

TEACHER AND STUDENT RESOURCE

Compare Functions Across Representations



NC Math 1 • NC.M1.F-IF.9

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.9 | NC Math 1 mathematics

This sample contains 20 complete selected pages from the 110-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-15, 34-35, 64, 79-80

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) 34

O02: sample PDF page(s) 18; original page(s) 35

Selected teacher prompts and keys: original page(s) 64, 79-80

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

Compare key features of two functions (linear, quadratic, or exponential) each with a different representation (symbolically, graphically, numerically in tables, or by verbal descriptions).

T1 Compare linear features using different representations.

T2 Compare exponential initial values, rates, outputs, and behavior.

T3 Compare quadratic key features across representations.

T4 Compare mixed families and justify the limits of the available evidence.

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, M02, M03, M04, M13, M14, M21, M24, O01, O02, O03, O04, O05, O06, O20

T2: M05, M06, M07, M08, M17, M18, M22, M25, O13, O14, O15, O16, O17, O18, O21, O27

T3: M09, M10, M11, M12, M15, M16, M19, M20, M23, M26, O07, O08, O09, O10, O11, O12, O19, O22, O26, O29

T4: M27, M28, M29, M30, O23, O24, O25, O28, O30

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 coordinates and tables, evaluate functions, identify linear slopes, exponential ratios and quadratic vertices, and use domain and range language.

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.

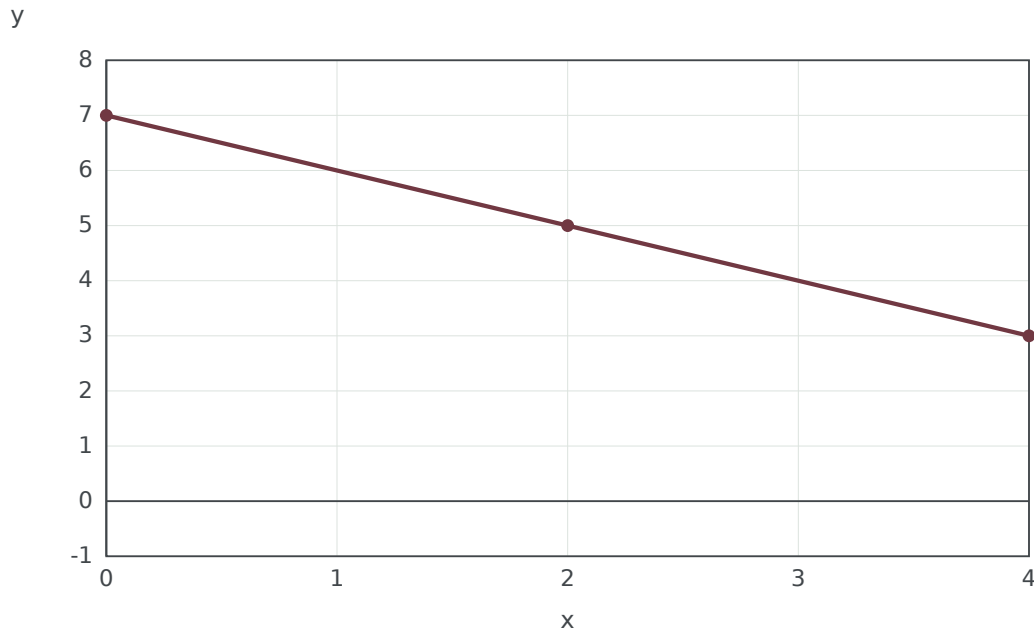
Review convention

Use exact fractions or terminating decimals. Unless context restricts a function, its domain is all real numbers. A stated family is essential when a finite table is used to determine a rule. Plotted curves are windows; they do not impose finite domains. Positive and negative intervals exclude zeros.

TEACHER MODEL

Compare the feature, not the format

$A(x)=2x+3$. B is linear with $B(0)=7$, $B(2)=5$, $B(4)=3$. Compare initial values, slopes and outputs at $x=4$.



A starts at 3 and has slope 2. B starts at 7; its slope is $(5-7)/(2-0)=-1$, so $B=-x+7$. At $x=4$, $A=11$ and $B=3$. B starts higher but decreases while A increases. Equality occurs at $2x+3=-x+7$, $x=4/3$. Say: “Choose one feature, extract it from each representation, then compare quantities with the same meaning.”

