## CSC-101 – HW5

**Q1 (25 Points)** Write a program that defines the named constant PI, const double PI = 3.14159;, which stores the value of π. The program should use PI and the functions listed below

- Output the value of √π .

- Prompt the user to input the value of a double variable r, which stores the radius of a sphere. The program then outputs the following:
  - The value of *4.0πr²*, which is the surface area of the sphere.
  - The value of *(4.0/3.0)πr³*, which is the volume of the sphere.

You should format your output like the following example:

Surface area of the sphere: 4 * PI * 5.00 ^ 2 = 314.16

Volume of the sphere: 4 / 3 * PI * 5.00 ^ 3 = 523.60

Your output must match the wording precisely to earn full credit. Format your output with setprecision(2) to ensure the proper number of decimals for testing!

```cpp
#include <iostream>
#include <cmath>
#include <iomanip>

using namespace std;


int main()
{
// Write main here
}
```

| Function | Header File | Purpose | Parameter(s) Type | Result |
|---|---|---|---|---|
| abs(x) | <cmath> | Returns the absolute value of its argument: abs(-7) = 7 | int (double) | int (double) |
| ceil(x) | <cmath> | Returns the smallest whole number that is not less than x: ceil(56.34) = 57.0 | double | double |
| cos(x) | <cmath> | Returns the cosine of angle x: cos(0.0) = 1.0 | double (radians) | double |
| exp(x) | <cmath> | Returns e$^x$, where e = 2.718: exp(1.0) = 2.71828 | double | double |
| fabs(x) | <cmath> | Returns the absolute value of its argument: fabs(-5.67) = 5.67 | double | double |
| floor(x) | <cmath> | Returns the largest whole number that is not greater than x: floor(45.67) = 45.00 | double | double |
| islower(x) | <cctype> | Returns true if x is a lowercase letter; otherwise it returns false; islower('h') is true | int | int |
| isupper(x) | <cctype> | Returns true if x is a uppercase letter; otherwise it returns false; isupper('K') is true | int | int |
| pow(x, y) | <cmath> | Returns x$^y$; If x is negative, y must be a whole number: pow(0.16, 0.5) = 0.4 | double | double |
| sqrt(x) | <cmath> | Returns the nonnegative square root of x, x must be nonnegative: sqrt(4.0) = 2.0 | double | double |
| tolower(x) | <cctype> | Returns the lowercase value of x if x is uppercase; otherwise, returns x | int | int |
| toupper(x) | <cctype> | Returns the uppercase value of x if x is lowercase; otherwise, returns x | int | int |

**Q2 (25 points)** The included program found in *main.cpp* is designed to find the area of a rectangle, the area of a circle, or the volume of a cylinder.

However:

- the statements are in the incorrect order;

- the function calls are incorrect;

- the logical expression in the while loop is incorrect;

- the function definitions are incorrect;

- You may assume that the value of π = **3.14159**.

Rewrite the program so that it works correctly. Your program must be properly indented. (Note that the program is menu driven and allows the user to run the program as long as the user wishes.)

```cpp
#include <iostream>
using namespace std;
const double PI = 3.14159;
double rectangle(double l, double w);
#include <iomanip>
int main()
{
    double radius;
    double height;
cout << fixed << showpoint << setprecision(2) << endl;
cout << "This program can calculate the area of a rectangle, "
        << "the area of a circle, or volume of a cylinder." << endl;
    cout << "To run the program enter: " << endl;
    cout << "1: To find the area of rectangle." << endl;
    cout << "2: To find the area of a circle." << endl;
    cout << "3: To find the volume of a cylinder." << endl;
    cout << "-1: To terminate the program." << endl;
    cin >> choice;
    cout << endl;
```

```cpp
int choice;
while (choice == −1)
{
    {
    case 1:
        cout << "Enter the radius of the base and the "
            << "height of the cylinder: ";
        cin >> radius >> height;
        cout << endl;
          cout << "Area = " << circle(length, height) << endl;
        break;
    case 3:
        double length, width;
        cout << "Enter the radius of the circle: ";
        cin >> radius;
        cout << endl;
        cout << "Area = " << rectangle(radius)
            << endl;
        break;
    case 2:
        cout << "Enter the length and the width "
            << "of the rectangle: ";
        cin >> length >> width;
        cout << endl;
        cout << "Volume = " << cylinder(radius, height)
            << endl;
        break;
    default:
        cout << "Invalid choice!" << endl;
    }
    switch (choice)
}
double circle(double r)
double cylinder(double bR, double h);
cout << "To run the program enter: " << endl;
cout << "2: To find the area of a circle." << endl;
cout << "1: To find the area of rectangle." << endl;
cout << "3: To find the volume of a cylinder." << endl;
cout << "−1: To terminate the program." << endl;
```

```cpp
    cin >> choice;
    cout << endl;
    return 0;
 }
double rectangle(double l, double w)
{
    return l * r;
}
double circle(double r)
{
    return PI * r * w;
}
double cylinder(double bR, double h)
{
    return PI * bR * bR * l;
}
```

**Q3 (25 Points)** Consider the definition of the function main in the provided
file *main.cpp*:

The variables x, y, z, rate, and hours referred to in the bullets below are the variables of the
function main. Each of the functions described must have the appropriate parameters to
access these variables. Write the following definitions:

```cpp
int main()
{
    int x, y;
    char z;
    double rate, hours;
    double amount;

    .

    .

    .
}
```

- Write the definition of the function initialize that initializes x and y to **0** and z to the blank character.
- Write the definition of the function getHoursRate that prompts the user to input the hours worked and rate per hour to initialize the variables hours and rate of the function main.
- Write the definition of the value-returning function paycheck that calculates and returns the amount to be paid to an employee based on the hours worked and rate per hour. The hours worked and rate per hour are stored in the variables hours and rate, respectively, of the function main.

  The formula for calculating the amount to be paid is as follows:

  *For the first 40 hours, the rate is the given rate; for hours over 40, the rate is 1.5 times the given rate.*

- Write the definition of the function printCheck that prints the hours worked, rate per hour, and the salary.
- Write the definition of the function funcOne that sets the value of x and y to **35** and **20** respectively. Then prompt the user to input a number. The function then changes the value of x by assigning the value of the expression two times the (old) value of x plus the value of y minus the value entered by the user.
- Write the definition of the function nextChar that sets the value of z to the next character stored in z.

An example of the program is shown below:

After initialization: x = 0, y = 0, z =

Enter hours worked: 60

Enter pay rate: 20

Hours worked:     60
Pay Rate:       $20
This week's salary: $1400
Before calling funcOne: x = 35, y = 20
Enter an integer:
2

After funcOne: x = 88

z = B

After nextChar: z = C

**Q4 (25 Points)** Write a program that reads a string and outputs the number of times each lowercase vowel appears in it. Your program must contain a function called countVowels with one of its parameters as a string variable and return the number of times each lowercase vowel appears in it. Also, write a program to test your function.

An example of the program is shown below:

Enter a string:

Lorem ipsum dolor sit amet

The number of a's: 1

The number of e's: 2

The number of i's: 2

The number of o's: 3

The number of u's: 1

If str is a variable of type string, then str.at(i) returns the character at the **ith** position. The position of the first character is **0.** Also, str.length() returns the length of the str, that is, the number of characters in str.