

TEACHER AND STUDENT RESOURCE

Sequences Series and Spreadsheet Models



DCS.F.1

Functions

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

Free sample | Contents

DCS.F.1 | NC Discrete Mathematics for Computer Science mathematics

This sample contains 19 complete selected pages from the 92-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-15, 30-31, 60, 75

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) 60, 75

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

Apply recursively-defined relationships to solve problems.

DCS.F.1.1 Implement procedures to find the n th term in an arithmetic or geometric sequence using spreadsheets.

DCS.F.1.2 Represent the sum of a sequence using sigma notation.

DCS.F.1.3 Implement procedures to find the sum of a finite sequence.

DCS.F.1.4 Implement procedures to find the sum of an infinite sequence and determine if the series converges or diverges.

DCS.F.1.5 Interpret the solutions to arithmetic and geometric sequences and series problems, in context.

The decimal codes are the official objectives. All are represented in the item bank. These materials support several sessions, not one 60-task lesson.

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

DCS.F.1.1: M01, M02, M03, M04, M05, M06, M30, O01, O02, O03, O04, O05, O28

DCS.F.1.2: M07, M08, M09, M25, O06, O07, O08, O09

DCS.F.1.3: M10, M11, M12, M23, M24, M27, O10, O11, O12, O13, O14, O15, O29

DCS.F.1.4: M13, M14, M15, M19, M20, M22, M28, O16, O17, O18, O19, O20, O21, O22, O30

DCS.F.1.5: M16, M17, M18, M21, M26, M29, O23, O24, O25, O26, O27

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1 Build and interpret representations

Learning target: Implement procedures to find the n th term in an arithmetic or geometric sequence using spreadsheets. Represent the sum of a sequence using sigma notation.

Use selected Warm-up and I Do tasks; compare an initial prediction with the worked model.

Session 2 Apply and explain methods

Learning target: Implement procedures to find the sum of a finite sequence. Implement procedures to find the sum of an infinite sequence and determine if the series converges or diverges. Interpret the solutions to arithmetic and geometric sequences and series problems, in context.

Use We Do and collaborative tasks across the objectives. Require each learner to explain one mathematical choice.

Session 3 Transfer and collect independent evidence

Learning target: Apply the listed objectives with accurate representations, justified methods, and contextual checks.

Choose independent tasks covering each objective. Reteach an evidenced gap, then use a fresh exit task without answer-supplying cues.

PLANNING

Materials, access and pacing

Materials

Pencils, erasers, printed tasks, and optional scratch paper. Spreadsheet software is required for tasks aligned to DCS.F.1.1. Use an accessible spreadsheet interface and record actual formulas and output.

Prerequisites

Exponents, fractions, function notation, and basic spreadsheet cell references.

Pacing

Select two to four tasks for a session. Preserve first independent evidence, discuss a model, and revisit with a fresh task. The full banks are reusable choices, not a timed requirement.

Neutral access

Read directions aloud without identifying a method or answer. Enlarge diagrams, allow dictated or typed reasoning, and provide accessible tables. Preserve all mathematical conditions.

Keep evidence interpretable

Record neutral supports separately from answer-supplying cues. Retain first responses. A selected distractor is not by itself a diagnosis.

Conventions

Sequences begin at $n=1$ unless stated otherwise. Σ indicates a sum over the inclusive integer bounds. A finite sum always has finitely many terms; a nonzero infinite geometric series converges exactly when $|r| < 1$.

TEACHER MODEL

Make the spreadsheet match the index

Build the arithmetic sequence $a_1=5, d=3$ through $n=5$ using a spreadsheet and verify the final term.

Row	Index cell	Term cell	Value
2	1	5	5
3	=A2+1	=B2+3	8
4	=A3+1	=B3+3	11
5	=A4+1	=B4+3	14
6	=A5+1	=B5+3	17

With headers in row 1, row 2 holds $n=1$ and $a_1=5$. Fill the two relative formulas downward. The fifth term is on row 6 and equals 17; check $5+(5-1) \cdot 3=17$.

Think aloud: I distinguish the worksheet row from the mathematical index, check the first transition, and compare a later output with an explicit formula.

REUSABLE REASONING GUIDE

Represent justify interpret

Givens and conditions

Model and calculation

Justification and independent check

Conclusion in context

WARM-UP

Teaching script

Core O01 | DCS.F.1.1

Collect a short first response before discussion. Ask learners what is given and which condition controls the method.

Display and ask

Use a spreadsheet to generate the first 10 terms of $a_1 = -3$, $a_n = a_{n-1} + 4$. Record the starting cells, fill-down formulas, complete output, and a direct formula check of a_{10} .

