

TEACHER AND STUDENT RESOURCE

Domain and Range in Context



NC Math 1 • NC.M1.F-IF.5

Interpreting functions in context

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.5 | NC Math 1 mathematics

This sample contains 22 complete selected pages from the 108-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-17, 37-38, 67, 82-83

Representative activities

M01: sample PDF page(s) 17; original page(s) 16

M02: sample PDF page(s) 18; original page(s) 17

O01: sample PDF page(s) 19; original page(s) 37

O02: sample PDF page(s) 20; original page(s) 38

Selected teacher prompts and keys: original page(s) 67, 82-83

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

Interpret a function in terms of the context by relating its domain and range to its graph and, where applicable, to the quantitative relationship it describes.

T1 Identify meaningful inputs and their restrictions in a context.

T2 Relate a function's possible outputs to its domain and rule.

T3 Connect domain and range to continuous or discrete graphs.

T4 Evaluate model boundaries, endpoints and contextual limitations.

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, M03, M08, M20, M23, M25, O01, O03, O08, O20, O23

T2: M02, M04, M06, M07, M12, M13, M15, M18, M19, M24, M27, M29, M30, O02, O04, O06, O07, O12, O13, O15, O18, O19, O24, O26, O29, O30

T3: M05, M10, M16, M21, M28, O05, O10, O14, O16, O21, O27

T4: M09, M11, M14, M17, M22, M26, O09, O11, O17, O22, O25, O28

SESSION TARGETS

Plan short learning sequences

Session 1: meaningful inputs

Use T1 with M01–M04 and O01–O04. Identify counted or measured inputs, restrictions, and units before evaluating outputs.

Session 2: representations and attainable outputs

Use T2 and T3 with selected M05–M13 and O05–O13. Model O05 using its table and graph. Contrast that finite set with the continuous models in O06 and O07.

Session 3: endpoints and contextual limits

Use T3 and T4 with M14–M23 and O14–O23. Interpret open and filled endpoints, construction graphs, stopping rules, and model boundaries.

Session 4: transfer and explanation

Reteach from M24–M27 and O24–O27 as needed. Collect one M28–M30 and one O28–O30 as new independent evidence of domain, range and context.

Select a small subset at each meeting; the full bank supports reuse and responsive grouping over multiple sessions. Targets describe the mathematics, not a required daily item count.

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

Read ordered pairs and function rules; substitute into linear, simple quadratic and exponential rules; compare values and use units. Identify counted versus measured quantities.

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.

