Assignment #1 – Find Real Roots of a Quadratic Equation

Overview

In this assignment, you will write a program using Visual Basic 2019 to find real roots of a quadratic equation. Three coefficients of a quadratic equation are to be entered through three textboxes; calculation process is initiated (or called) by clicking a button; and the results are then displayed on two labels.

This assignment must be done individually, and it is worth 5% of the course grade.

Mathematical Background

A quadratic equation, $ax^2 + bx + c = 0$, may have two different real roots, two equal real roots, or two imaginary (or not real) roots, depending on the value of $b^2 - 4ac$.

- If $b^2 - 4ac > 0$, then the quadratic equation has two different (or distinct) real roots, x_1 and x_2. And
$$x_1 = \frac{-b-\sqrt{b^2-4ac}}{2a} \quad \text{and} \quad x_2 = \frac{-b+\sqrt{b^2-4ac}}{2a}$$

- If $b^2 - 4ac = 0$, then it has two equal real roots, also called double real roots, i.e., $x_1 = x_2$. And
$$x_1 = x_2 = \frac{-b}{2a}$$

- If $b^2 - 4ac < 0$, then it has two imaginary (or not real) roots, which are
$$x_1 = \frac{-b}{2a} - \frac{\sqrt{4ac-b^2}}{2a}i \quad \text{and} \quad x_2 = \frac{-b}{2a} + \frac{\sqrt{4ac-b^2}}{2a}i$$

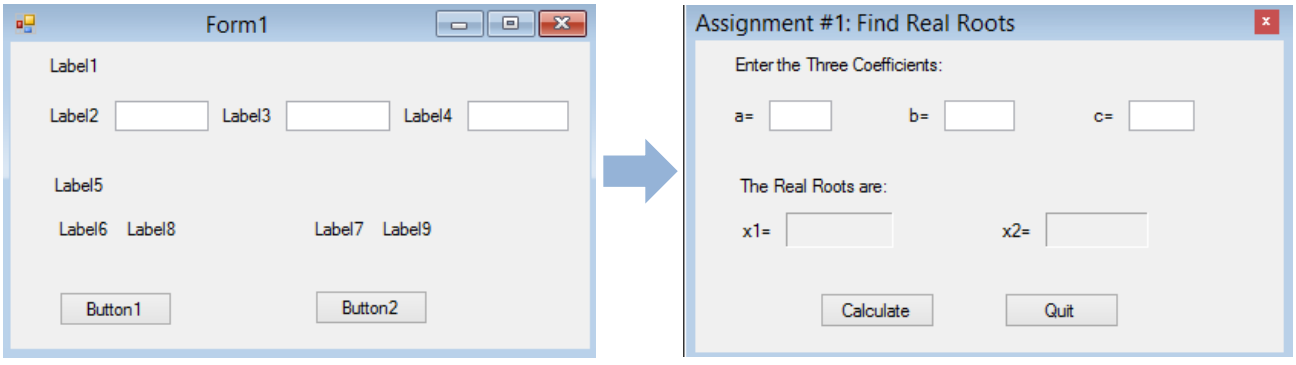
This assignment requires you to develop a VB program to identify the above 3 conditions, but you only need to find and display the real roots.

Design and Coding

1. Launch Visual Studio 2019 and create a Visual Basic Windows Forms App (.NET Framework).
   1.1. Project Name: **A1_FindRealRoots_YourCollegeUsername**
   - Your College username is the username you use to log into eConestoga.

   1.2. Project Location: your Visual Studio 2019 projects folder on your College OneDrive

2. Design a graphical user interface (GUI) to include the following controls with property settings:



CONTROL	PROPERTY	SETTING
Form1	Text FormBorderStyle StartPosition	Assignment #1: Find Real Roots FixedToolWindow CenterScreen
Label1	Text	Enter the Three Coefficients:
Label2	Text	a=
Label3	Text	b=
Label4	Text	c=
Label5	Text	The Real Roots are:
Label6	Text	x1=
Label7	Text	x2=
TextBox1	(Name) TextAlign	txtCoeffA Right
TextBox2	(Name) TextAlign	txtCoeffB Right
TextBox3	(Name) TextAlign	txtCoeffC Right
Label8	(Name) AutoSize Text TextAlign BorderStyle	LBLRootX1 False MiddleRight Fixed3D
Label9	(Name) AutoSize Text TextAlign BorderStyle	LBLRootX2 False MiddleRight Fixed3D
Button1	(Name) Text	btnCalculate Calculate
Button2	(Name) Text	btnQuit Quit

3. Here are the detailed requirements for this assignment:
   3.1. Follow the "IPOD" coding model that was discussed in class and practiced in tutorials #2 and #3 to create the VB code.
   3.2. The calculation process is initiated by clicking the Calculate button.
   3.3. If $b^2 - 4ac < 0$, show a message to indicate that the quadratic equation has no real roots, and then return to the program for re-entering coefficients.
   3.4. If $b^2 - 4ac \geq 0$, then the calculation process is performed with the real roots displayed in the two result labels.
      3.4.1. Keep 2 decimal places for the calculated roots using Round math function.
      3.4.2. If $b^2 - 4ac > 0$, show a message that this quadratic equation has two distinct real roots.
      3.4.3. If $b^2 - 4ac = 0$, show a message that this quadratic equation has two equal real roots.
      3.4.4. You can either use a message box that will display the message and disappear after clicking OK, or add another label and place it on the interface to display the message.