VISUAL ANCHOR

A common language for comparisons

Extract matching features before deciding greater, equal, or undetermined.

Feature	How to extract	Comparison check
Initial value	Set/read input0	Same input and units
Linear rate	Slope or table differences	Divide by input change
Exponential rate	Successive output ratio	Subtract1 for relative rate
Quadratic extremum	Vertex or symmetric table	Compare output coordinates

Different forms can represent the same function, and matching one feature does not make every feature match. State uncertainty when the description does not determine a feature.

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: Compare linear features using different representations.

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

$A(x)=3x+(-2)$. B is linear and represented by the table. Compare slopes, y-intercepts, and whether each increases or decreases. Build a matching table for A at the same inputs, and explain where their outputs are equal.

Input x	-1	0	2
Output y	3	4	6

Teacher solution and discussion

A slope/intercept: 3, -2. B slope = $(6-(3))/3=1$; intercept 4. A table outputs: -5, -2, 4. $B(x)=1x+(4)$. A increases; B increases. Equal outputs when $x=3$.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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: Compare linear features using different representations.

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

$A(x)=2x+(0)$. B is linear and represented by the table. Compare slopes, y-intercepts, and whether each increases or decreases. Build a matching table for A at the same inputs, and explain where their outputs are equal.

Input x	-1	0	2
Output y	-9	-7	-3

Teacher solution and discussion

A slope/intercept: 2, 0. B slope = $(-3 - (-9))/3 = 2$; intercept -7. A table outputs: -2, 0, 4.

$B(x)=2x+(-7)$. A increases; B increases. No intersection because slopes agree and intercepts differ.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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: Compare quadratic key features across representations.

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

$A(x) = -1(x - 2)^2 + 6$. B is quadratic and represented by this table. Determine B's rule.

Compare vertices, extrema, axes, ranges and y-intercepts. Create a table for A using these inputs and justify your claims.

Input x	1	2	3
Output y	3	0	-5

Teacher solution and discussion

For B, consecutive first differences are -3 and -5; the second difference is -2, so the leading coefficient is -1. In $B(x) = -1(x - H)^2 + K$, the first difference at $x = 1$ is $-1[2(1 - H) + 1] = -3$, giving $H = 0$. Substitution gives $K = 4$. A vertex (2,6); B vertex (0,4). Axes $x = 2$, $x = 0$. Maxima: 6, 4. Ranges: $A \leq 6$, $B \leq 4$. Y-intercepts: 2, 4. The completed table verifies both rules.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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: Compare exponential initial values, rates, outputs, and behavior.

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

$A(t)=40(3/4)^t$. B is exponential and shown in the table. Compare initial values, one-step multipliers, percentage changes, and outputs at $t=2$. Supply a matching table for A. Explain why a larger initial value alone cannot decide the later comparison.

Input x	0	1	2
Output y	60	30	15

Teacher solution and discussion

A starts at 40 and multiplies by $3/4$; B starts at 60 and multiplies by $1/2$ (ratios of successive outputs). Rates: -25% and -50% per step. A table: 40, 30, 45/2. At $t=2$, compare 45/2 and 15. Later outputs depend on both starting amounts and multipliers; the initial comparison alone omits growth/decay behavior. At $t=2$, A is greater than B.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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: 019 • T3: Compare quadratic key features across representations.

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 is the all-real quadratic graphed below; $B(x) = (x+1)^2 - 9$. Compare zeros, minima, and intervals of negative output. State how you read A's features and verify B's features algebraically.

Teacher solution and discussion

$A = (x-2)^2 - 4$ has roots 0, 4 and minimum -4 at $x=2$. $B = (x+1)^2 - 9 = (x-2)(x+4)$ has roots $-4, 2$ and minimum -9 at $x=-1$. $A < 0$ for $0 < x < 4$; $B < 0$ for $-4 < x < 2$. Zero endpoints are excluded. Graph read-off and factor checks support the comparisons.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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: Compare mixed families and justify the limits of the available evidence.

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 is exponential and is represented numerically: $A(0)=1$, $A(1)=3$, $A(2)=9$. Compare A with the symbolically given $B(x)=x^2+1$ at $x=0,1,2,3$. Compute each average rate on $[1,3]$ and explain why matching at one input does not make the functions equal.

