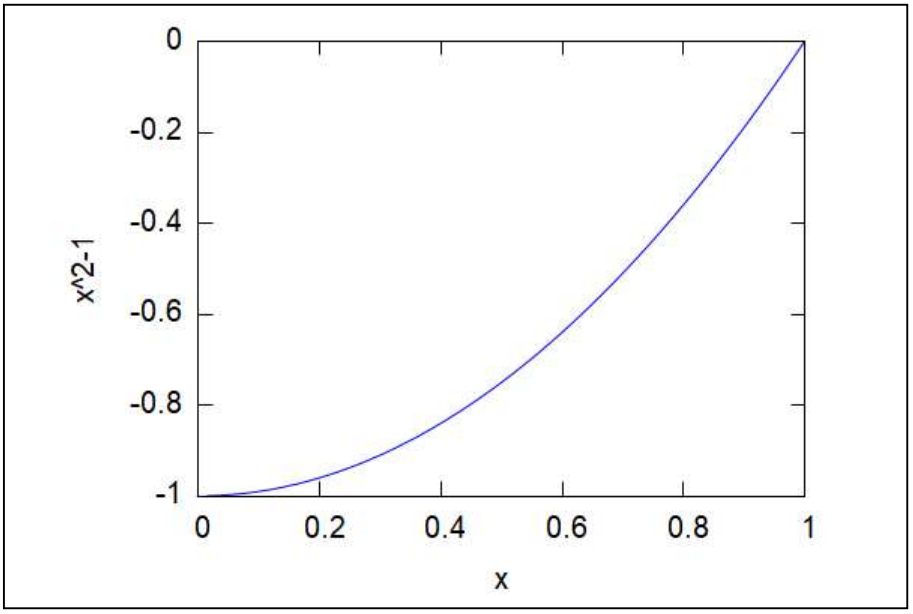
(%o1) $x0=-1.0$

(%o2) $x1=1.0$

(%o3) $f(x):=x^2-1$

*Root is:* $x2$

(%t6)




(%o6)

Assignment: Do two similar questions.