

TEACHER AND STUDENT RESOURCE

Sequences as Discrete Functions



NC Math 1 • NC.M1.F-IF.3

Interpreting Functions

Seven instructional sections with 30 multiple-choice and 30 open or performance tasks, teaching scripts, original mathematical visuals, generous workspaces, and worked keys.

Free sample | Contents

NC.M1.F-IF.3 | NC Math 1 mathematics

This sample contains 20 complete selected pages from the 112-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-15, 35-36, 65, 80-81

Representative activities

M01: sample PDF page(s) 16; original page(s) 15

M02: sample PDF page(s) 16; original page(s) 15

O01: sample PDF page(s) 17; original page(s) 35

O02: sample PDF page(s) 18; original page(s) 36

Selected teacher prompts and keys: original page(s) 65, 80-81

Using this sample

Read the preparation and access guidance before using a selected activity.
Keep teacher keys and private preparation pages separate from student copies.
Use the original resource contents to see the scope of the complete packet.

Complete paid download

The complete resource includes the full PDF task bank and teaching materials.

ALIGNMENT

Standard and learning targets

Recognize that recursively and explicitly defined sequences are functions whose domain is a subset of the integers, the terms of an arithmetic sequence are a subset of the range of a linear function, and the terms of a geometric sequence are a subset of the range of an exponential function.

T1 Connect explicit and recursive sequences to integer domains.

T2 Relate arithmetic sequences to linear-function ranges.

T3 Relate geometric sequences to exponential-function ranges.

Each item names its own target. The bank supports multiple sessions; do not assign all 60 tasks in one sitting.

NAVIGATION

Choose evidence deliberately

Warm-up: M01-M04 and O01-O04

I Do: M05-M08 and O05-O08

We Do: M09-M13 and O09-O13

Collaborative practice: M14-M18 and O14-O18

Independent practice: M19-M23 and O19-O23

Small-group reteach: M24-M27 and O24-O27

Exit ticket: M28-M30 and O28-O30

T1: M03, M06, M09, M12, M15, M18, M21, M24, M27, M30, O03, O06, O09, O12, O15, O18, O21, O24, O27, O30

T2: M01, M04, M07, M10, M13, M16, M19, M22, M25, M28, O01, O04, O07, O10, O13, O16, O19, O22, O25, O28

T3: M02, M05, M08, M11, M14, M17, M20, M23, M26, M29, O02, O05, O08, O11, O14, O17, O20, O23, O26, O29

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1: identify and interpret

Learning target: Connect explicit and recursive sequences to integer domains.

Learning target: Relate arithmetic sequences to linear-function ranges.

Warm-up, I Do and selected We Do tasks. Use the model as explicit instruction; preserve a first independent response.

Session 2: represent and connect

Learning target: Relate arithmetic sequences to linear-function ranges.

Learning target: Relate geometric sequences to exponential-function ranges.

Selected We Do and collaborative tasks. Ask partners to compare representations and justify domains.

Session 3: apply independently

Learning target: Connect explicit and recursive sequences to integer domains.

Learning target: Relate arithmetic sequences to linear-function ranges.

Learning target: Relate geometric sequences to exponential-function ranges.

Select independent tasks spanning all targets; retain first responses. Reteach one evidenced gap, then collect a fresh exit task.

PLANNING

Materials, access and pacing

Materials

Pencils, erasers, straightedge, student pages, and optional graph paper. A calculator may support arithmetic after a learner states the intended relationship. No device or paid software is required.

Prerequisites

Check ordered-pair order, integer arithmetic, exponents, axis scales, and the meaning of input and output. Teach missing prerequisites before collecting independent evidence.

Pacing

Use a short diagnostic warm-up, a model and shared task in one session; collaborative and independent reasoning in later sessions; then targeted reteaching and an exit task. Select two to four tasks at a time based on evidence. Each section's full bank is reusable, not mandatory in one lesson.

Neutral access

Read directions aloud without interpreting the graph, enlarge a page, supply a writing or pointing response method, and allow a learner to dictate an explanation. Keep axes, units, data and mathematical demand unchanged.

Separate instruction from evidence

Keep the learner's first response. Record answer-supplying cues separately from access supports. A completed teacher graph or worked key is for discussion after independent work, never a student construction template.

