

MATH 1351 TI-85 EXERCISE X
Newton and the TI-85

Name: _____ SID: _____

At the end of Chapter 4 we learned Newton's method for searching for roots of a function $y = f(x)$; that is, find values of x so that $y = 0$. Basically the idea is to see where successive tangent lines cross the x -axis. If we start with some value of x , henceforth referred to as an *answer*, we get the next value of x , the *new answer*, by the following formula:

$$\text{new answer} = \text{answer} - f(\text{answer}) / f'(\text{answer}).$$

Consider the example $f(x) = x^2 - 3$. So $f'(x) = 2x$ and Newton's formula becomes

$$\text{new answer} = \text{answer} - ((\text{answer})^2 - 3) / (2 \text{ answer})$$

If the initial *answer* is 1, what is the *new answer*? ____ Now let this number be the *answer*, what is the next *new answer*? ____ To continue this process to find the next *new answer* type the following command onto the screen (**Ans** is gotten from the keyboard via **2nd ANS**):

$$\text{Ans} - (\text{Ans}^2 - 3) / (2 \text{ Ans}).$$

Pressing **ENTER** then will activate Newton's method on the previous answer. What do you get? _____. Continue pressing **ENTER** until the numbers stabilize to 10 decimal places. What is the answer?_____ How does this compare to $\sqrt{3}$?_____

Perhaps it is time to write a simple program for doing Newton's method on our machine. Choose **PRGM** from the keyboard and **EDIT** from the screen menu. We are asked for the program's name. Notice the TI is already in the *alpha mode*, so all we need to do is type in the letters. Let's name our program **NEW**. Press **ENTER** and then type in the following program:

$$\text{Ans} - \text{evalF}(y1, x, \text{Ans}) / \text{evalF}(\text{der1}(y1, x), x, \text{Ans})$$

pressing **ENTER** ends the editing session and stores the program called **NEW**. (Both **evalF** and **der1** can be found in the general CATALOG or in the special calculus package accessed by choosing **2nd CALC** from the keyboard.)

This program will apply Newton's method to whatever function you have defined as $y1$ in the graph package, starting at whatever answer you have put into the machine (right number on screen). To apply it on our above example define $y1 = x^2 - 3$ in the graph package. Exit to the home screen, press **1** and **ENTER**. This makes 1 the previous answer (**ANS**). Press **PRGM** and choose **NAMES** from the screen menu. Choose **NEW** and press **ENTER**. Pressing **ENTER** now causes our program to act on each previous answer. In a few iterations you should be able to obtain $\sqrt{3}$ to 10 decimal places. Try it. Try the process with the initial answer = 0. (Press **0**, then **ENTER**, then invoke our program **NEW**. What happens?_____ Why? _____)

Next try starting at the initial answer **-1**. What does Newton's method yield to 10 decimal places? _____.

Use this program on the homework problems you did on page 191 and compare the results with your previous calculations.