**Name:**

**Advanced Programming in C++**

**Sequences and Sums**

**Lab Exercise 3/13/2024**

In this lab you will explore the mathematical concepts of sequences and sums. You will use your programming skills to solve these problems. You are to submit your documented source code including a sample output.

In mathematics, a sequence is an infinite list of values. An element of a sequence is often called a term. The terms of a sequence are numbered by integers starting from 1 or sometimes 0 such as:



Sometimes we use a formula to define a sequence such as:



to define the nth term of a sequence.

1. Given the following sequence,



Determine the formula for this sequence:

an =

Write a program that prints out the first hundred terms of this sequence.

Two special types of sequences are arithmetic and geometric. In an arithmetic sequence, the difference between any two consecutive terms is the same. In a geometric sequence, the ratio of a term and the next term is constant.

Arithmetic sequence example:

5, 15, 25, 35, …, 5+10(n-1) //distance = 10

Geometric sequence example:

1, 2, 4, 8, 16, 32, … , 2n

1. Suppose a sequence has a first term of 1 and an 11th term of 1024. Write a program to find the 21st, 31st, and 41st term.

We say that a sequence converges to a number (called the limit of the sequence) if it gets closer and closer to a number as n increases.

1. Does the sequence:



converge? Write a program to help you find out if it does and to what number?

In many mathematical situations, we are interested in the sum of the first n terms of a sequence. There is a special “sigma” notation for sums:



Sometimes the sum can be infinite. The infinite sum is very special with many applications (as long as it converges). That special sum is called a series. For a series to converge, it’s terms must be getting smaller and smaller approaching 0.

1. Does the series



converge? \_\_\_\_\_\_\_\_\_\_\_\_\_ (answer)

Write a program to calculate the infinite sum of this series.