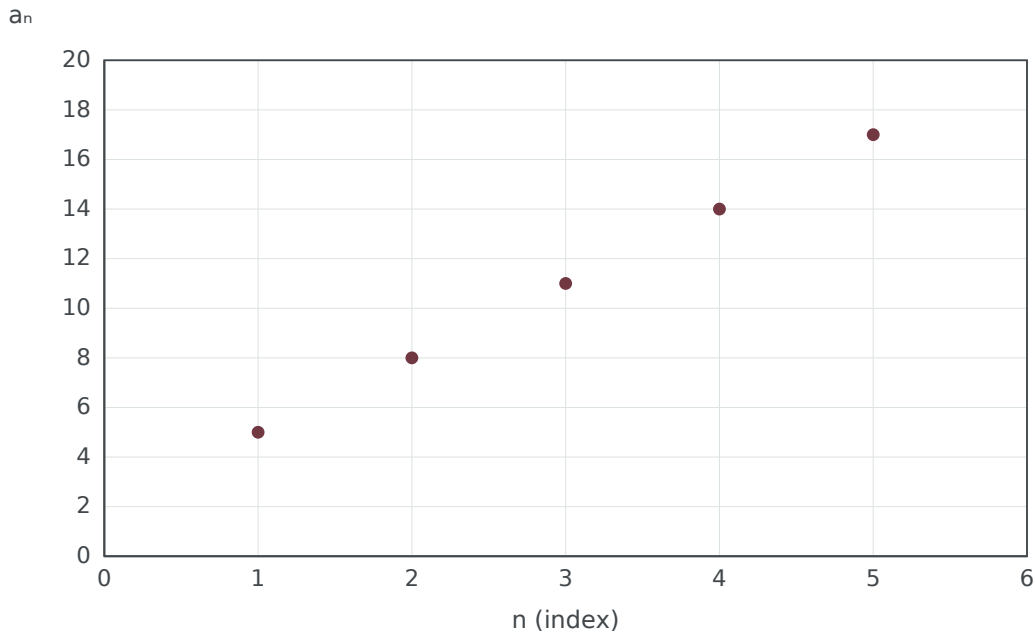
Review convention

A function assigns exactly one output to each allowed input. A repeated output is permitted. Finite lists contain only the points stated; connect points only when the stated model includes all intervening real inputs. Parentheses in $f(x)$ mark an input, not multiplication.

TEACHER MODEL

A sequence sits inside a function

The sequence has $a_1=5$ and $a_n=a_{n-1}+3$ for $n \geq 2$. Find five terms and an explicit rule. Connect the sequence to a line.



Starting at index 1 gives 5, 8, 11, 14, 17. There are $n-1$ increases from the first term, so $a_n=5+3(n-1)=3n+2$. Plot $(1,5), \dots, (5,17)$ as separate points. They lie on $y=3x+2$. The sequence permits positive integer inputs; the full line permits real inputs. Its sequence outputs form a subset of the line's range.

REUSABLE REASONING GUIDE

Represent, justify, interpret

Name: _____ Date: _____

Givens, quantities and restrictions**Representation and calculation****Justification or check****Conclusion, domain and units**

WARM-UP

Teaching script

Core: 001 • T2: Relate arithmetic sequences to linear-function ranges.

Optional bank: M01–M04; 001–004. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 5–8 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page 001, including its graph when present. Invite a first independent response before discussion. Ask, “What do the symbols represent? What evidence supports your claim?”

Core task

Let $b_1=12$ and $b_n=b_{n-1}+5$ for $n \geq 2$. Find the first four terms and b_5 . Write an explicit rule and the equation of a real-input linear function containing these sequence points. Explain the domain difference.

Teacher solution and discussion

First four terms: 12, 17, 22, 27. $b_5=12+5(5-1)=32$. Rule $b_n=12+5(n-1)$. The containing line is $y=5x+7$. Sequence domain: positive integers; line domain: real numbers. Sequence outputs form a subset of the line’s range.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M01 to compare all alternatives after evidence is collected.

I DO

Teaching script

Core: 005 • T3: Relate geometric sequences to exponential-function ranges.

Optional bank: M05–M08; 005–008. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–12 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page 005, including its graph when present. Think aloud through the core task. Say, “I will identify the quantities first, then build a representation and check it against the stated domain.” Hide the worked key until after predictions.

Core task

A geometric sequence starts with $w_1=192$; each next term is half the previous term. Write recursive and explicit rules, find w_3 , and graph the first five terms. Explain the relationship to a real-input exponential graph.