Work and discuss

With headers in row 1, enter $A2=1, B2=-3$; $A3 = A2+1$ and $B3 = B2+4$, then fill to row 11. Terms: $-3, 1, 5, 9, 13, 17, 21, 25, 29, 33$. Direct check $a_{10} = -3 + 9 \cdot 4 = 33$. Record actual spreadsheet output or an accessible equivalent.

Listen for evidence

Actual spreadsheet implementation, all ten terms, and independent indexing check.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M01 for contrast after discussion. Select another task from M01-M04 or O01-O04 to check transfer. Record support and the new evidence separately.

I DO

Teaching script

Core 005 | DCS.F.1.1

Make a prediction before modeling. Think aloud through the core task, making each calculation and check visible.

Display and ask

Implement the same arithmetic sequence $a_1=6, d=-2$ two ways in a spreadsheet: recursively and directly from the index. Compare the first six outputs and explain why agreement is a useful but limited check.

Work and discuss

Recursive: $B_2=6, B_3=B_2-2$, fill down. Direct: $C_2=6-2*(A_2-1)$, fill beside indices 1..6. Both columns give 6, 4, 2, 0, -2, -4. Agreement checks these rows; the general identity follows because each index increase subtracts 2 and both begin at 6.

Listen for evidence

Two actual implementations, rowwise comparison, and distinction between testing and general reasoning.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M05 for contrast after discussion. Select another task from M05-M08 or O05-O08 to check transfer. Record support and the new evidence separately.

WE DO

Teaching script

Core 009 | DCS.F.1.2

Ask learners to propose the next step and have a partner verify it against the original conditions.

Display and ask

A learner writes the sum $2+4+8+16$ as $\sum$ from $k=0$ to 4 of 2^k . Explain both errors and give two correct sigma forms.

Work and discuss

The written expression starts at 1 and has five terms, giving $1+2+4+8+16$. Correct forms: $\sum$ from $k=1$ to 4 of 2^k , or $\sum$ from $j=0$ to 3 of $2^{(j+1)}$. Each gives exactly $2,4,8,16$.

Listen for evidence

Identify first-term and term-count errors separately and repair both.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M09 for contrast after discussion. Select another task from M09-M13 or O09-O13 to check transfer. Record support and the new evidence separately.

COLLABORATIVE PRACTICE

Teaching script

Core O14 | DCS.F.1.3

Assign reader, modeler, checker, and explainer roles. Require a private first attempt before comparing approaches.

Display and ask

For ratio 1, explain why the usual expression $a(1-r^n)/(1-r)$ cannot be substituted directly. Find the sum of nine terms all equal -4 and justify without dividing by zero.

Work and discuss

At $r=1$ the displayed expression has $0/0$ and is not the appropriate formula. The sequence is constant, so $S_9=9(-4)=-36$. The finite sum exists; use $S_n=na$ when $r=1$.

Listen for evidence

Formula-domain awareness and the constant-sequence case.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M14 for contrast after discussion. Select another task from M14-M18 or O14-O18 to check transfer. Record support and the new evidence separately.

INDEPENDENT PRACTICE

Teaching script

Core O19 | DCS.F.1.4

Provide only neutral access supports. Keep the first response and ask for justification without selecting a method.

Display and ask

A learner assigns the sum $1-1+1-1+\dots$ the value 0 by grouping pairs. Use the ordinary sequence of partial sums to critique the argument without adopting a different summation convention.

Work and discuss

Partial sums are $1, 0, 1, 0, \dots$. Odd and even subsequences have different limits, so the ordinary series diverges. Pairing all terms in one chosen way hides the odd partial sums; it cannot establish an ordinary limit.

Listen for evidence

All partial sums and a clear restriction to ordinary convergence.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M19 for contrast after discussion. Select another task from M19-M23 or O19-O23 to check transfer. Record support and the new evidence separately.

SMALL-GROUP RETEACH

Teaching script

Core O24 | DCS.F.1.5

Use the earlier work to identify a specific gap. Model that connection, then remove the cue on a fresh item.

Display and ask

A machine's output is 120 units in its first hour and doubles each hour for five hours. Find hour 5 output and total five-hour production. State one reason the model should not be extended indefinitely without checking assumptions.

Work and discuss

$a_5 = 120 \cdot 2^4 = 1920$ units. Total $S_5 = 120(2^5 - 1) = 3720$ units. Continued doubling assumes unlimited capacity, inputs, and demand; real constraints can invalidate indefinite extrapolation.

Listen for evidence

Term and finite series, units, and a specific model limitation.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M24 for contrast after discussion. Select another task from M24-M27 or O24-O27 to check transfer. Record support and the new evidence separately.

