**Sequences and Summation Notation**

**Objective:** To find terms of sequences given the nth term and find and evaluate a series.

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**DEFINITIONS**

- **sequence** – a function in the form of a list, whose domain is the set of _______ numbers
- _______ – each number in a sequence
- **nth term** – _______ term

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**Fibonacci Sequence**

- The Fibonacci Sequence is an infinite sequence that begins as follows: 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, ….
- The first two terms are 1. After that, do you notice a pattern?
- Each term is the sum of the two previous terms.

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**Sequence Notation**

- Instead of f(x), we write \(a_n\).
  - \(a_n = f(n)\) where n is a natural number
  - \(a_n\) is the “nth term”

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**Types of Sequences**

- **Sequence** – has an end
  - Domain is the set \(\{1, 2, 3, 4, \ldots n\}\)
- **Sequence** – does not end
  - Domain is all natural numbers

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**What is a sequence? (re-cap)**

- An infinite sequence is a function whose domain is the set of positive integers. The function values, terms, of the sequences are represented by \(a_1, a_2, a_3, \ldots a_n\).
- Sequences whose domains are the first n integers, not ALL positive integers, are finite sequences.
Example

- Write the first four terms of the sequence whose $n$th term, or general term is given.
  a) $a_n = 2n + 5$
  b) $a_n = \frac{(-1)^n}{2^n + 1}$

Summation Notation

- The sum of the first $n$ terms, as $i$ goes from 1 to $n$ is given as:
  \[
  \sum_{i=1}^{n} a_i = a_1 + a_2 + a_3 + \ldots + a_{n-1} + a_n
  \]
- Example:
  \[
  \sum_{i=2}^{8} \left(5i - 2\right) = (5 \cdot 2 - 2) + (5 \cdot 3 - 2) + (5 \cdot 4 - 2) + \ldots + (5 \cdot 8 - 2)
  \]
  \[
  = 18 + 23 + 28 + 33 + 38 = 140
  \]

Summation Notation

- Sigma notation:
  \[
  \sum_{k=1}^{n} a_k = a_1 + a_2 + \ldots + a_n
  \]
  - Formula to find $k$th term

Example

- Expand and evaluate the sum:
  a) $\sum_{i=1}^{5} 2i$
  b) $\sum_{k=3}^{5} (2^k - 3)$
  c) $\sum_{i=1}^{6} 4$