Teacher solution and discussion

$w_1=192$, $w_n=(1/2)w_{n-1}$ for $n \geq 2$. Explicit: $w_n=192(1/2)^{n-1}$; $w_3=48$. Plot $\{(1, 192.0), (2, 96.0), (3, 48.0), (4, 24.0), (5, 12.0)\}$ as separate points. Each lies on $y=192(1/2)^{x-1}$, but the sequence uses positive integer inputs only. Its term values are a subset of the positive-real range of the exponential.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M05 to compare all alternatives after evidence is collected.

WE DO

Teaching script

Core: 009 • T1: Connect explicit and recursive sequences to integer domains.

Optional bank: M09–M13; O09–O13. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–15 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O09, including its graph when present. Have learners propose the next step, then ask a partner to verify it using the original representation. Record more than one valid explanation.

Core task

The finite sequence $u_n = 12 - 2n$ is defined for integer n with $0 \leq n \leq 8$. State its domain and range. Evaluate u_0 and u_8 . Explain why $u(1.5)$ is not a term even though substitution into the expression is possible.

Teacher solution and discussion

Domain $\{0, 1, 2, 3, 4, 5, 6, 7, 8\}$; range $\{-4, -2, 0, 2, 4, 6, 8, 10, 12\}$. $u_0 = 12$ and $u_8 = -4$. The index 1.5 is not an integer. This sequence starts at zero, so its domain need not start at one.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M09 to compare all alternatives after evidence is collected.

COLLABORATIVE PRACTICE

Teaching script

Core: O14 • T3: Relate geometric sequences to exponential-function ranges.

Optional bank: M14–M18; O14–O18. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 15–20 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O14, including its graph when present. Assign reader, representer, checker and explainer roles. Each learner first makes a private prediction; compare reasoning and resolve differences with the data.

Core task

Let $g_1=14$ and $g_n=2g_{n-1}$ for $n \geq 2$. List the first four terms, give an explicit rule, and find g_5 . Describe a corresponding exponential function and how its range contains the sequence terms.

Teacher solution and discussion

First terms: 14, 28, 56, 112. $g_n=14 \cdot 2^{n-1}$, so $g_5=224$. The real-input exponential $y=14 \cdot 2^{x-1}$ has all positive real outputs; the positive-integer-indexed sequence has only its listed-and-continuing discrete term values, a subset of that range.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M14 to compare all alternatives after evidence is collected.

INDEPENDENT PRACTICE

Teaching script

Core: O19 • T2: Relate arithmetic sequences to linear-function ranges.

Optional bank: M19–M23; O19–O23. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 15–20 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O19, including its graph when present. Provide the printed task and neutral access supports. Preserve the first independent response; do not point to the requested answer or select a method for the learner.

Core task

Let $b_1=15$ and $b_n=b_{n-1}+8$ for $n \geq 2$. Find the first four terms and b_8 . Write an explicit rule and the equation of a real-input linear function containing these sequence points. Explain the domain difference.

Teacher solution and discussion

First four terms: 15, 23, 31, 39. $b_8=15+8(8-1)=71$. Rule $b_n=15+8(n-1)$. The containing line is $y=8x+7$. Sequence domain: positive integers; line domain: real numbers. Sequence outputs form a subset of the line's range.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M19 to compare all alternatives after evidence is collected.

SMALL-GROUP RETEACH

Teaching script

Core: O24 • T1: Connect explicit and recursive sequences to integer domains.

Optional bank: M24–M27; O24–O27. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 10–15 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O24, including its graph when present. Start with the learner’s prior evidence. Rebuild one representation with explicit terms and operations, then use a fresh item to check transfer without the prior cue.

Core task

A rule says $z_n = z_{n-1} + 8$ for $n \geq 2$, with no initial value. Construct two different sequences satisfying it, one starting at 19 and the other at 23. Give three terms and an explicit rule for each. Explain why each completed sequence is a function.

Teacher solution and discussion

First: 19, 27, 35, with $z_n = 19 + 8(n-1)$. Second: 23, 31, 39, with $z_n = 23 + 8(n-1)$. For either chosen starting value, each positive integer index has exactly one output. The recurrence alone did not select between these functions.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M24 to compare all alternatives after evidence is collected.

EXIT TICKET

Teaching script

Core: O28 • T2: Relate arithmetic sequences to linear-function ranges.

Optional bank: M28–M30; O28–O30. Select tasks across more than one meeting if needed.

Suggested discussion/work time: 5–8 minutes. Adjust for access and evidence; this is not a speed criterion.

