INDIAN INSTITUTE OF TECHNOLOGY GANDHINAGAR

MA 202: MATHEMATICS - IV
Semester–II, Academic Year 2022-23

Tutorial Set -1
Question - 4

By

Kush Patel
[20110131]

➔ In the 4th question, we are asked to find the root of the given equation using Newton's method. Approximation after the (i+1)th iteration, Newton's method, as we know, is given by:

$$x(i+1) = x(i) - f(x)/f'(x)$$

➔ Initially, after tracking the input form the user, the input value goes into the function in which the value of function and derivative value of its function are calculated. Then, I have checked whether the derivative is zero or not because if the derivative is zero then the method will not be applicable so initial guess should be different in that case. If the derivative is not zero then iteration will start and it will stop when the relative error will be smaller than tolerance.

```
% Create a fuunction to call the vale of x0 and return the vale of x_r
function [x_r] = T4_20110131(x0)
% to print the value of x_r up to long decimal digits
format("long")
% Initialize the vales of tolerance and error
tol = 0.000001;
err = 100;

% Run the while loop to run the iterations
while err > tol
    [f , df] = Function_3(x0);
    % Check wheather the deriavtive of the function is zero or not
    % otherwise it will retuen infinite value
    if df==0
        x_r = "Please change the initial guess";
        break;
    else
        x_r = x0 - (f/df);
        err = abs((x_r - x0)/(x_r));
        x0  = x_r;
    end
end

% Create the function to find the given function value and it's derivative
function  [val , dval] = Function_3(x)
% For Question-4
val = exp(-0.5*x) * (4 - x) - 2;
dval = exp((-0.5)*x) * (-3 + (0.5 * x));
end
```

```
>> [x_r] = T4_20110131(-1406)

x_r =

   Inf

>> [x_r] = T4_20110131(-1405)

x_r =

   0.885708802004777

>> [x_r] = T4_20110131(0)

x_r =

   0.885708802004777

>> [x_r] = T4_20110131(5)

x_r =

   0.885708802004777

>> [x_r] = T4_20110131(6)

x_r =

    "Please change the initial guess"
```

➔ As we can see in the second image, before (-1405) and after (+5), if we take any value then the function will diverge and the method will not be applicable. This method is only applicable when functions converge.

➔ Root finding after plotting :