

In-Class 2 - Area, Volume, etc Calculations

In this assignment, you are writing an area calculator to practice

- performing console input & output,
- using some basic data types,
- formatting output, and
- performing some basic arithmetic in C++.

Description

1. In CodeBlocks, create a new project (call it, for example, inclass2 or ic2), for this assignment. **Never use spaces in filenames or project names.** Follow the same process as you did in the first in-class assignment to create the project and edit main.cpp. Refer back to the InClass1 exercise, if necessary.
2. We need to `#include` an additional header file for this assignment in order to use some math functions. So, `#include <cmath>` and this `#define` before the other `#include` statements (at the very top of your program file):

```
#define _USE_MATH_DEFINES // for C++
#include <cmath>
```

This allows you to use the constant `M_PI` for π in your expressions in your program.

4. You are to write a program that prompts the user to enter the radius of a circle, all in meters. Then, your program calculates the diameter, circumference, and area of a circle with the entered radius, and the surface area and volume of a sphere using the same radius.
5. You need variables to store value(s) that the user enters. To do this, at the top of the `main()` function after its beginning brace `{` declare three variables of type `double` for radius, width, and length. e.g.

```
int main()
{
    double radius;
```

6. Remember how we used `cout` to write text output to the screen? When reading input, you usually prompt the user with some text using `cout`. Then using `cin`, you read the data that the user responds with. For example, here is what you do for radius:

```
cout << "Enter the radius of a circle: ";
cin >> radius;
```

Notice that there is a space after the colon and no **endl** at the end of the prompt line. This means that when you run the program and are asked to enter a number, it will go on the same line as the prompt. The Enter shown below in the output is *from the user hitting Enter!* The user must hit *Enter* (carriage return) in order for the program to read the numbers.

Also note the direction of the "arrows" << and >> for **cout** and **cin**! The arrows point towards where the data is going -- towards the output, or into a variable. e.g.

```
cout << "printed words... \n\n";
cin >> variable1;
```

And multiple items can be output or input in one statement:

```
cout << "printed words..." << var1 << "more text\n";
cin >> variable1 >> variable1 >> variable1;
```

7. Run the program to make sure you don't have any errors at this point. Adding a few lines of code and running it (to make sure there are not errors) is called incremental development.
8. Next, declare more variables at the top of the main() function of type **double** to hold the values your program needs to *calculate* for **diameter**, **circumference**, and **area** of a circle, and the **surface area** and **volume** of a sphere. Variables must be declared **before** you can use them in expressions.
9. Mathematical formulas to calculate the circle area, sphere volume are:

The area of a circle is $\pi \text{ radius}^2$

The area of a sphere is $\frac{4}{3} \pi \text{ radius}^3$

Additional formulas can be found at

http://www.austincc.edu/pintutor/pin_mh/_source/Handouts/Geometry_Formulas/Geometry_Formulas_2D_3D_Perimeter_Area_Volume.pdf

You use these formulas to assign values to the variables declared in step #9.

```
circArea = M_PI * radius * radius;
```

And you need to declare circArea "above" this line of code in which you use it.

10. Finally, output the text and variable values as shown below.

You need to format your output using fixed and setprecision() as covered in class.

Your output should look like this: (Please copy and paste the text from the prompts and output text into your code! You are graded on this on Web-CAT.)

Enter the radius of a circle: 19.5555

The diameter of the circle is 39.111.

The circumference of the circle is 122.871.

The area of the circle is 1201.400.

The surface area of the sphere is 4805.601.

The volume of the sphere is 31325.310.

Run your code with several different inputs and hand check the values to make sure your code is doing the calculations right.

Programming Style

An important part of programming is using proper programming style, formatting, and comments. At this point, the most important items are:

- Use descriptive variable names
- Vertical (proper use of blank line mostly) and horizontal spacing (putting spaces around operators, indentation, etc.)
 - Indent properly, as shown in class and in the text
 - Skip a line between each small **section** of your program, so that each section is separated by a blank line,
- Have a beginning comment that describes what the program is doing (just “Homework 1” is not good enough). See the main Canvas page for what every program header needs to contain.
- Each section (i.e. logical chunk of code) begins with a comment describing what that section does, so that the comments alone would provide an outline of the program (It’s NOT good to follow every line of code with a comment.)
- Continue typing your code on the next line if it is too long. Too long is over 80 characters. In Code::Blocks, there is a column indicator at the bottom-middle-ish of the screen that tells you which column the cursor is at.

Submit Your Work

To submit your work to Web-CAT to be graded.