Display student page O28, including its graph when present. Ask for a concise claim supported by the representation. Collect the response before sharing a solution; use it to choose the next instructional step.

Core task

An arithmetic sequence starts at $a_1=24$ and decreases by 7 each step. Graph the first five terms. Write recursive and explicit rules. State the sequence domain for the continuing sequence and the domain of its containing line.

Teacher solution and discussion

Plot $\{(1, 24), (2, 17), (3, 10), (4, 3), (5, -4)\}$ as separate points. $a_1=24$, $a_n=a_{n-1}-7$ for $n \geq 2$.

Explicit: $a_n=24-7(n-1)$. The sequence domain is positive integers; the containing line $y=-7x+31$ has all real inputs. Do not connect the sequence points.

Evidence and response

Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then collect a fresh response. A selected option alone does not identify a unique misconception.

Closure: Ask learners to state one feature they verified and one check they used. Use the worked key for M28 to compare all alternatives after evidence is collected.

MULTIPLE-CHOICE BANK

M01 / M02 • Select and justify**M01 | Warm-up | T2**

A sequence is defined by $a_1=5$, $a_n=a_{n-1}+2$ for $n \geq 2$. Which explicit rule matches it?

- A. $a_n=5+2n$.
- B. $a_n=2+5(n-1)$.
- C. $a_n=5 \cdot 2^{n-1}$.
- D. $a_n=5+2(n-1)$.

Reasoning: _____

M02 | Warm-up | T3

A geometric sequence begins 4, 8, 16, ... at index $n=1$. Which explicit rule fits?

- A. $g_n=4 \cdot 2^n$.
- B. $g_n=4 \cdot 2^{n-1}$.
- C. $g_n=4+2(n-1)$.
- D. $g_n=2 \cdot 4^{n-1}$.

Reasoning: _____

WARM-UP

001 • Show your reasoning

T2: Relate arithmetic sequences to linear-function ranges.

Let $b_1=12$ and $b_n=b_{n-1}+5$ for $n \geq 2$. Find the first four terms and b_5 . Write an explicit rule and the equation of a real-input linear function containing these sequence points. Explain the domain difference.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T3: Relate geometric sequences to exponential-function ranges.

Let $g_1=12$ and $g_n=2g_{n-1}$ for $n \geq 2$. List the first four terms, give an explicit rule, and find g_3 . Describe a corresponding exponential function and how its range contains the sequence terms.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02**M01 • T2: Relate arithmetic sequences to linear-function ranges.****Answer: D. $a_n = 5 + 2(n - 1)$.**

The explicit rule is $5 + 2(n - 1)$. At $n = 1$ it gives 5; each increase of 1 in n adds 2.

Check each alternative

- A. At $n = 1$ this adds a step too soon.
- B. This exchanges the first term and common difference.
- C. This multiplies by the step instead of repeatedly adding it.
- D. There are $n - 1$ additions after the first term.

M02 • T3: Relate geometric sequences to exponential-function ranges.**Answer: B. $g_n = 4 \cdot 2^{n-1}$.**

Consecutive terms have ratio 2. At $n = 1$ the factor 2^0 is 1, giving 4.

Check each alternative

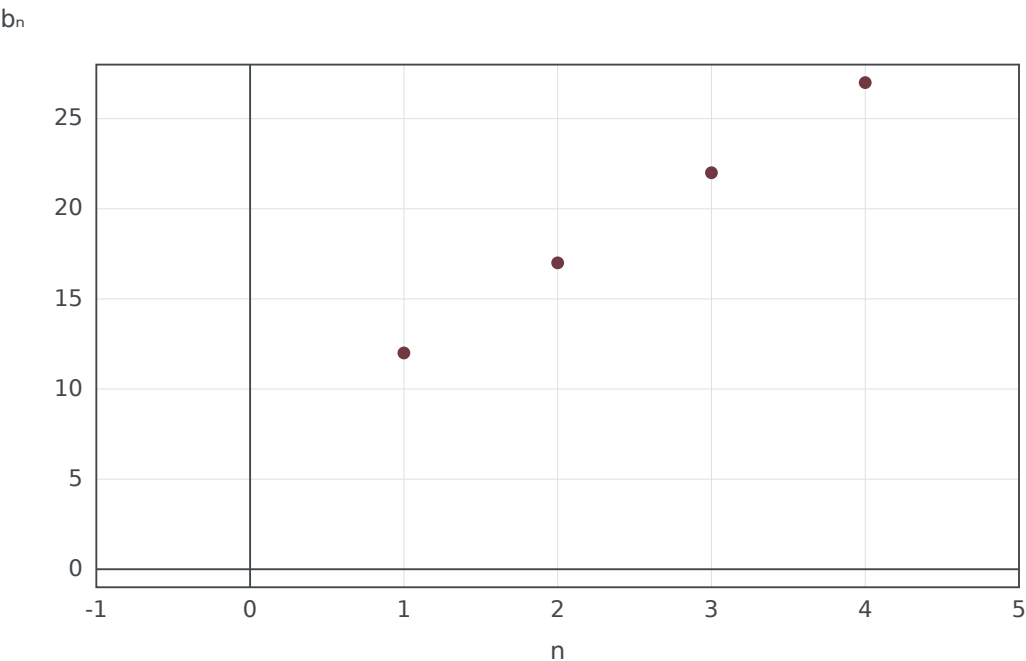
- A. This starts at the second term when $n = 1$.
- B. This starts at the first term and applies $n - 1$ factors of the ratio.
- C. This adds the ratio instead of multiplying by it.
- D. This exchanges the first term and ratio.

