

TEACHER AND STUDENT RESOURCE

Explicit and Recursive Sequences



NC Math 1 • NC.M1.F-BF.2

Building and Comparing Function Models

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-BF.2 | NC Math 1 mathematics

This sample contains 20 complete selected pages from the 107-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-15, 30-31, 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) 30

O02: sample PDF page(s) 18; original page(s) 31

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

Translate between explicit and recursive forms of arithmetic and geometric sequences and use both to model situations.

T1 Translate arithmetic sequences between explicit and recursive rules.

T2 Translate geometric sequences between explicit and recursive rules.

T3 Model situations with both sequence forms and a stated index.

T4 Verify and compare sequence rules using terms and initial conditions.

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: M01, O01, M02, O02, M07, O07, M08, O08, M13, O13, M14, O14, M19, O19, M20, O20, M25, O25, M26, O26

T2: M03, O03, M04, O04, M09, O09, M10, O10, M15, O15, M16, O16, M21, O21, M22, O22, M27, O27, M28, O28

T3: M05, O05, M11, O11, M17, O17, M23, O23, M29, O29

T4: M06, O06, M12, O12, M18, O18, M24, O24, M30, O30

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1: Notice and represent

Learning target: Translate arithmetic sequences between explicit and recursive rules.

Use M01–M04 and selected O01–O04 as a diagnostic. Model O05; ask learners to check its rule with the supplied data.

Session 2: Build and justify

Learning target: Translate geometric sequences between explicit and recursive rules.

Learning target: Model situations with both sequence forms and a stated index.

Choose from M09–M18 and O09–O18. Partners compare representations, check every given condition, and explain disagreements.

Session 3: Apply and revisit

Learning target: Verify and compare sequence rules using terms and initial conditions.

Collect independent evidence from M19–M23 and O19–O23. Use M24–M27 and O24–O27 for fresh reteaching examples; select an exit task from each bank.

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. For the optional digital comparisons, use a school-approved graphing calculator or spreadsheet; no paid service or account is required. Enter the supplied rules and tables and record your own results.

Prerequisites

Check signed arithmetic, ratios, exponents and ordered pairs. Distinguish a quantity from its change. Review arithmetic and geometric patterns before scoring 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.

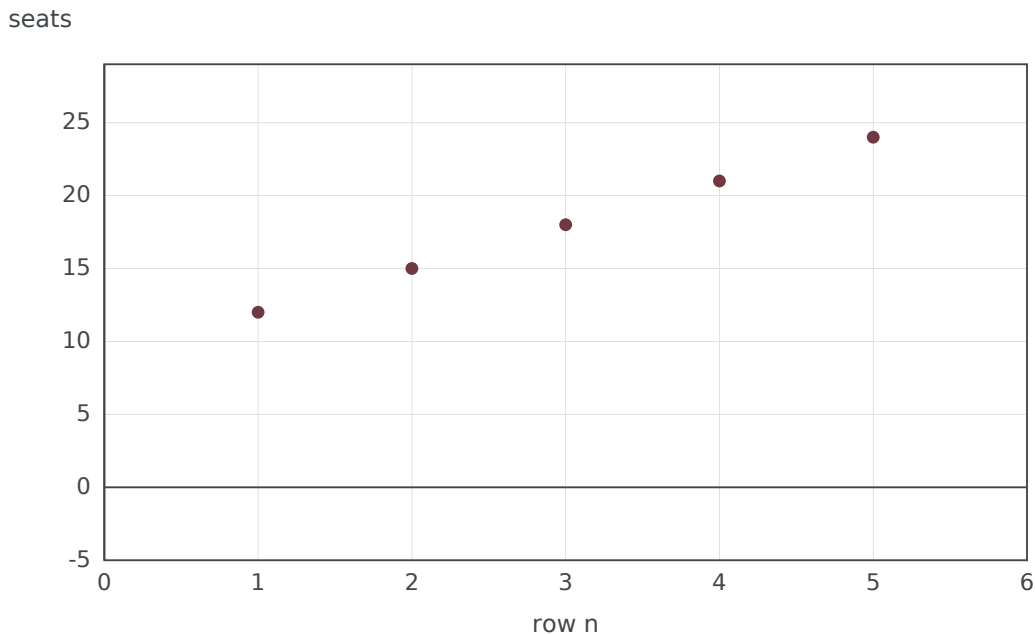
Review convention

Every recursive rule needs an initial term and a valid index range. Unless stated otherwise $n=1$ is the first term. Sequences are functions on integers, so plotted sequence points are not connected. A recurrence applies only from its stated next index.

