A Sequence Is a Function

Students see that a sequence is a function from term numbers to terms, state its domain and range in context, graph it as dots, use the notation a sub n and f(n), and sort lists into arithmetic, geometric, or neither.

TIME	40 minutes (one student with a parent or tutor, or a small group)
WHO	Math 1 (algebra readiness), about age 12. Follows Unit 8. Opens Unit 9; read the family-of-graphs note first.
MATERIALS	Student worksheet (PDF), the Deep Dive 5 interactive page for this lesson, pencil, graph paper
PRIOR KNOWLEDGE	Function, input, output, domain, range, discrete (Unit 2). Lines add, exponentials multiply (Unit 7). The simple and compound interest table (Unit 8, Lesson 2).
STANDARDS	NC.M1.F-IF.3, NC.M1.F-IF.2, NC.M1.F-IF.5.
KEEP OUT	The recursive and explicit rules (Lessons 2 to 4).

Learning goals

1. Define sequence, term, and term number, and name terms with a sub n and f(n).
2. Explain why a sequence is a function and state its domain and range in context.
3. Graph a sequence as separate dots and say why they are not connected.
4. Decide whether a list adds (arithmetic), multiplies (geometric), or does neither.

Vocabulary: say both, every time

The rule for the whole lesson: whenever the adult or the student says a math word, they follow it with the plain-English version. Proper term first, plain English second, until the student does it without being asked.

TERM	LOOKS LIKE	PLAIN ENGLISH
Sequence, term	a list; one number in it	In a set order.
Term number	the position	The input.
a_n	say: a sub n	The nth term; same as f(n).
Discrete	separate dots	Whole-number inputs only.
Arithmetic, geometric	adds; multiplies	The two families as lists.

> THE ONE SENTENCE TO SAY OUT LOUD
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> Position in, term out: a sequence is a function made of dots. Adding gives arithmetic, multiplying gives geometric.

Lesson timeline (40 minutes)

0:00 to 0:06	**Warm-up: the Unit 8 table.** Rebuild the simple and compound columns. Ask: if you just read down one column, what do you have? A list. Name the two columns arithmetic and geometric.
0:06 to 0:18	**Mini-lesson: a sequence is a function.** The theater table. Input: row. Output: seats. Function test. Domain (whole rows), range (seat counts). Run the pattern builder: dots, no line. Introduce a sub 1, a sub 4, a sub n, and f(n), reading each aloud.
0:18 to 0:26	**Neither.** Square numbers and Fibonacci numbers. Then the adds, multiplies, or neither sort.
0:26 to 0:36	**Practice.** The practice problems or Worksheet Parts A to D. Same buttons: Hint, Show next step, Reveal answer, Hide help.
0:36 to 0:40	**Exit ticket.** Worksheet Part E. Success looks like 4, 18, 32, and a one-input-one-output explanation with whole-number inputs.

Misconceptions to listen for

- **a sub 4 means a times 4.** The 4 is a position label.
- **Connect the dots.** No term number 2.5 exists.
- **The domain is all real numbers.** Whole numbers only.
- **Every list adds or multiplies.** Some do neither.
- **A sequence is not a function.** It is: one term per position.

Support and stretch

Support

Write the position numbers above every list before doing anything else. Have the student say a sub n aloud each time it is written.

Stretch

Ask for the rule for the square numbers in terms of n. Ask whether 5, 5, 5, 5 is arithmetic, geometric, or both (both: add 0, or multiply by 1).

Where this goes next

Lesson 2: arithmetic sequences. The common difference is the slope, and the two kinds of rule, recursive and explicit.

> THE HABIT TO BUILD
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> Number the positions, name terms with a sub n, plot dots, and check: subtract, then divide.