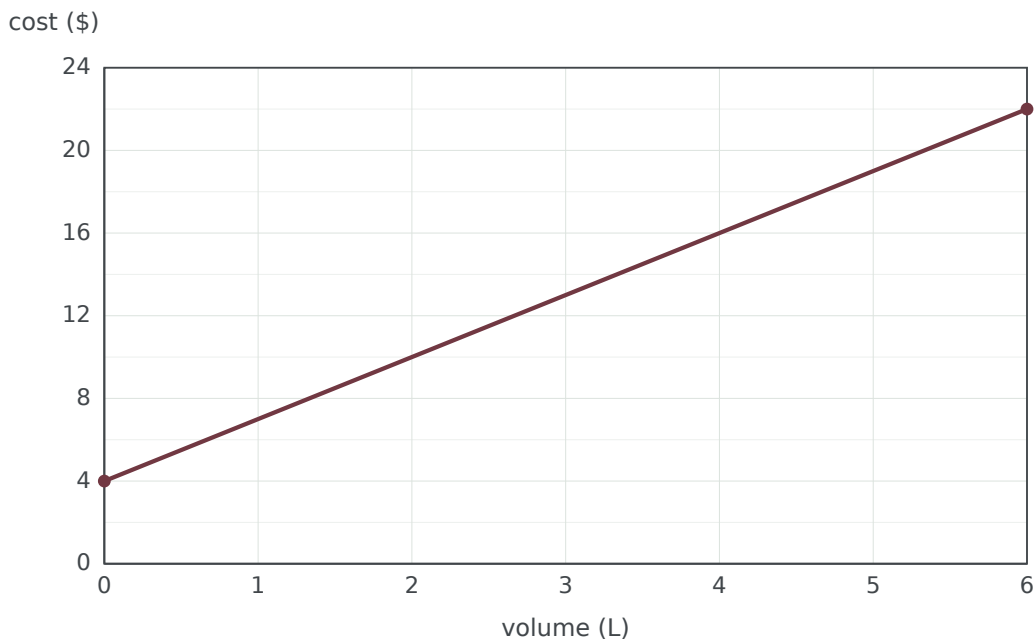
Review convention

A domain lists allowed inputs; a range lists outputs actually attained. Braces list separate values. An inequality or interval includes every real value between its bounds unless integers are specified. $[a, b]$ includes both endpoints; (a, b) excludes both. Filled graph endpoints are included; open circles are excluded. Counted objects generally require whole-number inputs; measured quantities may vary continuously when stated.

TEACHER MODEL

Counting and measuring use different domains

A refill service charges $C = 4 + 3v$ dollars for v liters. Any real amount from 0 through 6 L is allowed. Find the domain and range, then explain how selling only whole liters changes the graph.



With measured volumes, the domain is $0 \leq v \leq 6$ and the range is $4 \leq C \leq 22$. The line segment includes both endpoints. If only whole liters are allowed, the domain is $\{0, 1, 2, 3, 4, 5, 6\}$; the range is $\{4, 7, 10, 13, 16, 19, 22\}$. Plot seven separate points for that different policy. Equal endpoint bounds do not make a finite set the same as an interval.

VISUAL READING GUIDE

Connect the representation to context

Domain: collect allowed horizontal coordinates; ask what inputs mean and which restrictions the context imposes.

Range: collect attained vertical coordinates after applying the allowed domain.

Continuous segment: includes every point along the drawn segment; isolated dots include only the plotted points.

Endpoints: filled means included, open means excluded. Check which output the endpoint would have.

Extrema may occur inside the domain, not only at its endpoints.

A formula can be algebraically evaluable at an input that the contextual model excludes.

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: Identify meaningful inputs and their restrictions in a context.

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

The graph models volume while a tank drains. State domain and range with units. Explain why extending the line to later times would violate this context.

Teacher solution and discussion

Domain: $0 \leq t \leq 9$ min. Range: $0 \leq V \leq 27$ L. Both endpoints are included. Extending past 9 min would yield negative volume, which cannot represent water remaining in the tank.

Evidence and response

Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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: Connect domain and range to continuous or discrete graphs.

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

For each whole input $n = 0, 1, 2, 3$, a display uses $T(n) = 4n + 2$ tiles. Complete a value table and graph the contextual function on the separate blank axes. State the domain and range.

Teacher solution and discussion

Table and graph pairs: (0, 2), (1, 6), (2, 10), (3, 14). Domain: {0, 1, 2, 3}; range: {2, 6, 10, 14} tiles. Plot four isolated points. Do not connect them because intermediate stage inputs are not included.

Evidence and response

Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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 • T4: Evaluate model boundaries, endpoints and contextual limitations.

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

A rectangle has perimeter 16 m and positive side lengths x and $8 - x$. Area is $A = x(8 - x)$. State the contextual domain and range. Explain the inclusion or exclusion of each bound.

Teacher solution and discussion

Both sides positive gives $0 < x < 8$ m. Complete the square: $A = 16 - (x - 4)^2$. The maximum 16 m^2 occurs at $x = 4$ and is included. Area approaches 0 as x approaches 0 or 8 but never equals 0 for a positive-sided rectangle. Range: $0 < A \leq 16 \text{ m}^2$.

Evidence and response

Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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: Connect domain and range to continuous or discrete graphs.

