Exercise 1

a) The following program takes in a temperature value in Celsius and converts it to Kelvin. This code has many errors in it. Find the errors and correct the code.

```
1   #include <iostream>
2   #include <iomanip>
3   using namespace std;
4
5   int main()
6   {
7       double c = 0;                    // declare input variable
8       cout << "Celsius: ";
9       cin >> d;                    // retrieve temperature to input variable
10      double k = ctok("c");            // convert temperature
11      Cout <<"Kelvin: "<< k << '/n'; // print out temperature
12      // system("pause");
13      return 0;
14  }
15
16  double ctok(int c)              // converts Celsius to Kelvin
17  {
18      double k = c + 273.15;
19      return k;
20  }
```

Hint: Windows users can uncomment line 12 to check results.

b) Write a simple makefile that describes how to compile the single C++ source file compiled in question a). **Hint:** gcc / g++.

Test Points:

- Test Input: 15
  Expected Output: 288.15

c) Absolute zero is the lowest temperature that can bereached; it is $-273.15°C$, or 0 K. The above program, even when corrected, will produce erroneous results when given a temperature below this. Place a check in the main program that will produce an error if a temperature is given below $-273.15°C$. Write a new makefile to tell *make* what to do.

Test Points:

- Test Input: -173.15
  Expected Output: 100
- Test Input: -273.15
  Expected Output: 0

- Test Input: -300
  Expected Output: Error reporting!

d) Do question c) again, but this time handle the error inside **ctok()**. Write a new makefile to tell *make* what to do.

Test Points:

- Test Input: -173.15
  Expected Output: 100
- Test Input: -273.15
  Expected Output: 0
- Test Input: -300
  Expected Output: Error reporting!

Exercise 2

Quadratic equations are of the form

$$a \cdot x^2 + b \cdot x + c = 0$$

To solve these, one uses the quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

There is a problem, though: if $b^2 - 4ac$ is less than zero, then it will fail. Write a program that can calculate x for a quadratic equation.

Requirements:

a) Create a function *solve*() that points out the roots of a quadratic equation given a, b, c in a file named *solve.cpp* and attach a header file *solve.h* in order to be referenced.

b) Create a *main.cpp* to test your quadratic equations solver. Randomly input three coefficients and print out the roots if the equation has real roots. When the program detects an equation with no real roots, have it throw an exception caught by the main function and output the error message: **$b^2 - 4ac$ is less than zero!**.

c) If the input is illegal, for example, strings or a equals to zero, then the program will print out: **Illegal inputs!**.

d) Write a makefile to generate your target *main.exe*.

Hint: It may be helpful if using throw / try / catch, cin.fail(), vector, etc.

Test Points:

- Test Input: 1 5 6
  Expected Output: 2 3
- Test Input: 1.2 4.5 1.7
  Expected Output: -0.613759 -4.78624
- Test Input: 1 1 2
  Expected Output: $b^2 - 4ac$ is less than zero!
- Test Input: 1 2 a
  Expected Output: Illegal inputs!
- Test Input: 0 2 1
  Expected Output: Illegal inputs!