

**Lab 4:** Predefined functions**Due:** 9/21/22

**Problem:** Suppose your math professor asks you to create a program that solves quadratic equations in vertex form, that is,  $a(x + h)^2 + k$  where  $a$ ,  $h$ , and  $k$  are three known values.

In order to find the two possible values of  $x$  that solve the equation you can use the square root principle as shown below.

$$x = -h \pm \sqrt{k/a}$$

For example, given  $3(x + 7)^2 = 24$  the values of  $x$  that solve the equation are calculated in the following way:

$$x = -7 \pm \sqrt{24/3} = -7 \pm \sqrt{8}$$

The values corresponding to **a**, **h**, and **k** must be **whole** numbers but the value of **x** must be a **double precision real** number with two decimal digit.

**Your task:** implement in C++ the algorithm solution shown below.

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**Algorithm solution (in pseudocode):**

To solve this problem your program must perform the following tasks:

Declares variable name that holds text

Declares variables  $a$ ,  $h$ ,  $k$  that hold whole numbers

Declares variables  $x_1$  and  $x_2$  that hold double precision real numbers

Prompts the user to "Please enter your name: "

Reads the name from keyboard and stores it in the corresponding variable

Displays title "Please enter the known terms for the quadratic equation:"

Prompts the user to enter  $a$

Reads the value from the keyboard and stores it in the corresponding variable

Prompts the user to enter  $h$

Reads the value from the keyboard and stores it in the corresponding variable

Prompts the user to enter  $k$

Reads the value from the keyboard and stores it in the corresponding variable

Displays "Thanks ", name

Calculates  $x_1$  using the formula shown in the figure above  $-h + \text{square root}(k/a)$

Rounds  $x_1$  to the second decimal digit and reassigns it to  $x_1$

Calculates  $x_2$  using the formula shown in the figure above  $-h - \text{square root}(k/a)$

Rounds  $x_2$  to the second decimal digit and reassigns it to  $x_2$

Formats the output to display the solutions in fixed format with two decimal digits

Prints a message like the one below:

"The solutions for the equation are:"

"x1: ",  $x_1$

"x2: ",  $x_2$

**Note:** ensure your formulas do not use mixed data types by using the `static_cast` operator where needed.

The program must compile without errors or warnings.

Open **lab04.cpp** in your IDE and implement the above algorithm (already provided in the source code as comments).

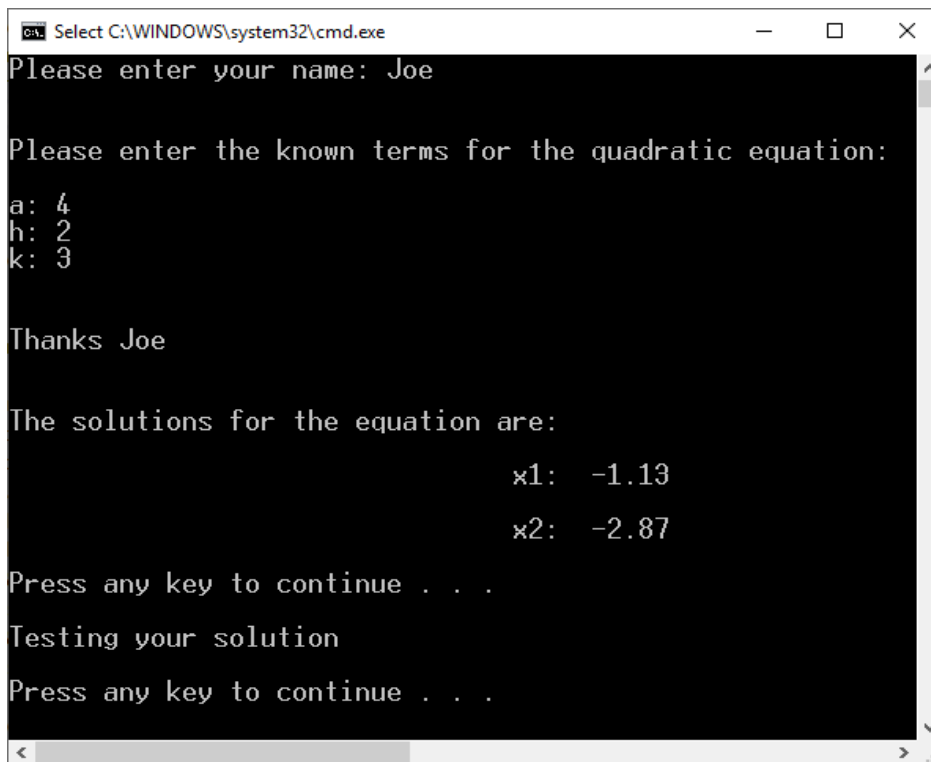
Implement the above algorithm (already provided in the source code as comments). **Your C++ statements MUST be right below EACH step they implement.**

