Programming Exercise 01
Mathematical Formulas

C# Step by Step

   This activity consists of four programming exercises. The following exercises are open book and open note. You are free to use any written documentation you wish. However, these are individual exercises, and you cannot consult with each other in writing your programs.
   There are five things that you have not seen that you will need. They are:

```
string str_var = Console.ReadLine()
int int_var = int.Parse(str_var);
Math.PI // evaluates to 3.1415962...
Math.Sqrt(some_number) // calculates the square root of a number
Console.WriteLine($"The value of number is {nnmber}");
```

`Console.ReadLine()` pauses the execution of a program, waits for the user to enter some text, reads all the text up to the first new line character (Enter on the keyboard), and returns a string variable. `int.Parse()` takes a string as a parameter and, if possible, returns an integer. `Math.PI` evaluates to the approximate value of pi. `Math.Sqrt()` takes a number as a parameter and returns the square root. The last line interpolates the value of the variable in the curly braces({...}).
   This programming exercise has four parts consisting of four requirements. The grade for each requirement is indicated, for a maximum of 100 points. At a minimum, your program must compile successfully and run. You may use the listing below as a starter.

Area and circumference of circle: 70 points   Write a program that calculates both the area and the circumference of a circle given the radius r. Assume that r is greater than zero, but not necessarily an integer. Use these formulas. The C# syntax for the square root is `Math.Sqrt()`. π is 3.14159.

$$\text{Circumference} = 2\pi r$$
$$\text{Area} = \pi r^2$$

Volume of a hemisphere: 80 points   Write a program that calculates the volume of a hemisphere given the length of the radius. Assume that the radius is not negative.

$$\text{Volume} = \frac{\frac{4}{3}\pi r^3}{2}$$

Area of triangle given the length of the sides: 90 points   Write a program that calculates the area of a triangle given the length of the three sides. Use Heron's formula, below. Sides are designated a, b, and c. p is half the circumference, or $\frac{a+b+c}{2}$. Assume that the length of every side is an integer greater than zero.

$$p = \frac{a+b+c}{2}$$
$$\text{Area} = \sqrt{p(p-a)(p-b)(p-c)}$$

Solving a quadratic equation: 100 points Write a program that solves a quadratic equation. The formula is given below. The coefficients for the terms are a for x^2, b for x, and c. Assume that the coefficients are non-negative integers, that is, a coefficient could be zero. Also note that the term under the square root symbol will not give a valid answer for this problem if it is negative. (You cannot take the square root of a negative number ... we are not using imaginary numbers.) Also, note that many solutions will not work.

$$ax^2 + bx + c = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

```
1   namespace progex01
2   {
3       class Program
4       {
5           static void Main(string[] args)
6           {
7               Console.WriteLine("\nPart 1, circumference and area of a circle.");
8               Console.Write("Enter an integer for the radius: ");
9               string strradius = Console.ReadLine();
10              int intradius = int.Parse(strradius);
11              double circumference =  /*some code here*/
12              Console.WriteLine($"The circumference is {circumference}");
13              double area = /*some code here*/
14              Console.WriteLine($"The area is {area}");
15
16              Console.WriteLine("\nPart 2, volume of a hemisphere.");
17              double volume = /*some code here*/
18              Console.WriteLine($"The volume is {volume}");
19
20              Console.WriteLine("\nPart 3, area of a triangle (Heron's formula).");
21              area = /*some code here*/
22              Console.WriteLine($"The area is {area}");
23
24              Console.WriteLine("\nPart 4, solving a quadratic equation.");
25              doulbe positive_num = /*some code here*/
26              doulbe negative_num = /*some code here*/
27              doulbe denominator = /*some code here*/
28              Console.WriteLine($"The positive solution is {positive_num / denominator}");
29              Console.WriteLine($"The negative solution is {negative_num / denominator}");
30
31          }
32      }
33  }
```