

TEACHER AND STUDENT RESOURCE

Functions: Inputs, Outputs and Graphs



NC Math 1 • NC.M1.F-IF.1

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.1 | 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: 1-16, 40-41, 70, 85

Representative activities

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

M02: sample PDF page(s) 17; original page(s) 16

O01: sample PDF page(s) 18; original page(s) 40

O02: sample PDF page(s) 19; original page(s) 41

Selected teacher prompts and keys: original page(s) 70, 85

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

Build an understanding that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range by recognizing that:

- if f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x .
- the graph of f is the graph of the equation $y = f(x)$.

T1 Decide whether each allowed input has exactly one output.

T2 Identify domains and ranges and interpret function notation.

T3 Connect $f(x)$ to the ordered pairs of $y = f(x)$.

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, M05, M07, M11, M13, M17, M19, M23, M25, M29, O01, O05, O07, O11, O13, O17, O19, O23, O25, O29

T2: M02, M04, M08, M10, M14, M16, M20, M22, M26, M28, O02, O04, O08, O10, O14, O16, O20, O22, O26, O28

T3: M03, M06, M09, M12, M15, M18, M21, M24, M27, M30, O03, O06, O09, O12, O15, O18, O21, O24, O27, O30

DAILY LEARNING TARGETS

A multi-session teaching path

Session 1: identify and interpret

Learning target: Decide whether each allowed input has exactly one output.

Learning target: Identify domains and ranges and interpret function notation.

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: Identify domains and ranges and interpret function notation.

Learning target: Connect $f(x)$ to the ordered pairs of $y = f(x)$.

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

Session 3: apply independently

Learning target: Decide whether each allowed input has exactly one output.

Learning target: Identify domains and ranges and interpret function notation.

Learning target: Connect $f(x)$ to the ordered pairs of $y = f(x)$.

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.

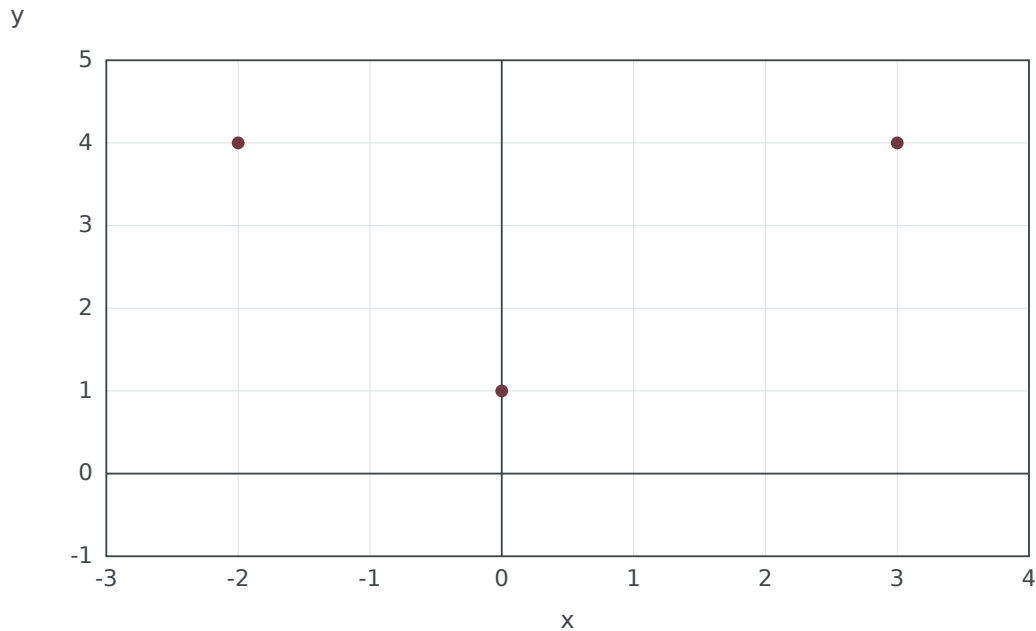
Review convention

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

One input, one assigned output

Let f have domain $\{-2, 0, 3\}$, with $f(-2)=4$, $f(0)=1$ and $f(3)=4$. Explain why f is a function and graph $y=f(x)$.



Each of the three inputs has one assigned output. Both -2 and 3 may produce 4 . The domain is $\{-2, 0, 3\}$; the range is $\{1, 4\}$. Plot $(-2, 4)$, $(0, 1)$ and $(3, 4)$, without connecting them: other inputs are not in this domain. The notation $f(3)=4$ identifies the point $(3, 4)$, not $(4, 3)$.

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: Decide whether each allowed input has exactly one output.