**Note:**

- Do NOT remove or modify the statements that I use to test certain things in your program.
- Run my sample solution to know how your program must behave (click on the link provided below). Pay attention to the input and the output formats. Your solution must behave exactly like mine.

<https://replit.com/@GDietrich/1370-lab04sample>

- Carefully analyze the following figure and use it as a reference to ensure you do the right things.



```
Select C:\WINDOWS\system32\cmd.exe
Please enter your name: Joe

Please enter the known terms for the quadratic equation:
a: 4
h: 2
k: 3

Thanks Joe

The solutions for the equation are:
                                x1: -1.13
                                x2: -2.87

Press any key to continue . . .
Testing your solution
Press any key to continue . . .
```

To write your program, review the concepts learned in class (review examples discussed in class) and read the book (analyze the examples in it).

I am posting my solution for your reference. Please run it and ensure that your program works like mine. **First use the values for a, h, and k shown in the example above and check if you get the**

**right results (compare with my solution).** If you get an error message on the output, read the comment on the line specified in the message to find out what is wrong. Next, try different values for a, h, and k (for example, use the values used in my two sample runs shown below) and compare the results returned by your solution with mine. If you have concerns or specific questions, post them on the Discussion Board of Blackboard.

**Include ALL the libraries that are required to ensure your program runs with any compiler.**

Don't forget to include at the top of the program the comments shown below with your information (name, class and section number, etc.)

```
////////////////////////////////////  
//  
// Name: <Put your name here>  
// Date: <Today's date>  
// Class: <Your class number and section number, like: CSCI 1370.02>  
// Semester: <This semester, like: Spring 2012>  
// CSCI/CMPE 1370 Instructor: <Your lecture instructor's name>  
//  
// Program Description: Enter here your description of what the program does  
//  
////////////////////////////////////
```

**When done, submit your solution through Blackboard using the “Assignments” tool. Do Not email it.**

**Paste the [link](#) to your solution and the [source code](#) in the textbox corresponding to Text Submission (click on the [Write Submission button](#)) before you click on Submit.**

The following is the basic criteria to be used to grade your submission:

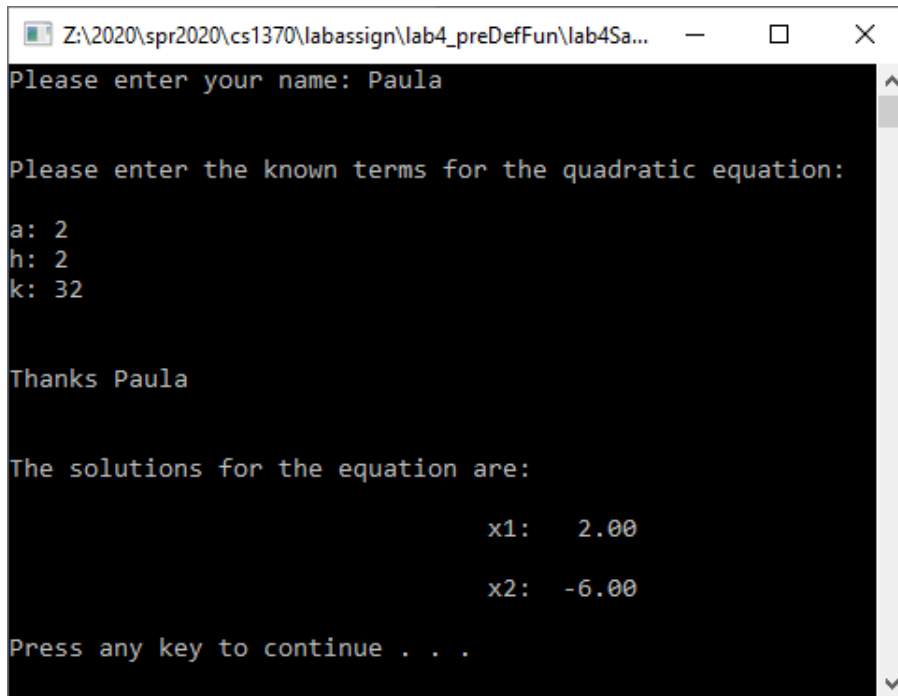
You start with 100 points and then lose points as you don't do something that is required.

