CA146 Introduction to Programming in C++

CA146 Tutorial 9

Note: As usual, when you have finished the tasks, or at least as many as you were able to do, ask a tutor to sign off to confirm this.

1 Program a function to calculate the volume of a sphere

1.1 Write a program that asks the user to enter a value for the radius of a sphere. The program should pass this value to a function that computes the corresponding volume. Have the function print out the value calculated. ($v = 4/3\ \pi\ r^3$)

1.2 Modify the program of 1.1 so that instead of the function printing out the volume it passes the volume back to the caller function and the caller function (in this case main) prints out the volume.

1.3 Modify the program of 1.2 so that it repeatedly asks the user to enter a radius and print out the corresponding volume until the user enters a radius of –1.

2 Program a function to calculate the volume of a cone

2.1 Write a program that asks the user to enter a value for the radius of the base of a cone and its height. The program should pass these values to a function that computes the corresponding volume. Have the function return the value computed to the caller function, which then prints it out. ($v = 1/3\ \pi\ r^2\ h$)

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3 Using more than one function

3.1 Type in & compile the following program. Then, run it for various inputs[1].

```
#include <iostream>
using namespace std;
float f(float);
float df(float);

int
main()
{
   float a, b, x, h;
   int i, n;
   cout << "Program to print out the value of f(x)" << endl;
   cout << "and its first derivative" <<endl;
   cout << "at n points in [a, b]" << endl;
   cout << endl;
   cout << "Specify start (a) and end (b) of [a, b]:" << endl;
   cin >> a >> b;
   cout << "Specify number of points n (at least 2):" <<endl;
   cin >> n;
   cout << "x\t" << "f(x)\t" << "df(x)" << endl;
   h = (b - a) / (n - 1);

   for (i = 0; i < n; i++) {
         x = a + h*i;
         cout << x << "\t" << f(x) << "\t" << df(x) <<endl;
   }
   return (0);
}

float
f(float u)
{
   return (u * u);
}
float
df(float u)
{
   return (2.0 * u);
}
```

3.2 Modify the program of part 1 so that the function (and corresponding derivative) that it calculates instead of x^2 is

(a) $4x^2 + 3x^3 + 2$ (Remember its derivative is $8x + 9x^2$)

(b) sin(2x) (Its derivative is 2cos(x); also you will need to "#include <cmath>")

[1] You should find that, for $f(x) = x^2$, it prints out f(x) and its first derivative df(x)/dx at equidistant points. For example, if the inputs are a = 0, b = 1 and n =3 you should get
1 0 0 0 then 2 0.5 0.25 1 and finally 3 1 1 2