TEACHER MODEL

Same sequence, two ways to compute

A theater has 12 seats in row 1 and adds 3 seats per row. Give recursive and explicit forms, then represent the first five rows.



Let $a(n)$ be seats in row n . Recursion: $a(1)=12$ and $a(n)=a(n-1)+3$ for integer $n \geq 2$. Explicit: $a(n)=12+3(n-1)=3n+9$ for $n \geq 1$. Terms are 12, 15, 18, 21, 24. Recursion needs the previous term; the explicit rule uses n directly.

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 • T1: Translate arithmetic sequences between explicit and recursive rules.

Optional bank: M01–M04; O01–O04. 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 O01, 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

Given $b(1)=18$, $b(n)=b(n-1)+(1)$ for $n \geq 2$, write an explicit rule. Compute $b(5)$ both ways and explain the $n-1$.

Teacher solution and discussion

$b(n)=18+(1)(n-1)$. Recursion produces 18, 19, 20, 21, 22; explicit $b(5)=18+4(1)=22$. There are four changes from term 1 to term 5.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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: Model situations with both sequence forms and a stated index.

Optional bank: M05–M08; O05–O08. 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 O05, 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 paper design has 9 pieces before any folds (stage 0). Each fold multiplies the pieces by 2. Define explicit and recursive models for integer stage $n \geq 0$. Use both to find stage 3.

Teacher solution and discussion

$P(0)=9$; $P(n)=2P(n-1)$, $n \geq 1$. Explicit $P(n)=9 \cdot 2^n$. Recursion gives 9, 18, 36, 72; explicit $P(3)=9 \cdot 2^3=72$. Stage 0, not 1, is the initial index.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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 • T2: Translate geometric sequences between explicit and recursive rules.

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

Given $d(1)=18$ and $d(n)=(1/2)d(n-1)$ for $n \geq 2$, translate to an explicit rule and compute $d(4)$ recursively and explicitly.

Teacher solution and discussion

$d(n)=18 \cdot (1/2)^{n-1}$. Recursion gives 18, 9, 9/2, 9/4. Explicitly $d(4)=18 \cdot (1/2)^3=9/4$. Both include exactly three multiplications.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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 • T1: Translate arithmetic sequences between explicit and recursive rules.

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

For $n \geq 1$, $c(n) = 19 + (6)(n - 1)$. Write a complete recurrence, list terms 1–4, and plot those terms.

Teacher solution and discussion

$c(1) = 19$; $c(n) = c(n - 1) + (6)$ for $n \geq 2$. Terms are 19, 25, 31, 37. Plot each (index, term) separately; do not join a discrete sequence.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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 • T1: Translate arithmetic sequences between explicit and recursive rules.

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

Given $b(1)=27$, $b(n)=b(n-1)+(-3)$ for $n \geq 2$, write an explicit rule. Compute $b(5)$ both ways and explain the $n-1$.

Teacher solution and discussion

$b(n)=27+(-3)(n-1)$. Recursion produces 27, 24, 21, 18, 15; explicit $b(5)=27+4(-3)=15$. There are four changes from term 1 to term 5.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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 • T4: Verify and compare sequence rules using terms and initial conditions.

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

For $n \geq 1$, a learner claims $u(n) = 7 \cdot 3^n$ matches $u(1) = 7$, $u(n) = 3u(n-1)$. Evaluate the claim, repair the formula, and verify the first three terms.

Teacher solution and discussion

The proposed formula gives $u(1) = 21$, not 7. Repair: $u(n) = 7 \cdot 3^{n-1}$. It gives 7, 21, 63, matching the recurrence. Both rules need the same initial index.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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: Translate geometric sequences between explicit and recursive rules.

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

Translate $h(n)=9 \cdot (1/2)^{n-1}$, $n \geq 1$, to a complete recurrence. Make a table and graph for terms 1–4. Explain what the ratio means.

Teacher solution and discussion

$h(1)=9$; $h(n)=(1/2)h(n-1)$, $n \geq 2$. Terms are 9, 9/2, 9/4, 9/8. Each term is 1/2 times the preceding term. Plot separate points.

