Lab 19

Instructions: Complete the steps below. Be sure to show your code to one of the lab TAs before you leave, so that you can receive credit for this lab. You must also upload a copy of all your source code (.java) files to the link on Blackboard by **11:59 PM on Monday November 9, 2020 for L01, L02, L03, L05 and by 11:59 PM on Thursday November 5, 2020 for L06, L07, L08 and L09**.

1. Design a class named Rectangle to represent a rectangle. The class contains:

   - Two double data fields named width and height that specify the width and height of the rectangle. The default values are 1 for both width and height.
   - A no-argument constructor that creates a default rectangle.
   - A constructor that creates a rectangle with the specified width and height.
   - A method named getArea() that returns the area of this rectangle.
   - A method named getPerimeter() that returns the perimeter.

   Write a test program that creates two Rectangle objects -- one with width 4 and height 40, and the other with width 3.5 and height 35.9. Display the width, height, area, and perimeter of each rectangle in this order.

2. Design a class named **QuadraticEquation** for a quadratic equation $ax^2 + bx + c = 0$. The class contains:
   a. Private data fields a, b, and c that represents three coefficients.
   b. A constructor with the arguments for a, b, and c.
   c. Three getter methods for a, b, c. [getter are the methods which help access the private data fields].
   d. A method named **getDiscriminant()** that returns the discriminant, which is $b^2 - 4ac$.
   e. The method named **getRoot1()** and **getRoot2()** for returning two roots of the equation

   $$r_1 = \frac{-b + \sqrt{b^2-4ac}}{2a} \quad \text{and} \quad r_2 = \frac{-b - \sqrt{b^2-4ac}}{2a}$$

   These methods are useful only if the discriminant is nonnegative. Let these methods return 0 if the discriminant is negative.
   Write a test program that prompts the user to enter values for a, b, and c and display the result based on the discriminant. If the discriminant is positive display the two roots, if the discriminant is 0, display the one root. Otherwise, display "The equation has no roots."
   Note: you can use $Math.pow(x, 0.5)$ to compute $\sqrt{x}$.
   Here is the sample run:
   Enter a, b, c : 1.0 3 1
   The equation has two roots $-0.381966\ and\ -2.61803$

Enter a, b, c : 1 2.0 1
The equation has one root -1.0
Enter a, b, c : 1 2 3
The equation has no real roots.

Grading Guidelines: This lab is graded on a scale of 0-6 points, assigned as follows:

- **0 points:** Student is absent or does not appear to have completed any work for the lab
- **2 point (2*1):** Student has written the program, but it has errors.
- **4 points (2*2):** Student has written the program it compiles without error, but it does not produce the correct output.
- **6 points (2*3):** Student has written the program and it compiles and runs correctly, without any errors.