Teacher solution and discussion

A outputs: 1, 3, 9, 27. B outputs: 1, 2, 5, 10. They agree only at $x=0$ among these inputs. Average rates on $[1,3]$: $A=(27-3)/2=12$; $B=(10-2)/2=4$. Agreement at a single input does not establish equality of every output.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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 • T4: Compare mixed families and justify the limits of the available evidence.

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

A is a line with y-intercept 5 and slope 2. $B(x)=(x-1)^2+2$. Compare y-intercepts, minima, and average rates on $[0,2]$. Explain any agreement despite the different function families.

Teacher solution and discussion

$A=2x+5$: y-intercept 5, no global minimum on the real domain; average rate 2. $B=x^2-2x+3$: y-intercept 3, minimum 2 at $x=1$; $B(0)=B(2)=3$, so average rate 0. Both are positive on $[0,2]$, but they do not share these three compared features.

Evidence and response

Look for a claim tied to specific terms, factors, operations or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If a sign or operation is mishandled, reconstruct that step with a numerical analogy, 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

$A(x)=2x+(3)$. B is linear and given by this table. Compare their rates of change.

Input x	-1	0	1
Output y	-5	-1	3

- A. A: 2; B: 8
- B. A: -2; B: -4
- C. A: 2; B: 4
- D. A: 3; B: -1

Reasoning: _____

M02 | Warm-up | T1

$A(x)=-3x+(8)$. B is linear and given by this table. Compare their rates of change.

Input x	0	2	4
Output y	5	3	1

- A. A: 3; B: 1
- B. A: 8; B: 5
- C. A: -3; B: -4
- D. A: -3; B: -1

Reasoning: _____

WARM-UP

001 • Show your reasoning

T1: Compare linear features using different representations.

$A(x)=3x+(-2)$. B is linear and represented by the table. Compare slopes, y-intercepts, and whether each increases or decreases. Build a matching table for A at the same inputs, and explain where their outputs are equal.

Input x	-1	0	2
Output y	3	4	6

x	A(x)	B(x)

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T1: Compare linear features using different representations.

$A(x)=-2x+(9)$. B is linear and represented by the table. Compare slopes, y-intercepts, and whether each increases or decreases. Build a matching table for A at the same inputs, and explain where their outputs are equal.

Input x	-1	0	2
Output y	-7	-3	5

x	A(x)	B(x)

Representation / calculation

Explanation / check

WORKED TEACHER KEYS

M01 / M02**M01 • T1: Compare linear features using different representations.****Answer: C. A: 2; B: 4**

A has slope 2. B has slope $(3 - (-5)) / (1 - (-1)) = 4$. $B(x) = 4x + (-1)$. B has the greater numerical slope.

Check each alternative

- A. B's output change must be divided by its interval length.
- B. These reverse both signed rates without basis.
- C. Correct: use the coefficient in A and output difference/input difference in B.
- D. These are y-intercepts, not slopes.

M02 • T1: Compare linear features using different representations.**Answer: D. A: -3; B: -1**

A has slope -3. B has slope $(1 - (5)) / (4 - (0)) = -1$. $B(x) = -1x + (5)$. B has the greater numerical slope.

Check each alternative

- A. These reverse both signed rates without basis.
- B. These are y-intercepts, not slopes.
- C. B's output change must be divided by its interval length.
- D. Correct: use the coefficient in A and output difference/input difference in B.

WORKED TEACHER KEYS

001

001 • T1: Compare linear features using different representations.

A slope/intercept: 3, -2. B slope = $(6-(3))/3=1$; intercept 4. A table outputs: -5, -2, 4.
 $B(x)=1x+(4)$. A increases; B increases. Equal outputs when $x=3$.

Input	A(input)	B(input)
-1	-5	3
0	-2	4
2	4	6

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

002 • T1: Compare linear features using different representations.

A slope/intercept: -2, 9. B slope = $(5 - (-7))/3 = 4$; intercept -3. A table outputs: 11, 9, 5.
 $B(x) = 4x + (-3)$. A decreases; B increases. Equal outputs when $x = 2$.

Input	A(input)	B(input)
-1	11	-7
0	9	-3
2	5	5

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.