

UNIT 8 *Number Sequences*

Introduction to SIM

Learning objectives

The work in this unit is focused on number sequences. After completing this unit of STUDENT INSTRUCTIONAL MATERIAL (SIM) you should

- understand and deduce the rule that defines simple sequences
- be able to find sequences based on geometrical patterns
- be able to use formulae to find and use number sequences.

Key points and principles

- n represents the position in a sequence
- u_n denotes the n^{th} term of the sequence
- A sequence can be defined by a formula or by a context in words
- Not all sequences have constant differences, for example, 2, 4, 8, 16, ... ($u_n = 2^n$)

Facts to remember

- A linear sequence is defined by the formula

$$u_n = an + b \quad (n = 1, 2, 3, \dots)$$

where a and b are constants, a being the constant difference between terms.

Glossary of terms

Linear sequence This is given by the formula $u_n = an + b$, ($n = 1, 2, 3, \dots$) where a and b are constants. For example, $u_n = 3n + 4$ gives the sequence 7, 10, 13, 16, 19, ...

Fibonacci Sequence This is defined by $u_n = u_{n-1} + u_{n-2}$ ($n = 3, 4, 5, \dots$) with $u_1 = u_2 = 1$. This gives the sequence

1, 1, 2, 3, 5, 8, 13, ...

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Iterative formula When the n th term in a sequence is given in a formula in terms of earlier terms, but with sufficient information to generate the complete sequence. For example,

$$u_n = u_{n-1} + 1, \quad u_1 = 0 \quad \text{for } n = 2, 3, \dots$$

$$u_n = u_{n-1} + u_{n-2}, \quad u_1 = 1, \quad u_2 = 1 \quad \text{for } n = 3, 4, \dots$$

$$u_n = \frac{U_{n-1}}{2}, \quad u_1 = 2 \quad \text{for } n = 2, 3, \dots$$

Convergence This is where the terms of a sequence are tending towards a finite number.

For example, $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \dots$ converges to 0

$1, 1 - \frac{1}{2}, 1 - \frac{1}{3}, 1 - \frac{1}{4}, \dots$ converges to 1

Divergence This is where the terms of a sequence are tending towards infinity.

For example, $1, 2, 4, 8, 16, \dots$

$5, 10, 15, 20, 25, \dots$