Math 230 — Hour Exam 2

April 8, 2016

General Directions. This is an open-book, open-notes, open-computer test. However, you may not communicate with any person, except me, during the test. You have the full class period (50 minutes) in which to do the test. Put your answer to each question in the space provided (use the backs of pages if you need more space). Be sure to **show your work**! I give partial credit for incorrect answers if you show correct steps leading up to them; conversely, I do not give full credit even for correct answers if it is not clear that you understand where those answers come from. Good luck.

This test contains 3 questions, one with 2 parts, on 3 pages.

Question 1 (10 Points). Phineas Phoole wants to use Newton's method to find an x at which $2x^3 - 3 = 0$. Phineas chooses $x = 0$ as his initial guess for the root. What will go wrong in Newton's method in this case?

Question 2. Consider the function $m(x) = x^2 - 1$. Now consider the question of how many times you need to apply m to a number x, then apply m to the result, then apply m to that result, and so forth, in order to get a result greater than 1,000,000. For example, if x = 4, then $m(x) = 4^2 - 1 = 15$, $m(m(x)) = 15^2 - 1 = 224$, $m(m(m(x))) = 224^2 - 1 = 50,175$, and $m(m(m(m(x)))) = 50,175^2 - 1 = 2,517,530,624$, which exceeds 1,000,000, so for x = 4, you must compute m of x, then m of the result, and so forth 4 times in order to have a result above 1,000,000.

The following Matlab function is supposed to take the value of x as its argument, and to return the number of times you have to apply m as described above to get a result over 1,000,000. If x is greater than 1,000,000 to begin with, this function should return 0.

```
function n = countM( x )
    …
end
```

Part <u>A</u> (15 Points). Write Matlab statements that could replace the "…" in the definition of `countM` above in order to make it work as described.

Part <u>B</u> (10 Points). If you call m on an x whose absolute value is less than approximately 1.62, then no number of applications of m will produce a result over 1,000,000 (the results will oscillate around 0 instead). Assuming that variable `x` has already been assigned a value, write one or more Matlab statements that call `countM` on `x` and display the result, but only if $|x| > 1.62$. Your statement(s) should print the message "illegal x" if $|x| \leq 1.62$.

Question 3 (15 Points). Here is an outline of a Matlab function, `printFunny`, that takes a vector of numbers as its argument, and that should print those numbers one per line, except that any number less than 3 is printed twice. For example, if v is [5, 2, 7, 12, 1], `printFunny` should print

```
5
2
2
7
12
1
1
```

Fill in the body of the function so that it behaves as described above.

```
function [] = printFunny( v )




end
```