

Homework #3

Due date: March 7, 2018, Wednesday, 23:59

Finding Root of a Number by Newton-Raphson Method

In numerical analysis, **Newton's method** (also known as the **Newton-Raphson method**), named after Isaac Newton and Joseph Raphson, is perhaps the best known method for finding successively better approximations to the zeroes (or roots) of a real-valued function. Newton's method can often converge remarkably quickly; especially if the iteration begins "sufficiently near" the desired root.

Given a function $f(x)$ and its derivative $f'(x)$, we begin with a first guess x_0 . A better approximation x_1 is:

$$x_n = x_{n-1} - \frac{f(x_{n-1})}{f'(x_{n-1})}$$

This iterative solution can be used in finding the root of a number. Take $f(x)$ and $f'(x)$ as:

$$f(x) = x^2 - a \qquad f'(x) = 2x$$

For example if $a=400$, this iteration should give x approximately as 20.

Write a MatLab code that will do the following:

1. Get **a**, number of iterations, the initial guess, and ϵ from the user.
2. Find the root by using the Newton-Raphson method.
3. Find the exact root using the **sqrt()** function.
4. If the difference between the real root (found in step 3) and the root found by Newton-Raphson method is smaller than ϵ , display the root; otherwise display "the root could not be found".

Use only scalar variables; no vectors or matrices. ϵ (epsilon) is the sensitivity, which is used to test the accuracy of the solution.

Your program's output should look like this:

```
Enter a: 400
Enter number of iterations: 50
Enter initial guess: 21
Enter epsilon: 0.001
The root of the function is at 20.
>>
```

Name your MatLab m-file as `h03yourlastname.m` and then upload it to Blackboard Learn at <http://ku.blackboard.com>. Anyone e-mailing his/her homework will lose points!

While doing all your homework assignments, remember that:

- You should not work together,
- You should not give or take any files,
- You should not give or take help other than simple verbal hints.