- 10: wrong variable names
- 10: wrong data types
- 10: no/too few comments
- 10: mixed data types in expression
- 10: did not display two decimal digits
- 10: didn't round the value off
- 5: incorrect way to round the value off
- 15: didn't use predefined functions (each)
- 10: incorrect use of the function (each)
- 20: program does not implement the provided algorithm
- 20: program does not pass all tests
- 20: Incorrect/missing source code
- 20: Incorrect/missing link to your Repl.it solution
- 5: incorrect input format
- 5: incorrect output format
- 10: missing libraries

- 50: program doesn't compile
- 100: The code submitted is not your creation (you got it from a web site or another person)
- 10: Late

**Important:** more points may be lost for other reasons not specified here.

The following are sample runs of the program.



```
Z:\2020\spr2020\cs1370\labassign\lab4_preDefFun\lab4Sa...
Please enter your name: Paula

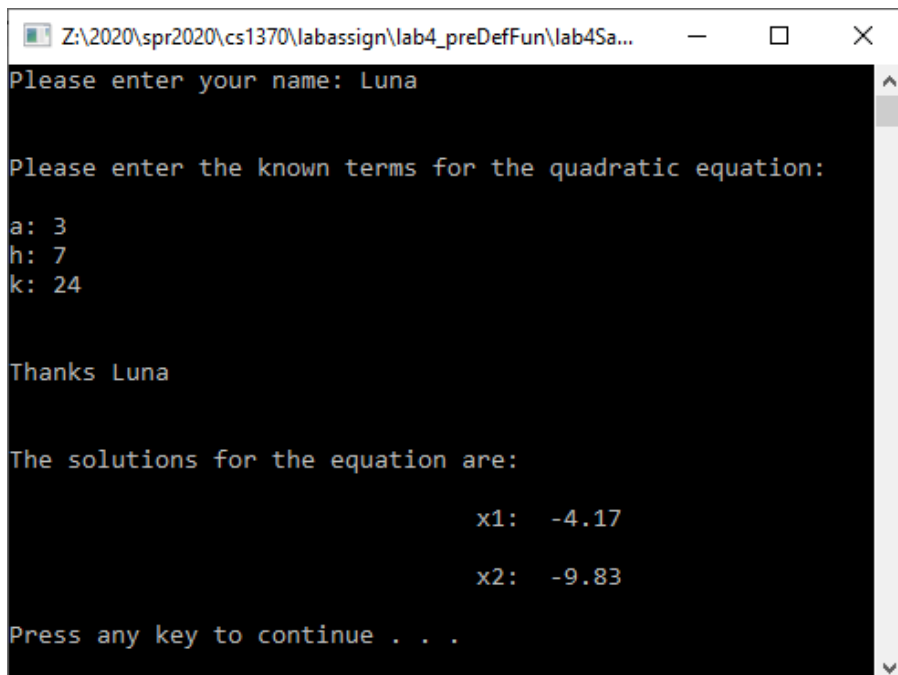
Please enter the known terms for the quadratic equation:
a: 2
h: 2
k: 32

Thanks Paula

The solutions for the equation are:

                        x1:  2.00
                        x2: -6.00

Press any key to continue . . .
```



```
Z:\2020\spr2020\cs1370\labassign\lab4_preDefFun\lab4Sa...
Please enter your name: Luna

Please enter the known terms for the quadratic equation:
a: 3
h: 7
k: 24

Thanks Luna

The solutions for the equation are:

                        x1: -4.17
                        x2: -9.83

Press any key to continue . . .
```