Military Institute of Science and Technology

Department of Computer Science & Engineering

Subject: Numerical Methods Sessional (**CSE 214)**

Exp. No.-2

Name of the Exp.: Finding Root of an Equation by Newton Raphson Method

Introduction:

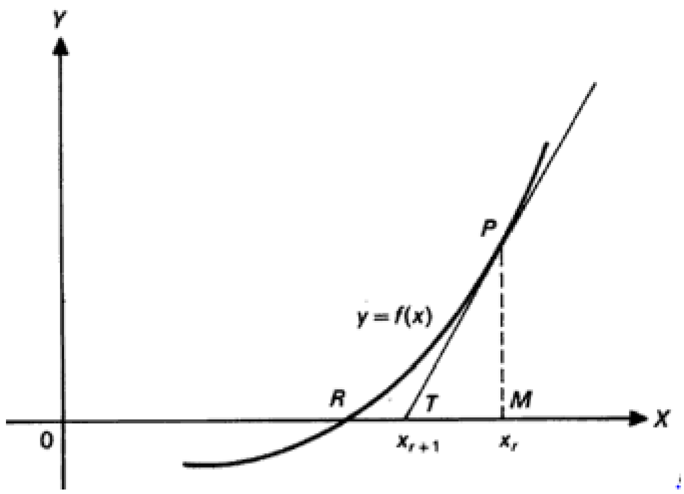
In scientific and engineering work, a frequently occurring problem is to find the roots of equations of the form $y = f(x) = 0$, i.e. finding the value of x where the value of $y = f(x)$ is equal to 0. In quadratic, cubic or biquadratic equations, algebraic formulae are available for expressing the roots in terms of co-efficient. But in the case, where f(x) is a polynomial of higher degree or an expression involving transcendental functions, the algebraic methods are not applicable and the help of numerical method must be taken to find approximate roots.

Objective of the Experiment:

1. To write a program in order to find out the real roots of a nonlinear equation by Newton Raphson Method.
2. Compare this method with the method of false position for the solution of the same equation.

Theory:

The Newton Raphson method is for solving equations of the form f(x) = 0. Let the graph of y= f(x) crosses the x-axis at the point R corresponding to the equation f(x) = 0.



Suppose the current approximation to the root is x_r in the r'th iteration. Let P be the corresponding point on the curve. The tangent to the curve at P cuts the x-axis at T, where x = x_{r+1}, say giving us the next approximation to the required root.

We have

$$PM = f(x_r) \text{ and } TM = x_r - x_{r+1}$$

so that the slope of the tangent at $P(x = x_r)$ is

$$\tan P\hat{T}M = f'(x_r) = f(x_r)/(x_r - x_{r+1})$$

Therefore

$$x_{r+1} - x_r = -f(x_r)/f'(x_r)$$

i.e.

$$x_{r+1} = x_r - [f(x_r)/f'(x_r)], \quad r = 1, 2, 3, \ldots$$

Now continue this iteration until $|x_{r+1} - x_r| <$ given accuracy.

Problems/Reports:

1. Write programs to find the real root of the following equations by using **Newton Raphson** Method.

   a) $f(x) = x^3 - 3x - 1 = 0$; correct to 5decimal point, near x=0,2,-2 .

   b) $x \sin x + \cos x = 0$; correct to 5decimal point, near x=3

   c) $x = e^{-x}$; correct to 5decimal point, near x=2

2. Solve 1(a) using **roots, fzero, fsolve** Matlab function
3. Solve 1(b) and 1(c) using **fzero, fsolve** Matlab function

USE OF MATLAB FUNCTION

ROOTS
ROOTS Find l roots of a polynomial.
ROOTS(C) computes the roots of the polynomial whose coefficients are the elements of the vector C.
to find all the roots of a polynomial x^3-3*x-1, use
C=[1 0 3 -1]
X=roots(C)

FZERO
Example: to find a root of xsinx near X0=3 use
X=fzero(@(x)x*sin(x),3)

FSOLVE
Example: to find a root of xsinx near X0=3 use
X=FSOLVE(@(x)x*sin(x),3)