3.5. Use the **TextChange** event of each textbox to perform the followings:

3.5.1. Whenever a new coefficient is entered, the program will clear the values in the two result labels.

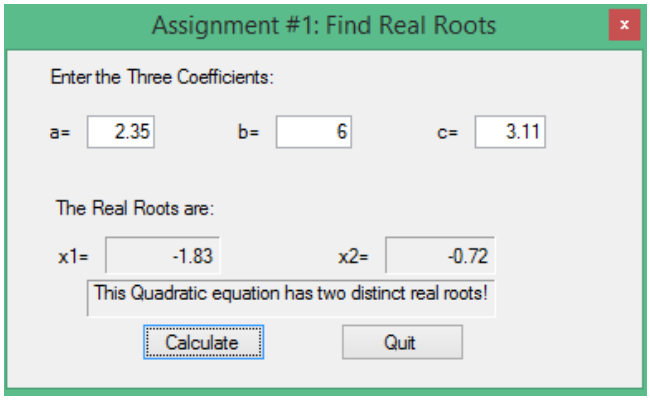
Note: if you chose to an extra label in Step 3.4.4, then clear that label as well.

3.5.2. Examine whether or not an entered coefficient is a number. If not a number, then display a message to remind the user of entering a number.

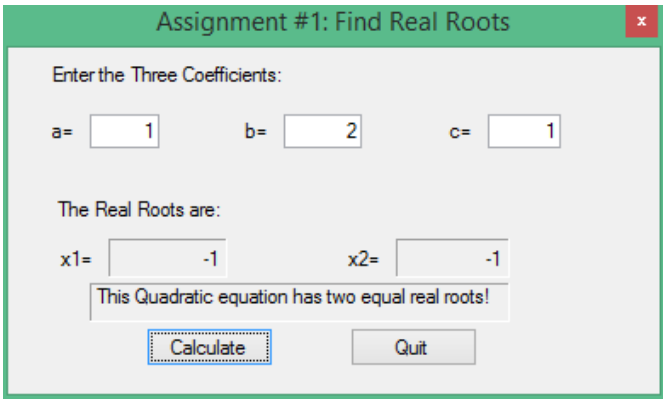
3.6. The app is ended and closed when the Quit button is pressed.

4. Here are three test cases for you to test your program.

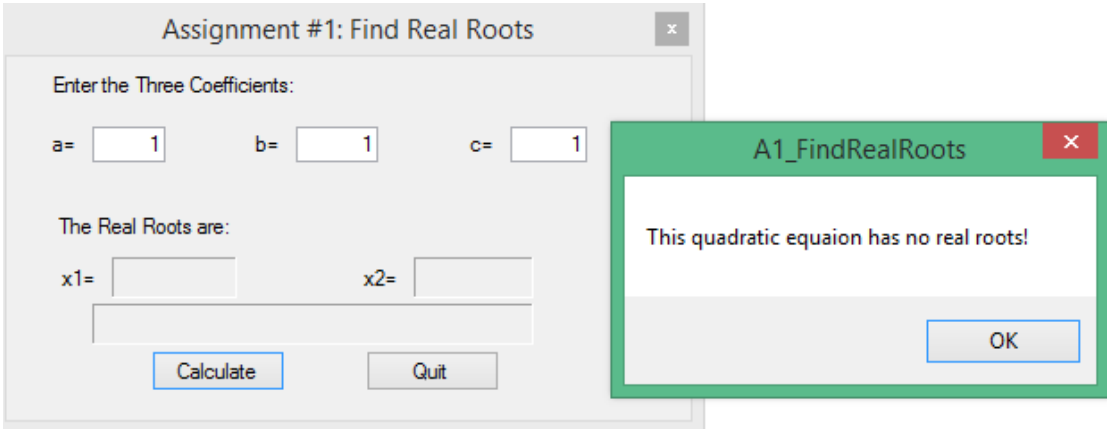
Case A: Two distinct real roots



Case B: Two equal real roots



Case C: The quadratic has no real roots.



Assignment Submissions

You need to submit a PDF file of your source code with a title page, as well as uploading the zipped file of your VB project to Assignment #1 dropbox.

a. For the PDF file, you must include your **full name**, course number, course name, etc. on the title page and on the FIRST line of your source code, as a comment.

b. For the zipped file, refer to Tutorial #04 (available in Week 04 syllabus) on how to compress a Visual Basic 2019 project for the detailed instructions.

c. The due date of Assignment #1 is shown on eConestoga. Both files must be submitted by the due date – **late submission will NOT be accepted**.