PIC 10A HOMEWORK 5

Storyline

Your customers and staff are happy with the new system you just put in with the loops, and you can breathe a sigh of relief! Now, however, you have some leisure time and you decided to have some fun with C++, especially since now you know how to generate random numbers! You decide that just for fun you are going to write a program that approximates the integral of some pretty weird positive functions, and let the user input the range of values. The program will keep prompting the user to integrate until the user specifies that they are done.

Assignment

The assignment is to make a program that asks the user to numerically approximate the integral of one of three functions, specify a range of integration, the number of iterations for the approximation, and then approximate the integral using random numbers. The functions are: 1. `abs`$(\sin(x^2))$, 2. e^{-x^2}, and 3. `abs`$(\arctan(x))$. The program should keep prompting the user to integrate one of the functions until requested to stop.

Note: Do not change the default values of precision for this assignment. Simply output values using cout and do NOT use fixed or cout.precision( ).

Assumptions

You may assume that will only input the numbers 1, 2, or 3 for the choice of function, that the lower and upper bounds will be numerical (not necessarily integer-valued!), and that a 0 or 1 will be input to determine whether or not to prompt for another round of approximation.

Also, Note that `abs`$(\sin(x^2))$ and e^{-x^2} have a minimum value of 0 and a maximum value of 1, and that `abs`$(\arctan(x))$ has a minimum value of 0 and a maximum value of $\pi/2$, which you may approximate using 1.571.

An example of input/output is given below.

```
Welcome! Please select a function to numerically integrate from the options below.

1. |sin(x^2)|
2. e^(-x^2)
3. |arctan(x)|

Integrate function number: 2

Please specify a lower bound: -4.234
Please specify an upper bound: 2.783
Please specify the number of iterations: 1000

The estimate for the area of e^(-x^2) from -4.234 to 2.783 is 1.786.

Would you like to integrate again? Enter 0 for 'no' and 1 for 'yes': 1

Please select a function to numerically integrate from the options below.

1. |sin(x^2)|
2. e^(-x^2)
3. |arctan(x)|

Integrate function number: 1

Please specify a lower bound: 0
Please specify an upper bound: 1.234
Please specify the number of iterations: 586

The estimate for the area of |sin(x^2)| from 0 to 1.234 is 0.55832.

Would you like to integrate again? Enter 0 for 'no' and 1 for 'yes': 0
```

Place your code in a source file labeled "hw5.cpp". ***If your file is not named this exactly, your homework will not be collected***. As with all programs in this course, your code should contain useful comments. In particular, your name, the date, and a brief description of what the program does should appear at the top of your source file.

What to Turn in

Place in your Submit folder the source file "hw5.cpp" with exactly this name (all lowercase, no spaces).

Grading		
I/O	Handles input/output correctly, formats output correctly,	5 points
Random	Correctly handles random numbers	5 points
Loops	Correctly handles loops	5 points
Style	Variable names, comments, indentation, basic functions	5 points
	TOTAL	20 points

Frequently Asked Questions:

Q1 Do we HAVE to use functions?

A1 Yes, you must use some kind of function somewhere. It can be very basic, but you must at least do it somewhere.

Q2 WHY do we have to use functions?

A2 Because I covered the basics on Wednesday, and you will definitely need to understand them for next week's homework, so this is your opportunity to ask questions now before it gets more complicated.