TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING

PURWANCHAL CAMPUS

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A Lab Report On: To Find A Root Of Non-Linear Using Newton Rapshson Method

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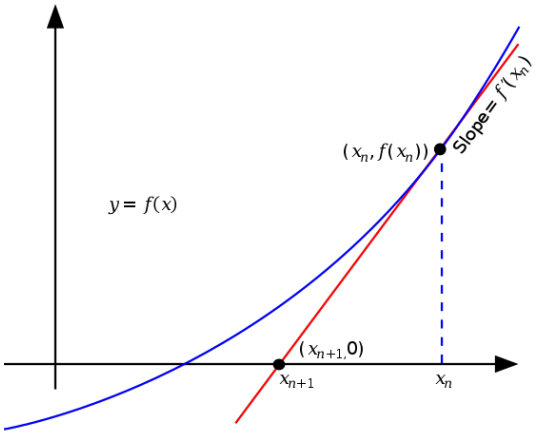
TITLE: TO FIND A ROOT OF NON-LINEAR USING NEWTON RAPHSON METHOD

THEORY

Newton Raphson Method is an open method and starts with one initial guess for finding real root of non-linear equations. In Newton Raphson method if x_0 is initial guess then next approximated root x_1 is obtained by following formula:

$$x_1 = x_0 - \frac{f(x_0)}{g(x_0)}$$

And an algorithm for Newton Raphson method involves repetition of above process i.e. we use x_1 to find x_2 and so on until we find the root within desired accuracy.



ALGORITHM

1. Start
2. Define function as f(x)
3. Define first derivative of f(x) as g(x)
4. Input initial guess (x0), tolerable error (e) and maximum iteration (N)
5. Initialize iteration counter i = 1
6. If g(x0) = 0 then print "Mathematical Error" and goto (12) otherwise goto (7)
7. Calcualte x1 = x0 - f(x0) / g(x0)
8. Increment iteration counter i = i + 1
9. If i >= N then print "Not Convergent" and goto (12) otherwise goto (10)
10. If |f(x1)| > e then set x0 = x1 and goto (6) otherwise goto (11)
11. Print root as x1
12. Stop

PROGRAM

```
import math

def fun(x):
 return x**3 - 6*x - 10

def derfun(x):
 return 3*x*x - 6

def newtonCalc(a, err):
 step = 1
 x1 = a
 flag = True
 while flag:
  xn = x1-(fun(x1)/derfun(x1))
  x1 = xn
  print('Iteration - %d, xn = %0.8f and f(xn) = %0.8f' % (step, xn, fun(xn)))
  flag = abs(fun(xn)) > err
  step += 1
 print("root is xn %0.6f", xn)

newtonCalc(2, 0.000001)
```

OUTPUT

```
Iteration - 1, xn = 4.33333333 and f(xn) = 45.37037037
Iteration - 2, xn = 3.43193525 and f(xn) = 9.83033801
Iteration - 3, xn = 3.09682386 and f(xn) = 1.11858243
Iteration - 4, xn = 3.04770064 and f(xn) = 0.02230021
Iteration - 5, xn = 3.04668076 and f(xn) = 0.00000951
Iteration - 6, xn = 3.04668032 and f(xn) = 0.00000000
root is xn %0.6f 3.0466803241501075
```

DISCUSSION AND CONCLUSION

The root of the equation x^2-6x-10 was found to be 1.0000 at 6^{th} iteration, within the error of 0.00001 using Newton Raphson Method.