**Name:**

**Advanced Programming in C++**

**Lab Exercise 2/12/2025**

In this exercise, you will write several programs that will demonstrate the use of functions in the C++ programming language. When you have completed your programs, you are to submit your documented source code as well as a sample output.

1. Write a program that calls four functions to compute the following properties of a sphere, given a diameter, d, which is greater than or equal to 0.0.
2. Radius
3. Surface area
4. Circumference
5. Volume

You are also to write a function called from main that will print out all of the sphere information in the following format:

Sphere with diameter 3

Radius = 1.5

Surface Area = 28.27

Circumference = 9.42

Volume = 14.14

Use the following formulas:



Use the following prototypes:

double calcRadius(double);

double calcSurfaceArea(double);

double calcCircumference(double);

double calcVolume(double);

void printSphere(double, double, double, double, double);

1. A statistician needs to evaluate the probability, *p*, of the value *x* occurring in a sample set with a known normal distribution. The mean of the distribution is

µ = 10.71 and the standard deviation is σ = 1.14.

1. Write a double function with a parameter *x* that computes the value of the probability for this normal distribution. Hint: use the *double exp(double x)* function from the math library to computer *ex*.
2. Use the following formula to calculate the probability:



1. Use the following prototype:

double probability(double, double, double);

where the parameters are the mean, standard deviation and x.

1. Consider a simple model of a hydrogen atom with a proton nucleus an electron moving in a circular orbit. The proton and electron each carries a charge of

1.60 x 10-19 coulomb. The force of attraction between them is given by Coulomb’s Law



Where *qp* and *qe* are the charges of the proton and electron, r is the radius of the orbit in meters, and K = 9.0 x 109 Nm2/coulomb2. The force also is equal to the centripetal force on the electron of mass *m* = 9.11 x 10-31 kg; that is,



Write a double function that takes a radius of the orbit of an electron as an argument and returns the velocity of the electron. Do not allow inputs of r > 6 x 10-11 m or

r < 3 x 10-15. At what distance will electron hit the speed of light?