Lab 1

Due Jan 16 by 11:59pm **Points** 10 **Submitting** a file upload **File Types** cpp

C++ Operators and Statements / Chapter 2

The General Programming Lab Instructions (%24CANVAS_OBJECT_REFERENCE%24/assignments/g802605efa941ab100e32a8a582cfaea3) apply to this assignment.

This lab consists of two C++ programs that relate to the content presented in chapter 2 (http://icarus.cs.weber.edu/~dab/cs1410/textbook/core-operations.html) . Please review Math Library Functions and Constants (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/math.html) and Converting Formulas to C++ Statements (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/formulas.html) . Please note that both programs are scored using Microsoft Visual Studio.

Program 1

Quadratic equations have the form: $ax^2 + bx + c = 0$ where a, b, and c are the coefficients, and x is the independent variable. Quadratic equations have two roots: x1 and x2 that are computed using the quadratic formula:

$$x1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$$

and

$$x2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$$

The C++ math library includes a function, named sqrt, that calculates the square root of its argument; the sqrt function is demonstrated in **hypot.cpp** (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/progexample/hypot.html).

There are two possible errors that you will ignore for now but will deal with in the next assignment. First, if 'a' is 0, the quadratic formula divides by 0 and fails. Second, if the roots are imaginary, the formula tries to take the square root of a negative number and fails. In both cases, you will see output that looks like -1.#IND or -1.#INF. If you use the test cases below, you will not encounter either problem.

Program 1 Requirements

1. Write a program named `roots.cpp` that calculates the roots of a quadratic equation.
2. Define the variables a, b, c, x1, and x2 as type double
3. Prompt for and read the coefficients one at a time in the order a, b, and c
4. Calculate the two roots using the quadratic formula
5. Print the two roots (no special formatting is required but separate the two roots with a space or a new line)
6. Do not include loops or any other prompts; do not perform a read or pause at the end of the program

Program 1 Test Cases

a = 2, b = -8, c = 6; x1 = 3, x2 = 1
a = 3, b = 1, c = -6: x1 = 1.25733, x2 = -1.59067

Program 2

The volume of a right cone is a function of the radius and the height of the cone: $v = \frac{1}{3}\pi r^2 h$

The surface area of a right cone is a function of the radius and the height of the cone: $S = \pi r\sqrt{r^2 + h^2} + \pi r^2$

Program 2 Requirements

1. Write a program named `cone.cpp` that calculates the volume and the surface area of a right cone.
2. Define the variables V, S, r, and h as type double
3. Program prompts for and reads (in this order) a radius and a height
4. Calculate and print the volume of a right cone
   a. Do NOT use a decimal point value (i.e., 0.3333333) in place of 1/3 (be careful not to introduce a **truncation error** (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/common.html#division) ; see the **ftoc.cpp** (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/progexample/ftoc.html) example to see how to solve this problem)
   b. Be careful of integer division (review the **ftoc.cpp** (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/progexample/ftoc.html) example if needed)
5. Calculate and print the surface area of a right cone
6. Use the symbolic constant for π: `M_PI` . There are two lines of code that your program must have to enable the symbolic constant:
   a. `#define _USE_MATH_DEFINES` - Microsoft requires this as the first line in your program. Other compilers do not require this directive but it will not cause any harm (and I use Microsoft to score your labs)
   b. `#include <cmath>` - this is where the symbolic constant is created
   c. See **circle.cpp** (http://icarus.cs.weber.edu/~dab/cs1410/textbook/2.Core/progexample/circle.html) for an example
7. Do not include loops, any other prompt or input or pause

Program 2 Test Case

radius = 1.5, height = 3; volume = 7.06858, surface area = 22.8744

Lab 1 Scoring

Criteria	Ratings	Pts
File Names Both file names are correct. Canvas may add a "-1" or "-2" to the name, which is okay.		1.0 pts
Roots Both roots are correct (verify by using the test cases).		4.0 pts
Fraction or Division The fraction 1/3 or division by 3 used (multiplication by 0.33333... NOT used).		1.0 pts
PI The C++ symbolic constant for PI is used. The #define needed by Windows also used.		1.0 pts
Volume and Surface Area The volume and surface area is correct (verify with the test cases).		2.0 pts
Header Files iostream is included. Non-standard header files (stdfx.h, pch.h, etc.) are removed or commented out.		1.0 pts
Miscellaneous Data input is in the correct order, one value at a time. All pause statements removed. Indentation is consistent. Both programs (i.e., projects) are created "Empty."		1.0 pts
		Total Points: 11.0