Evidence and response

Look for the stated initial condition, correct equal-interval change, and a model that matches every supplied observation. Ask learners to test their rule at two known inputs. If a learner adds where the situation multiplies, compare successive differences and ratios using actual data, 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 | T1**

A sequence has $a(1)=7$ and $a(n)=a(n-1)+(2)$ for $n \geq 2$. Which explicit rule matches for $n \geq 1$?

- A. $7+(2)n$
- B. $2+7(n-1)$
- C. $7+(2)(n-1)$
- D. $7 \cdot (2)^{n-1}$

Reasoning: _____

M02 | Warm-up | T1

For $n \geq 1$, $a(n)=7+(2)(n-1)$. Which complete recursive rule matches?

- A. $a(1)=7$; $a(n)=a(n-1)+(2)$, $n \geq 2$
- B. $a(1)=7$; $a(n)=a(n-1)+(-2)$, $n \geq 2$
- C. $a(1)=7$; $a(n)=a(n-1)+(4)$, $n \geq 2$
- D. $a(1)=7$; $a(n)=(2)a(n-1)$, $n \geq 2$

Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: Translate arithmetic sequences between explicit and recursive rules.

Given $b(1)=18$, $b(n)=b(n-1)+(1)$ for $n \geq 2$, write an explicit rule. Compute $b(5)$ both ways and explain the $n-1$.

Representation / calculation

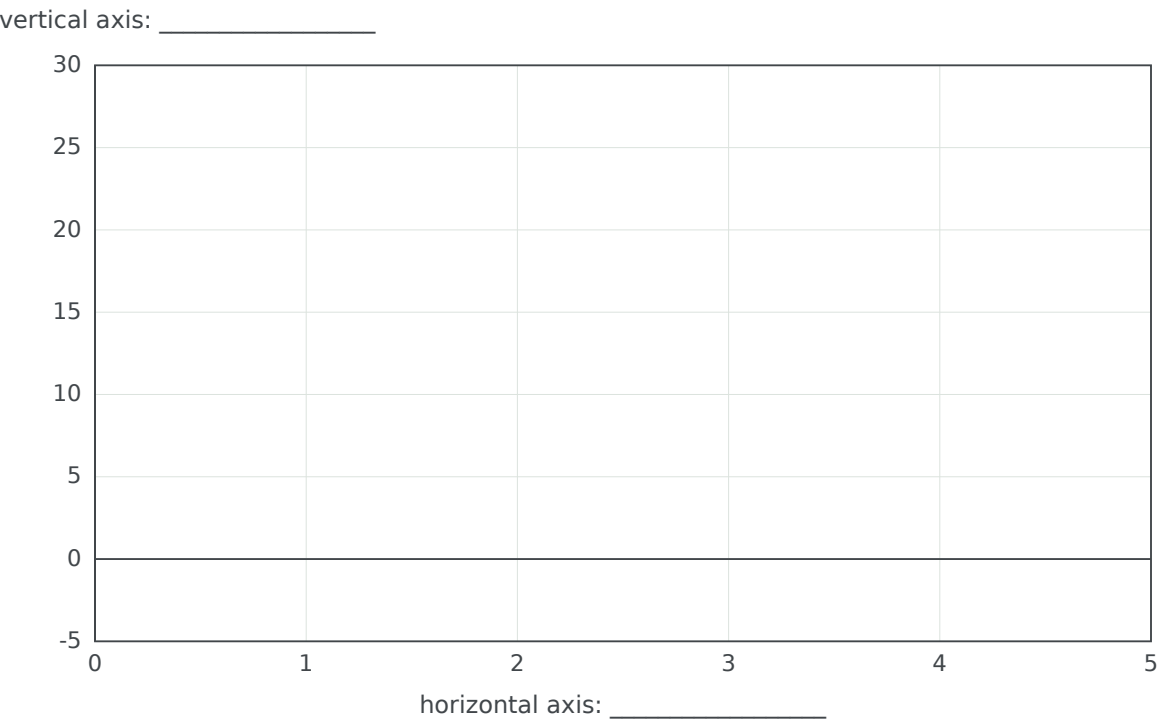
Explanation / check

WARM-UP

002 • Show your reasoning

T1: Translate arithmetic sequences between explicit and recursive rules.

