Math 451 ASSIGNMENT 1 **Due at 2 PM Tuesday, April 1st (no foolin'!)**

There are several outcomes we are looking for from this assignment:

- Perform elementary arithmetic computations in *MATLAB*.
- Create *MATLAB* script and function files using a "building up" approach; understand the difference between a script file and a function file.
- Create a function file that computes the roots of a quadratic equation from its coefficients.
- Use the *MATLAB* `if-else` commands.

The phrase "on scratch paper" will mean that you are doing some pencil-and-paper work that is not to be turned in.

1. On scratch paper, solve the equation $2x^2 - 5x - 3 = 0$ by factoring. You should of course get two solutions - in this class we will refer to solutions to equations as **roots**.
2. Solve the equation using the quadratic formula $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$. You should of course get the same roots as you did in Exercise 1! There will be many occasions in this class where opportunities arise to check your work - *you should be alert to those situations and take advantage of them!*
3. Define the coefficients a, b and c of the equation in the *MATLAB* command window and use *MATLAB* to compute the roots. *Name the roots* `r1` *and* `r2`. (Don't forget to use $*$ for times, and the *MATLAB* command for square root is `sqrt`.
4. Write a script file named *quad1* in which you define a, b and c and have the output of the file be the roots of the quadratic equation. Then change your names for the roots to `r(1)` and `r(2)`, which makes them components of a **row vector** `r`. Use a semicolon (;) at the end of each line except a last line consisting of only the letter `r` in order to output the vector consisting of the roots.
5. Now save your file as *quad2*. You will now turn your script file into a function file for a function whose arguments are a, b and c, and whose output is the vector `r` whose components are the roots of the equation. You will do this by adding a first line `function r=quad(a,b,c)` and removing the lines where you defined a, b and c. Test your function by typing `roots=quad2(2,-5,-3)` in the command window and hitting return. Make sure that the output is only the vector whose components are the roots of the equation, and that it only outputs it once. (Remove the last line in your code.)
6. Use your function to find the roots of $x^2 - 6x + 13 = 0$. What do you notice about the roots?
7. Suppose that we don't want to allow complex roots, and we want our function to return a statement to the effect that there are no real roots in that case. To do that you will need to use the *MATLAB* `if-else` commands. Rename your function file as *quad3* and use the following hints to make the desired change:
   (a) Under what condition will there be complex roots? Write a new line in your code, before where you compute the roots, consisting of the command `if` followed (on the same line) by the condition that gives complex roots.
   (b) Follow that line with a line that assigns the message "no real roots" to `r` if the roots are complex. This is done by including the line `r='no real roots'`.
   (c) Now we need to tell what to do in the event that the condition following `if` is *NOT* met. Add a line consisting only of the word `else`, and follow that with the already existing lines containing the formulas for finding the roots.
8. Test your file to make sure it does what it is supposed to. Now you will be asked to annotate your code with comments so that others can look at it and tell what it is doing.
   (a) Add text at the top of your function that describes the arguments of the function, what the function does and what it returns. *This text must be preceded by a percent (%) sign to make it a comment.*
   (b) Add three more comment lines, one before the `if` command, telling its purpose, one before the line giving the "no real roots" message, and on before the two lines assigning values to the roots. The comments should tell what each of the following lines does.
9. Add your first name and an underscore to the front of your *quad3* file and e-mail it to me.