EXIT TICKET

Teaching script

Core O28 | DCS.F.1.1

Collect a concise claim and supporting computation before showing the key. Use the evidence to select a next task.

Display and ask

Use a spreadsheet to compare arithmetic $a_1=4, d=3$ with geometric $b_1=4, r=3$ through $n=5$. Record both formula columns and outputs, and identify the first index where their values differ.

Work and discuss

For indices 1..5, set $B_2=4, B_3=B_2+3; C_2=4, C_3=C_2*3$ and fill. Arithmetic: 4, 7, 10, 13, 16. Geometric: 4, 12, 36, 108, 324. They first differ at $n=2$; the same number 3 serves different roles, additive difference versus multiplicative ratio.

Listen for evidence

Actual paired spreadsheet implementation and comparison of operation types.

Probe and respond

Ask whether the problem requests a term, cumulative sum, or tail. If indexing slips, mark term 1 and count transitions. Require observable spreadsheet work when spreadsheet implementation is the target.

Next: use M28 for contrast after discussion. Select another task from M28-M30 or O28-O30 to check transfer. Record support and the new evidence separately.

MULTIPLE-CHOICE BANK

M01 / M02 Select and justify**M01 | Warm-up | DCS.F.1.1**

A spreadsheet has $n=1$ in A2 and $a_1=7$ in B2. The arithmetic sequence adds 4 each term. Which formula in B3 can be filled downward?

- A. $=\$B\$2+4$
- B. $=B2+4$
- C. $=B2*4$
- D. $=B2+ A2$

Reasoning: _____

M02 | Warm-up | DCS.F.1.1

A sequence begins 6 and multiplies by 3. If B2 contains 6, what formula should B3 contain for recursive fill-down?

- A. $=B2*3$
- B. $=3/B2$
- C. $=\$B\$2*3$
- D. $=B2+3$

Reasoning: _____

WARM-UP

001 Show your reasoning

DCS.F.1.1 | Implement procedures to find the n th term in an arithmetic or geometric sequence using spreadsheets.

Use a spreadsheet to generate the first 10 terms of $a_1 = -3$, $a_n = a_{n-1} + 4$.

Record the starting cells, fill-down formulas, complete output, and a direct formula check of a_{10} .

Representation and calculation**Explanation and check**

WARM-UP

002 Show your reasoning

DCS.F.1.1 | Implement procedures to find the n th term in an arithmetic or geometric sequence using spreadsheets.

Build a spreadsheet for $a_1=5$, $a_n=-2a_{n-1}$. Generate through $n=6$, record the formulas, and explain the sign pattern and changing magnitude.

Representation and calculation

Explanation and check

WORKED TEACHER KEYS

M01 / M02**M01 | DCS.F.1.1****Answer B: $=B2+4$**

Use $B3 = B2+4$ and fill downward; successive entries are 7,11,15,19,... .

- A. This freezes the first term, so later rows repeat 11.
 - B. Correct. It refers to the preceding term and adds the common difference.
 - C. This creates a geometric sequence.
 - D. The increment would change with the index, not remain 4.
- Evidence: A relative previous-term reference and constant arithmetic increment.

M02 | DCS.F.1.1**Answer A: $=B2*3$**

The generated terms are 6,18,54,162,... when the reference to the preceding row shifts.

- A. Correct. Each new term is 3 times the preceding cell.
 - B. This uses a reciprocal rather than the stated ratio.
 - C. This repeats 18 after filling because the first cell is fixed.
 - D. This adds 3 instead of multiplying.
- Evidence: Distinguish geometric recursion from arithmetic and fixed-reference errors.

WORKED TEACHER KEYS

001 / 002**001 | DCS.F.1.1**

With headers in row 1, enter $A2=1, B2=-3$; $A3 = A2+1$ and $B3 = B2+4$, then fill to row 11.

Terms: $-3, 1, 5, 9, 13, 17, 21, 25, 29, 33$. Direct check $a_{10} = -3 + 9 \cdot 4 = 33$. Record actual spreadsheet output or an accessible equivalent.

Evidence: Actual spreadsheet implementation, all ten terms, and independent indexing check.

002 | DCS.F.1.1

Enter $A2=1, B2=5$; use $A3 = A2+1$ and $B3 = -2 \cdot B2$, fill through row 7. Terms $5, -10, 20, -40, 80, -160$.

The negative ratio alternates signs; magnitude 2 doubles absolute values each step. Direct $a_6 = 5(-2)^5 = -160$.

Evidence: Observed fill-down, signed terms, and ratio interpretation.