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

A pump fills a 48 L container at 6 L/min, starting empty and stopping when full. Sketch $V(t)$ with labeled axes. State domain and range and explain the endpoints.

Teacher solution and discussion

$V = 6t$. The graph is the closed segment from $(0, 0)$ to $(8, 48)$. Domain: $[0, 8]$ min; range: $[0, 48]$ L. The initial empty state and final full state are included; time and volume vary continuously between them.

Evidence and response

Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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 a function's possible outputs to its domain and rule.

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

A square panel can have any side length s from 2 cm through 6 cm. State domain and range of $A(s) = s^2$. Is area 20 cm² possible? Explain without rounding a side length.

Teacher solution and discussion

Domain: $[2, 6]$ cm. Range: $[4, 36]$ cm². Since the area function is continuous and increasing on positive side lengths, every area between 4 and 36 occurs, including 20. Equivalently, the positive side $\sqrt{20}$ is between 2 and 6.

Evidence and response

Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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 • T2: Relate a function's possible outputs to its domain and rule.

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 input/output quantities and restrictions, then use a fresh item to check transfer without the prior cue.

Core task

The connected graph models a growing plant, followed by trimming. State domain and range. Is a 7 cm length in the range? Explain why checking only the initial and final values is insufficient.

Teacher solution and discussion

Domain: $[0, 6]$ weeks. Range: $[3, 11]$ cm. A length of 7 cm occurs along the first rising segment. The initial length is 3 and final length is 5, but the interior peak is 11, so endpoint-only reasoning misses much of the range.

Evidence and response

Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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 • T4: Evaluate model boundaries, endpoints and contextual limitations.

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

The connected graph models only the first 8 minutes of an observation. State its domain and range. A student extends the final segment to minute 10 and reports another output. Explain what would need to be justified before using that prediction.

Teacher solution and discussion

Domain: $[0, 8]$ min; range: $[0, 6]$ units. Minute 10 is outside the displayed function's domain. A prediction there requires a new assumption that the last trend continues and that the physical context permits it. The existing graph alone does not establish that.

Evidence and response

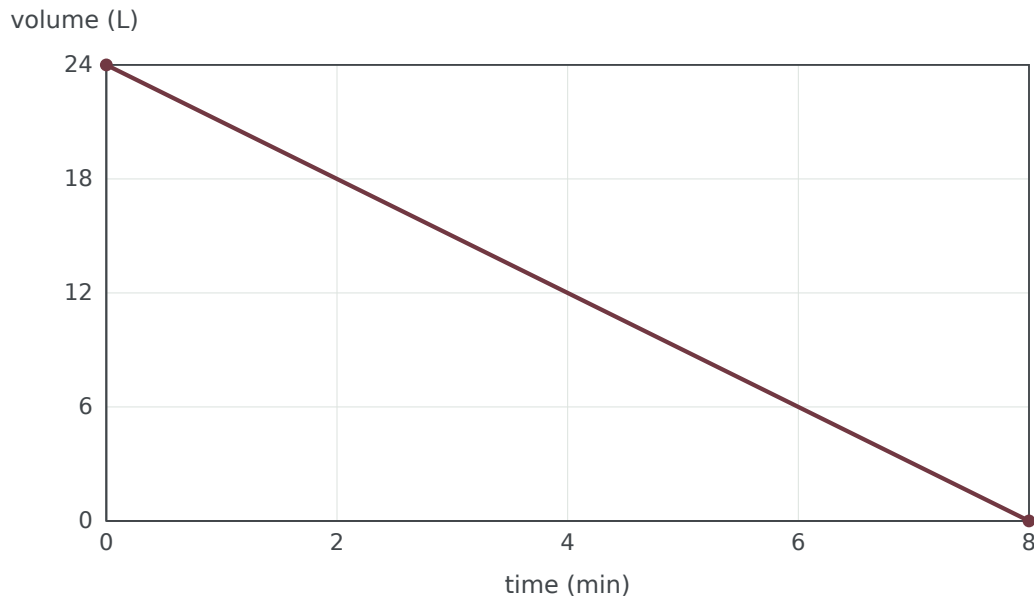
Look for a claim tied to allowed inputs, attained outputs, units or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output or sign and trend are confused, ask the learner to read one ordered pair with both units, then compare another pair. Revisit the allowed domain before collecting 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 • Select and justify**M01 | Warm-up | T1**

The graph models water volume until a tank is empty. What is the contextual domain?