For $n \geq 1$, $c(n) = 13 + (4)(n - 1)$. Write a complete recurrence, list terms 1-4, and plot those terms.



Explanation and check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Translate arithmetic sequences between explicit and recursive rules.****Answer: C. $7+(2)(n-1)$**

From term 1 to term n there are $n-1$ changes. Thus $a(n)=7+(2)(n-1)$. At $n=4$, $a(4)=13$.

Check each alternative

- A. This has already added one difference at $n=1$.
- B. This interchanges the first term and difference.
- C. At $n=1$ it gives the initial term and each increment adds the stated difference.
- D. This multiplies by the difference rather than adding it.

M02 • T1: Translate arithmetic sequences between explicit and recursive rules.**Answer: A. $a(1)=7$; $a(n)=a(n-1)+(2)$, $n \geq 2$**

Evaluate $n=1$ to get 7. Subtract consecutive formulas to get constant difference 2. Both parts are necessary.

Check each alternative

- A. Correct initial value and constant difference.
- B. The change has the opposite sign.
- C. This doubles the common difference.
- D. This multiplies by the difference rather than adding it.

WORKED TEACHER KEYS

001**001 • T1: Translate arithmetic sequences between explicit and recursive rules.**

$b(n)=18+(1)(n-1)$. Recursion produces 18, 19, 20, 21, 22; explicit $b(5)=18+4(1)=22$. There are four changes from term 1 to term 5.

Evidence to assess

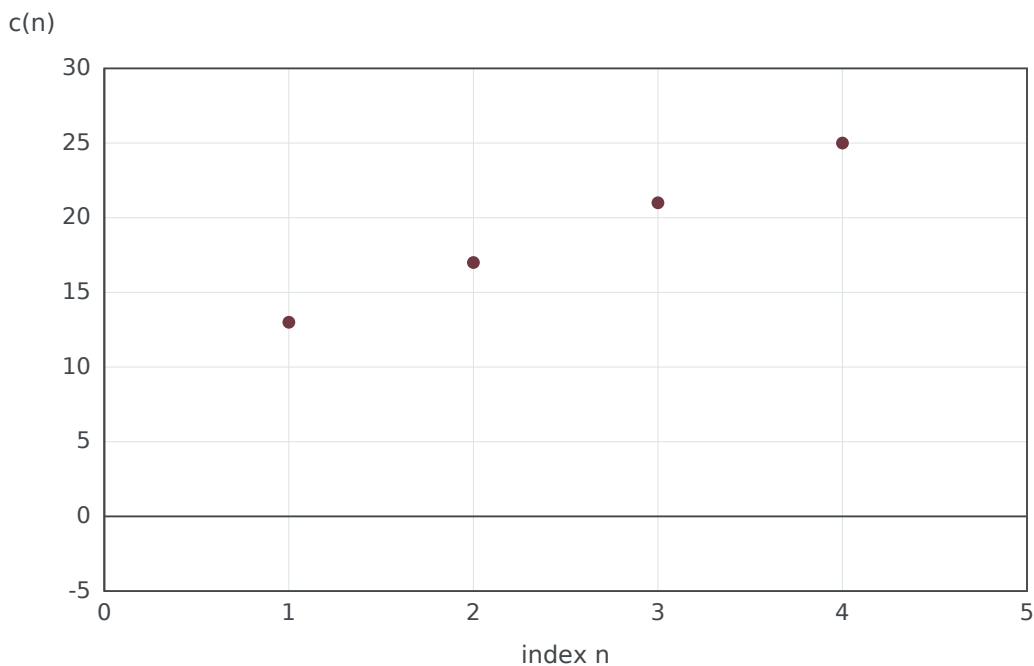
Score model/representation, calculation, reasoning and contextual interpretation separately. Require the stated initial condition, index or domain, and units where relevant. Accept equivalent formulas and valid alternative checks.

WORKED TEACHER KEYS

002

002 • T1: Translate arithmetic sequences between explicit and recursive rules.

$c(1)=13$; $c(n)=c(n-1)+(4)$ for $n \geq 2$. Terms are 13, 17, 21, 25. Plot each (index,term) separately; do not join a discrete sequence.

**Evidence to assess**

Score model/representation, calculation, reasoning and contextual interpretation separately. Require the stated initial condition, index or domain, and units where relevant. Accept equivalent formulas and valid alternative checks.