# Sequences

- A sequence is any succession of numbers.
- A general sequence is denoted by

$$u_1, u_2, \ldots, u_n, \ldots$$

  in which $u_1$ is the first term, $u_2$ is the second term and $u_n$ is the $n$-th term in the sequence.
- If the sequence goes on forever it is called an **infinite sequence**, otherwise it is called a **finite sequence**.
- A sequence usually has a rule, which is a way to find the value of each term.

# Sequences

**Examples of Sequences**

- $\{1, 2, 3, 4, \ldots\}$ is a very simple sequence (and it is an infinite sequence)
- $\{20, 25, 30, 35, \ldots\}$ is also an infinite sequence
- $\{1, 3, 5, 7\}$ is the sequence of the first 4 odd numbers (and is a finite sequence)

# Sequences: Recursive Formulas

- Often the rule for evaluating the current term in the sequence depends on the values of one or more previous terms.
- In such cases, these rules are called **recursive formulas**.
- Recursive Rules also have initial values that allow the terms to be evaluated.
- The rule defining the *Fibonacci* sequence is a recursive formula.

# Fibonnacci Sequence

$$u_n = u_{n-1} + u_{n-2} \qquad \text{for } n \geq 3,\ u_1 = 0,\ u_2 = 1$$

The first few terms of the Fibonnaci Sequence looks like this:

$$1, 1, 2, 3, 5, 8, \ldots$$

# Series

- A series is the sum of the terms of a sequence.

$$S_n = u_1 + u_2 + u_3 + \ldots + u_n$$

- A series is usuall expressed in terms pf **sigma notation**.
- It is useful to remember the following, particularl in the context of proof by induction.

$$S_1 = u_1$$

$$S_{n+1} = S_n + u_{n+1}$$