WORKED TEACHER KEYS

001

001 • T2: Relate arithmetic sequences to linear-function ranges.

First four terms: 12, 17, 22, 27. $b_5=12+5(5-1)=32$. Rule $b_n=12+5(n-1)$. The containing line is $y=5x+7$. Sequence domain: positive integers; line domain: real numbers. Sequence outputs form a subset of the line’s range.



Evidence to assess

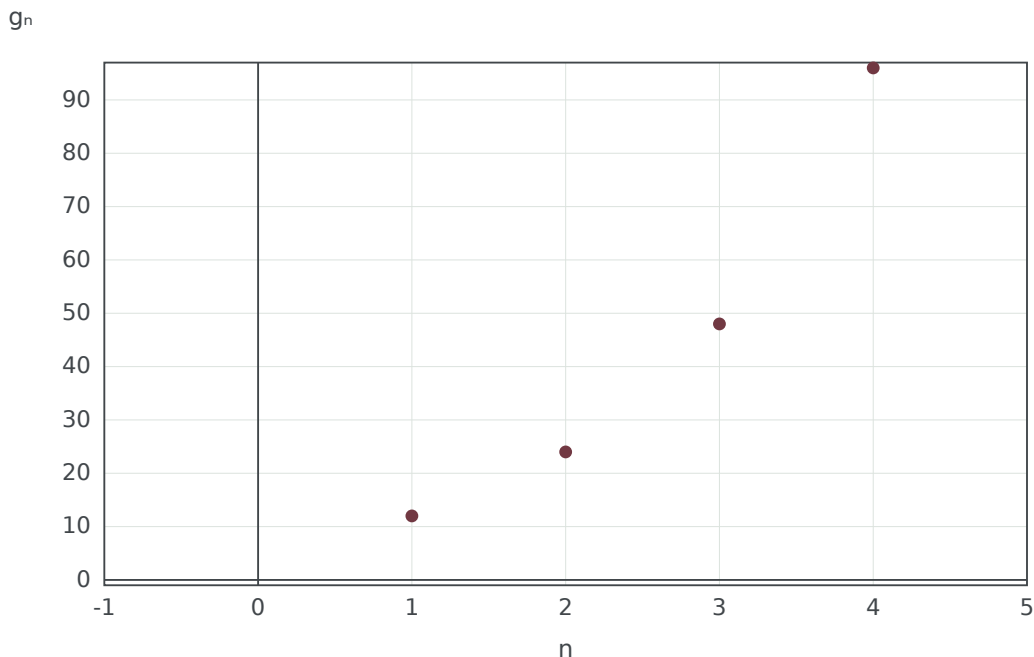
Assess each requested representation and conclusion separately. Require the stated domain, valid function notation, and a justification using the actual values. Accept other mathematically equivalent explanations.

WORKED TEACHER KEYS

002

002 • T3: Relate geometric sequences to exponential-function ranges.

First terms: 12, 24, 48, 96. $g_n = 12 \cdot 2^{n-1}$, so $g_3 = 48$. The real-input exponential $y = 12 \cdot 2^{x-1}$ has all positive real outputs; the positive-integer-indexed sequence has only its listed-and-continuing discrete term values, a subset of that range.

**Evidence to assess**

Assess each requested representation and conclusion separately. Require the stated domain, valid function notation, and a justification using the actual values. Accept other mathematically equivalent explanations.