- A. $t \geq 0$ with no end
- B. $0 \leq V \leq 24$ L
- C. $0 \leq t \leq 8$ min
- D. All real t

Reasoning: _____

MULTIPLE-CHOICE BANK

M02 / M03 • Select and justify

M02 | Warm-up | T2

The table is the entire function relating ticket count x to total cost y (dollars). What is its range?

Input x	0	1	2	3
Output y	2	7	12	17

- A. {2, 7, 12, 17}
- B. {0, 2, 7, 12, 17}
- C. All real values from 2 through 17
- D. {0, 1, 2, 3}

Reasoning: _____

M03 | Warm-up | T1

A ribbon cutter accepts any measured length from 0.5 m through 4 m, including fractions of a meter. Which domain models the accepted length x ?

- A. $0 \leq x \leq 4$
- B. $0.5 \leq x \leq 4$
- C. $x > 0$
- D. $x \in \{1, 2, 3, 4\}$

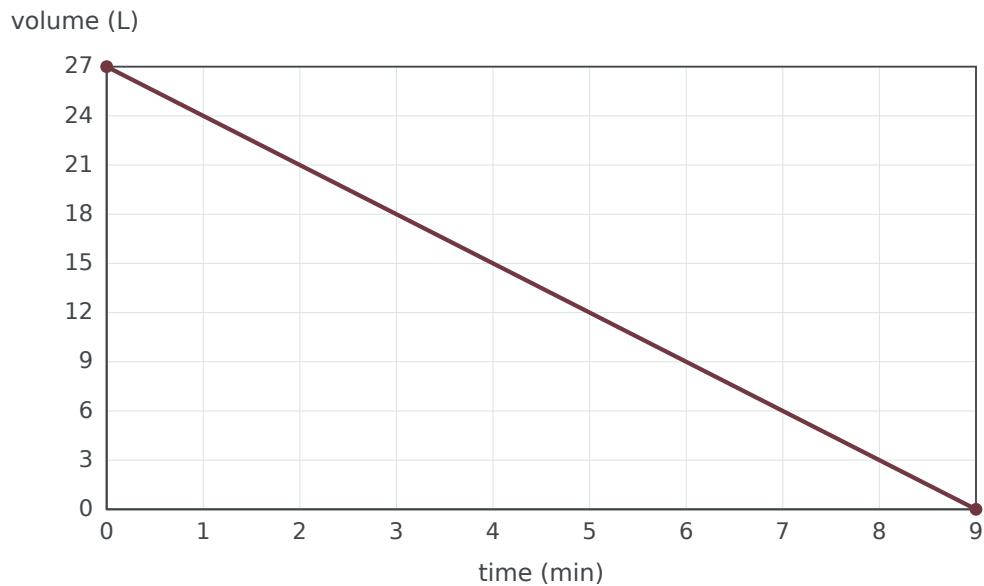
Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: Identify meaningful inputs and their restrictions in a context.

The graph models volume while a tank drains. State domain and range with units. Explain why extending the line to later times would violate this context.



Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T2: Relate a function’s possible outputs to its domain and rule.

The table is the entire function from numbers of tickets x to cost y (dollars). State its domain and range. Explain why the range is not all real values between its smallest and largest outputs.

Input x	0	1	2	3	4
Output y	1	7	13	19	25

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Identify meaningful inputs and their restrictions in a context.****Answer: C. $0 \leq t \leq 8$ min**

The horizontal coordinates extend from 0 to 8 min. Both endpoint dots are filled.