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

A relation contains $\{(-8, 2), (1, 8), (8, 2)\}$. Its declared domain is $\{-8, 1, 8, 9\}$. Decide whether this is already a function on that domain. Complete it with one ordered pair to make a function. Explain whether two inputs may share an output.

Teacher solution and discussion

It is not yet a function on the declared domain because input 9 has no output. One completion is $(9, 2)$. Each declared input then has one output. The repeated output 2 is permitted. Any single output for the missing input is valid; do not add two different outputs for it.

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 • T1: Decide whether each allowed input has exactly one output.

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

Build two relations with domain $\{0, 11, 12\}$. First, give a function whose range is exactly $\{2, 5\}$. Second, give a relation using the same domain that fails to be a function. Identify the exact failure. Draw a small mapping diagram for each.

Teacher solution and discussion

One function: $\{(0,2), (11,5), (12,2)\}$. Its three domain elements each have one arrow; its range is $\{2,5\}$. One nonfunction: $\{(0,2), (0,5), (11,2), (12,5)\}$. Input 0 has arrows to two different outputs. Accept other constructions with all required inputs and the specified first 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 M05 to compare all alternatives after evidence is collected.

WE DO

Teaching script

Core: 009 • T3: Connect $f(x)$ to the ordered pairs of $y = f(x)$.

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 entire function q has $q(-2)=11$, $q(1)=8$, and $q(11)=0$. Plot $y=q(x)$ on the blank axes. Label both axes, state domain and range, and explain why you do or do not connect points.

Teacher solution and discussion

Plot $\{(-2, 11), (1, 8), (11, 0)\}$; horizontal axis x , vertical axis $y=q(x)$. Domain $\{-2, 1, 11\}$; range $\{0, 8, 11\}$. Leave points disconnected because only the three stated inputs are allowed.

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 • T2: Identify domains and ranges and interpret function notation.

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

The entire function g is $\{(-11, 12), (2, -1), (13, 12)\}$. State its domain and range. Write two function-notation statements for different inputs with the same output. Explain why $g(14)$ is not defined here.

Teacher solution and discussion

Domain $\{-11, 2, 13\}$; range $\{-1, 12\}$. $g(-11)=12$ and $g(13)=12$. Input 14 is absent from the declared domain, so $g(14)$ has no assigned value.

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 • T1: Decide whether each allowed input has exactly one output.

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 relation contains $\{(-11, 2), (1, 11), (11, 2)\}$. Its declared domain is $\{-11, 1, 11, 12\}$. Decide whether this is already a function on that domain. Complete it with one ordered pair to make a function. Explain whether two inputs may share an output.

Teacher solution and discussion

It is not yet a function on the declared domain because input 12 has no output. One completion is $(12, 2)$. Each declared input then has one output. The repeated output 2 is permitted. Any single output for the missing input is valid; do not add two different outputs for it.

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 • T3: Connect $f(x)$ to the ordered pairs of $y = f(x)$.

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 learner says the relation $\{(-1, 16), (0, 14), (2, 16)\}$ is not a function because a horizontal line meets two points. Use a graph and function notation to evaluate the claim. State the appropriate one-output check.

Teacher solution and discussion

The claim is false: $f(-1)=16$, $f(0)=14$, $f(2)=16$. No input has two outputs, although -1 and 2 share output 16. Plot the three points without connecting. A vertical line meets at most one point for each input; the horizontal-line criterion concerns different inputs sharing outputs.

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: 028 • T2: Identify domains and ranges and interpret function notation.

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

$L(t)$ is tank volume in liters at elapsed time t minutes, with domain $0 \leq t \leq 17$. Interpret $L(11)=77$. Write a function-notation statement for “at 13 minutes the tank contains 73 liters.” Explain why $L(18)$ cannot be read from this definition.

Teacher solution and discussion

$L(11)=77$ means 77 liters at 11 minutes. The new statement is $L(13)=73$. Input 18 exceeds the domain endpoint 17, so this definition does not assign it an output.

