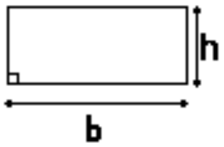
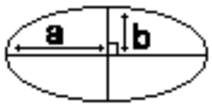
__Lab 9:__ Functions with value and reference parameters

Problem: Suppose your math professor asks you to write a C++ program that calculates the areas of a rectangle and of an ellipse and sends the results to an output file.



Area = base * height



Area = π * radius a * radius b

Note: all images extracted from http://www.mathsisfun.com/area-calculation-tool.html

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

Algorithm solution (in pseudocode):

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

1. 2 points. Declare a global constant named PI equal to 3.141592
2. 2 points. Declare variable named **outFile** to represent the output file
3. 2 points. Declare variables named **base**, **height**, **radiusa**, and **radiusb** that hold double precision numbers
4. 2 points. Declare variables named **rec_area**, and **elli_area tha**t hold double precision real numbers
5. 15 points. Open output file "**output9.txt**" and relate it to outFile
6. 2 points. Print on the screen "For the rectangle"
7. 15 points. Call void function **getData()** and receive in base and height the two lengths read from the keyboard
8. 2 points. Print on the screen "For the ellipse"
9. 15 points. Call void function **getData()** and receive in radiusa and radiusb the two lengths read from the keyboard
10. 15 points. Call function **area_rectangle()** to calculate the area of a rectangle and assign the returned value to rec_area
11. 14 points. Call function **area_area_ellipse()** to calculate the area of an ellipse and assign the returned value to elli_area
12. 12 points. Call function **printData()** to print the output to the output file
13. 2 points. Close the file

You need to **define** the following **functions** in the provided file **myfunctions.h** to implement part of the solution:

1) To get the data you must define function **getData(par1, par2)**. Gets two lengths from the keyboard and returns them to the caller through the parameter list.
It must:

a. Prompt the user to "Please enter two lengths: "
b. Get both values from the keyboard and store them in par1 and par2.

2) To print the output you must define function **printData(oFile, b, h, ar, ra, rb, ae)**. Receives the output file, base of the rectangle, height of the rectangle, area of the rectangle, radius a of the ellipse, radius b of the ellipse, and area of the ellipse and prints the output to the file. Except for the file all the other values received are double precision real numbers.
It must:
a. Format the output to display the numbers in fixed format with two decimal digits.
b. Print the message to the output file (formatted as shown in my examples):

"The area of the rectangle with base ", b, " and height ", h, " is ", ar
"The area of the ellipse with radius ", ra, " and radius ", rb, " is ", ae

3) To round a real number to a user-defined number of digits you must define function **round_off(value, digits)**. Receives a value (double precision real number) and a number indicating a quantity of digits (whole number) and returns the value rounded to the specified number of digits.

4) To calculate the area of a rectangle you must define function **area_rectangle(b, h)**. Receives the base and the height of the rectangle (double precision real numbers) and returns the calculated area (a double precision real number) rounded to one decimal digit.

5) To calculate the area of an ellipse you must define function **area_ellipse(ra, rb)**. Receives radius a and radius b of the ellipse (double precision real numbers) and returns the calculated area (a double precision real number) rounded to one decimal digit.

IMPORTANT: you must choose the most appropriate type of function and type of parameters for each of the functions described above.

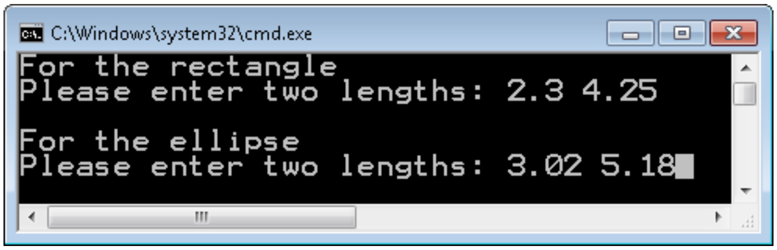
The program must compile without errors or warnings.

Create a project if necessary (or use one that is already open) and **add the existing item** named **lab09_FML.cpp** (provided with this handout).

Implement the above algorithm (already provided in the source code as comments) in **lab09_FML.cpp**.

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. Pay attention to the input and the output formats. Your solution must behave exactly like mine.
- Carefully analyze the following figures and use them as a reference to ensure you do the right things.



```
For the rectangle
Please enter two lengths: 2.3 4.25

For the ellipse
Please enter two lengths: 3.02 5.18
```

Screen shot of the input

```
The area of the rectangle with base   2.30 and height   4.25 is   9.80

The area of the ellipse with radius   3.02 and radius   5.18 is  49.10
```

Content of **output9.txt**

- I am posting the executable of my solution for your reference. Test and compare your solution with mine for different values of base, height, and radiuses to ensure they always produce the same outputs. Pay attention to the output format.
- Ensure your formulas do not use mixed data types by defining your literal values appropriately and using the static_cast operator if needed.

If you have concerns or specific questions, post them on the Discussion Board of Blackboard.

Don't forget to include at the top of the program and at the top of the header file 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
//
///////////////////////////////////////////////////////////////////
```

Please name your source file **lab09_FML.cpp** (replace F, M. and L with the initials of your first, middle (if any), and last names). Do not include blank spaces in the name of the file please. Put your source (.cpp) file and your header (.h) file in a compressed folder named **lab09_FML.zip** (replace F, M. and L with the initials of your first, middle (if any), and last names).

When done, submit your solution (the compressed folder) through Blackboard using the "Assignments" tool. Do Not email it.

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.

-8: no declaration/use of the constant
-4: incorrect declaration of the constant
-10: wrong variable names
-10: wrong data types
-10: no/too few comments
-5: no comments at the top of the program and at the top of the header file
-10: mixed data types in expression
-10: didn't display two decimal digits
-10: didn't round the value off
-5: incorrect way to round the value off
-20: didn't implement the required functions (each)
-20: didn't define the functions in the required header file
-15: incorrect implementation of the function (each) [For example, wrong type of function]
-10: incorrect function call (each)
-10: incorrect type of parameters (value or reference)
-10: file not passed to printData() as an argument
-20: didn't work with a file
-5: didn't close file
-5: incorrect input format
-5: incorrect output format
-50: program doesn't compile
-10: Late

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