Check each alternative

- A. The model ends at 8 min.
- B. These are output bounds, the range.
- C. The graph contains times from 0 to 8, including endpoints.
- D. Negative and later times are not modeled.

M02 • T2: Relate a function's possible outputs to its domain and rule.**Answer: A. {2, 7, 12, 17}**

Read the output row. The finite range is {2, 7, 12, 17} dollars.

Check each alternative

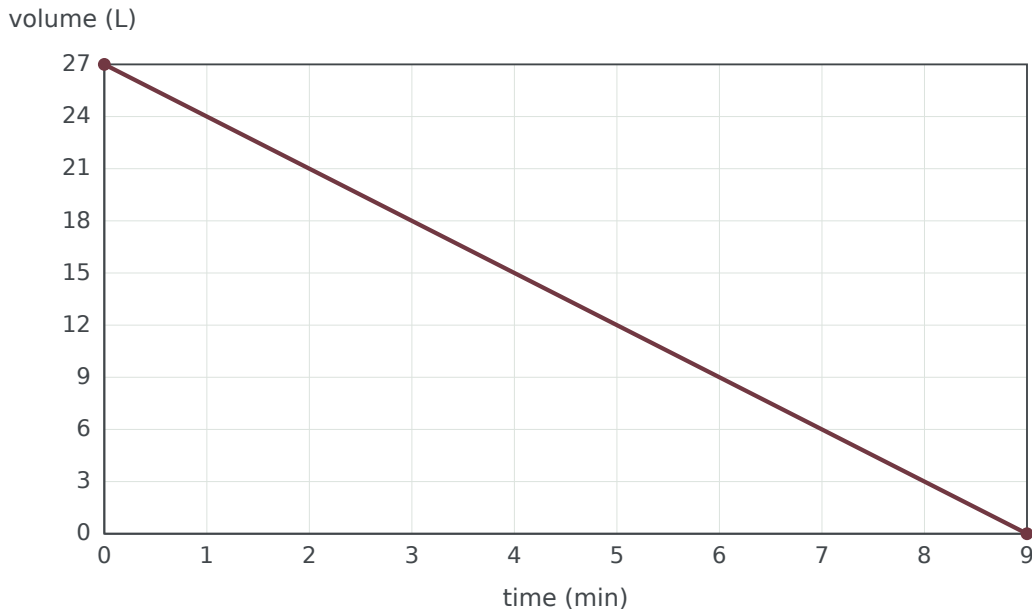
- A. These are exactly the distinct listed outputs.
- B. Zero is not an output.
- C. The table defines only four output values.
- D. This lists inputs.

WORKED TEACHER KEYS

001

001 • T1: Identify meaningful inputs and their restrictions in a context.

Domain: $0 \leq t \leq 9$ min. Range: $0 \leq V \leq 27$ L. Both endpoints are included. Extending past 9 min would yield negative volume, which cannot represent water remaining in the tank.

**Evidence to assess**

Assess accurate representation, a valid justification, and a conclusion consistent with the domain and units. Accept equivalent reasoning or another construction meeting every condition. An answer alone does not establish a unique misconception.

WORKED TEACHER KEYS

002 / 003**002 • T2: Relate a function's possible outputs to its domain and rule.**

Domain: $\{0, 1, 2, 3, 4\}$ tickets. Range: $\{1, 7, 13, 19, 25\}$ dollars. Only these five counts are allowed; for example \$10 is not generated by any listed input. The function is discrete.

003 • T1: Identify meaningful inputs and their restrictions in a context.

Domain: $0.25 \leq x \leq 3$ m, all real lengths in that interval. Range: $2 \leq C \leq 24$ dollars. $x = 1.4$ is allowed and gives $C = 11.2$ dollars, because fractional lengths are explicitly permitted.