Evidence and response

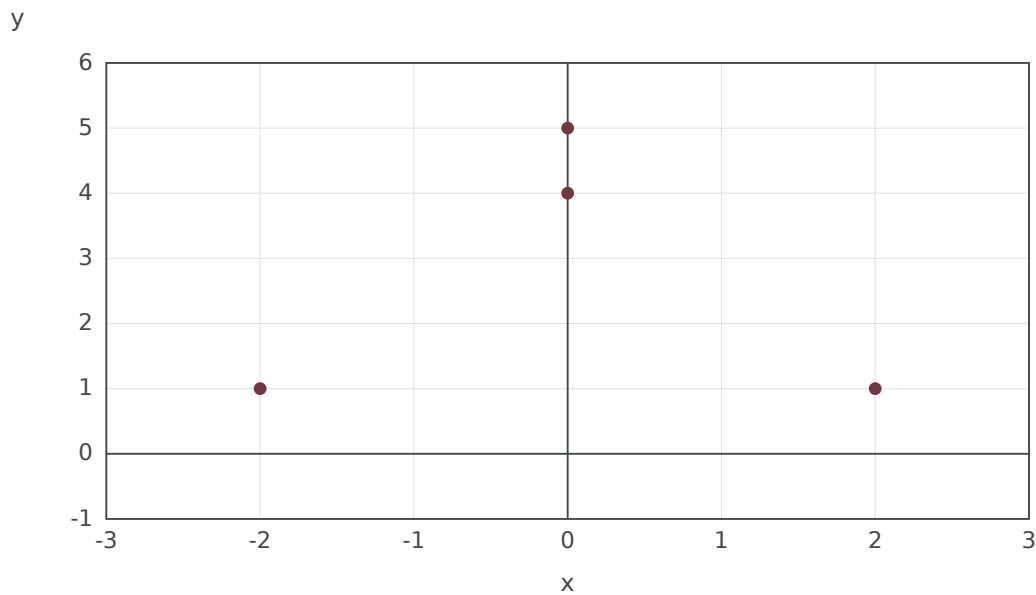
Look for a claim tied to allowed inputs, assigned outputs, function notation or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If input and output are reversed, trace one ordered pair from its horizontal coordinate to its vertical coordinate, then 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 • Select and justify**M01 | Warm-up | T1**

Consider exactly the ordered pairs $\{(-2, 1), (0, 4), (2, 1), (0, 5)\}$. Which conclusion and reason are valid?



- A. A function: any finite relation is a function.
- B. Not a function: an input has two different outputs.
- C. Not a function: a repeated output is forbidden.
- D. A function: the two outputs at input 0 may be averaged.

Reasoning: _____

MULTIPLE-CHOICE BANK

M02 • Select and justify

M02 | Warm-up | T2

The entire function f is $\{(-2, 6), (0, 3), (3, 6)\}$. Which gives its domain and range?

- A. Domain all real numbers; range all real numbers.
- B. Domain $\{3, 6\}$; range $\{-2, 0, 3\}$.
- C. Domain $\{-2, 0, 3\}$; range $\{3, 6\}$.
- D. Domain $\{-2, 0, 3\}$; range $\{3\}$.

Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: Decide whether each allowed input has exactly one output.

A relation contains $\{(-8, 2), (1, 8), (8, 2)\}$. Its declared domain is $\{-8, 1, 8, 9\}$. Decide whether this is already a function on that domain. Complete it with one ordered pair to make a function. Explain whether two inputs may share an output.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T2: Identify domains and ranges and interpret function notation.

The entire function g is $\{(-9, 10), (2, -1), (11, 10)\}$. State its domain and range. Write two function-notation statements for different inputs with the same output. Explain why $g(12)$ is not defined here.

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02

M01 • T1: Decide whether each allowed input has exactly one output.

Answer: B. Not a function: an input has two different outputs.

Input 0 is paired with both 4 and 5.

Check each alternative

- A. Finiteness alone does not establish one output per input.
- B. Input 0 is paired with both 4 and 5.
- C. A shared output does not violate the definition.
- D. Averaging changes the stated relation.

M02 • T2: Identify domains and ranges and interpret function notation.

Answer: C. Domain $\{-2, 0, 3\}$; range $\{3, 6\}$.

Inputs are $\{-2, 0, 3\}$. Outputs are $\{3, 6\}$; repeated output 6 is listed once in the range.

Check each alternative

- A. Only the three listed inputs and their assigned outputs are included.
- B. This reverses input and output sets.
- C. Domain lists first coordinates; range lists distinct second coordinates.
- D. This omits output 6, which occurs twice but still belongs to the range.

WORKED TEACHER KEYS

001 / 002**001 • T1: Decide whether each allowed input has exactly one output.**

It is not yet a function on the declared domain because input 9 has no output. One completion is $(9, 2)$. Each declared input then has one output. The repeated output 2 is permitted. Any single output for the missing input is valid; do not add two different outputs for it.

002 • T2: Identify domains and ranges and interpret function notation.

Domain $\{-9, 2, 11\}$; range $\{-1, 10\}$. $g(-9)=10$ and $g(11)=10$. Input 12 is absent from the declared domain, so $g(12)$ has no assigned value.