Please read the following carefully:

- Any student may be asked to explain the solution and code they have submitted as part of this project. Inability to properly and sufficiently explain any code used in the solution will result in zero points on the entire assignment and a possible reporting to the Dean of Students office for plagiarism.
- The content of this project is NOT in the public domain! Do not post any content of this project to any internet sites or make it public in any other form. By enrolling in this course you agree to honor this request.

MCS 275 Project 1

Write a class called Quadratic, which implements a quadratic polynomial with integer coefficients. For each quadratic polynomial $ax^2 + bx + c$, an instance is generated like this: *Quadratic([a, b, c])*.

For two concrete examples, the instances P and Q of the class Quadratic, where P represents the polynomial $3x^2 - 7x + 5$ and Q represents the polynomial $x^2 + 8x - 3$, are defined as

```
P = Quadratic([3, -7, 5])
Q = Quadratic([1, 8, -3])
```

When printing an instance, for example P, print(P) should display $3x\text{^}2 - 7x + 5$ on the screen.

In addition, write the following class methods which manipulate the instances of the class Quadratic.

roots(), which is called in the main function as P.roots(), and returns the two roots of the polynomial P inside a list. For P, P.roots() returns [1.16667+0.55277i, 1.16667+0.55277i]. For the instance Q, Q.roots returns [0.35890+0i, -8.3589+0i], since Q has only two real roots. If a polynomial has a double root, return the list containing the same root twice in the same way as for P and Q.

vertex(), which is called in the main function as P.vertex(), and returns the x and y coordinates of the location of the vertex as a list. For example, for instance P, P.vertex() returns [1.16667, 0.916667]. Recall that the vertex of a parabola is the point at the intersection of the parabola and its line of symmetry.

derivative(), which is called in the main function as P.derivative(), and returns a string representing the derivative of the instance. For example, for instance P, P.derivative() returns the string 6*x-7.

integral(a,b), which is called in the main function as P.integral(a,b), and returns a float representing the area underneath the curve of polynomial P $3x^2 - 7x + 5$. For example, for instance P, P.integral(1, 4) returns the float 25.5.

Overload the operations of additions, so that we can add the instances of the class Quadratic using the "+" symbol. For example, for a new instance R = P+Q (generated like this in the main function), print(R) should result in 4x^2+1x+2 being printed to screen. If an addition should eliminate one of the terms, zero should be used to denote such a scenario, ie. $0x\text{^}2 + 0x + 2$, for example is a valid outcome.

Overload the operations of multiplication, so that we can multiply the instances of the class Quadratic using the "*" symbol. For example, for a new instance R = 5*P (generated like this in the main function),

print(R) should result in 15x^2-35x+25 being printed to screen.

larger_area(Q,a,b), which is called in the main function as P.larger_area(Q,a,b), and returns the instance whose absolute value of the area, over the interval (a,b), is larger. For example, for instances P and Q and interval (1,4), P.larger_area(Q,a,b) returns the instance Q, since Q has a a larger area than P over this interval.

Project Guidelines, Submission Details, and Plagiarism Warning

This project is due on **due Friday, September 17, 2021 at 11:59 PM**!

Your solution to this project must consist of a single, computer typed (not hand-written), **TEXT file** in which the project is solved. Each such file must contain the main function and all other necessary functions (or classes and class-methods) which were used during the solving of the project.

Upload the file through Blackboard. Files without the .txt extension will receive 0 points. We need the .txt extension to check for plagiarism. Therefore, before submitting the file, **change the .py extension to .txt**.

This project must be solved **individually**. Under no circumstances are you allowed to copy or to collaborate with anyone else. All submitted files will be automatically checked for plagiarism. Regardless of who copied from whom, all caught in the act of plagiarism will be penalized as specified in the course syllabus.

In particular, using internet resources of any kind is **not** allowed. Internet sites are routinely checked for similarity to your submission, both for code content and code logic. Changing code order or variable names will not prevent plagiarism detection. In addition, do not post any content of this project to any internet sites or make it public in any other form. **The content of this project is not in the public domain!**

You are free, however, to use our course resources, such as lecture notes and our text books, during the solving of this project.

If you have questions about this project, come to my online office hours using the usual Blackboard link.