M 348 HOMEWORK 2

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1. Chapter 0

Coding Exercise: Modify the code quadraticEquation (Matlab, Python, or C++ version) to compute complex roots of quadratic equation. Apply the usual quadratic formula when the roots are complex. Print the roots in the main routine (driver). Make sure your output indicates the three different cases: real root(s), complex roots, or error. Test your code on the following equations:

(a) $3x^2 + 5x = 4$
(b) $3x^2 - 7.8x + 5.07 = 0$
(c) $2x^2 + 4 = 3x$
(d) $8 = 3x$

Solution.   (a) In this case, $a = 3, b = 5, c = -4$.
(b) In this case $a = 3, b = -7.8, c = 5.07$
(c) In this case $a = 2, b = -3, c = 4$

Date: 2/2/2024.

```
C:\Users\13464\AppData\Local\Programs\Python\Python310\python.exe C:\Users\13464\Desktop\M348\quadratic_modified_corrected.py
Solve ax^2 + bx + c = 0 for real or complex roots.
Enter a: 3
Enter b: 5
Enter c: -4
Real and distinct roots
Roots are 0.590667 and -2.257334

Process finished with exit code 0
```

(a) According to python code, we find that
$$r_1 = 0.590667, \quad r_2 = -2.257334$$

```
C:\Users\13464\AppData\Local\Programs\Python\Python310\python.exe C:\Users\13464\Desktop\M348\quadratic_modified_corrected.py
Solve ax^2 + bx + c = 0 for real or complex roots.
Enter a: 3
Enter b: -7.8
Enter c: 5.07
Complex roots
Roots are (1.3+1.4048949503631345e-08j) and (1.3-1.4048949503631345e-08j)

Process finished with exit code 0
```

(b1) Note that r is very close to 1.3. After adding a tolerance $1e^{-14}$, the answer become 1.3.

```
C:\Users\13464\AppData\Local\Programs\Python\Python310\python.exe C:\Users\13464\Desktop\M348\quadratic_modified_corrected.py
Solve ax^2 + bx + c = 0 for real or complex roots.
Enter a: 3
Enter b: -7.8
Enter c: 5.07
Real and equal roots
Roots are 1.3 and 1.3

Process finished with exit code 0
```

(b2) This is the result after adding tolerance $1e^{-14}$.

```
C:\Users\13464\AppData\Local\Programs\Python\Python310\python.exe C:\Users\13464\Desktop\M348\quadratic_modified_corrected.py
Solve ax^2 + bx + c = 0 for real or complex roots.
Enter a: 2
Enter b: -3
Enter c: 4
Complex roots
Roots are (0.75+1.1989578808281798j) and (0.75-1.1989578808281798j)

Process finished with exit code 0
```

(c) The results are complex numbers, which are:
$$r_1 = 0.75 + 1.1989578808281798j, \quad r_2 = 0.75 - 1.1989578808281798j$$

```
C:\Users\13464\AppData\Local\Programs\Python\Python310\python.exe C:\Users\13464\Desktop\M348\quadratic_modified_corrected.py
Solve ax^2 + bx + c = 0 for real or complex roots.
Enter a: 0
Enter b: -3
Enter c: 8
ERROR:Invalid inputs for a quadratic equation, such as a=0

Process finished with exit code 0
```

(d)ERROR happens since $a = 0$.

(d) In this case, $a = 0, b = -3, c = 8$
(I also upload these pictures and the code on canvas)