

## TEACHER AND STUDENT RESOURCE

# Recognizing Linear Functions



## Grade 8 • NC.8.F.3

### 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.8.F.3 | Eighth Grade mathematics

This sample contains 19 complete selected pages from the 106-page resource, plus this sample contents page. Original printed page numbers are retained. Gaps are intentional.

Included original pages: 1-14, 34-35, 64-65, 84

Representative activities

M01: sample PDF page(s) 15; original page(s) 14

M02: sample PDF page(s) 15; original page(s) 14

O01: sample PDF page(s) 16; original page(s) 34

O02: sample PDF page(s) 17; original page(s) 35

Selected teacher prompts and keys: original page(s) 64-65, 84

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

Identify linear functions from tables, equations, and graphs.

**T1 Identify linear functions from tables using rates of change.**

**T2 Identify linear functions from equations.**

**T3 Identify linear functions from graphs.**

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, M05, M06, M07, M08, M09, M10, O01, O02, O03, O04, O05, O06, O07, O08, O09, O10

T2: M11, M12, M13, M14, M15, M16, M17, M18, M19, M20, O11, O12, O13, O14, O15, O16, O17, O18, O19, O20

T3: M21, M22, M23, M24, M25, M26, M27, M28, M29, M30, O21, O22, O23, O24, O25, O26, O27, O28, O29, 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**

Check ordered pairs, input/output order, reading numbered scales, signed-number arithmetic, and the meaning of horizontal and vertical axes. Teach these separately 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 finite table describes only its displayed domain unless a broader rule or linear model is explicitly given. Do not infer a unique future rule from a short list of values.

TEACHER MODEL

# Equal changes require equal intervals

Table A:

Table (columns correspond):

|          |   |   |    |
|----------|---|---|----|
| Input x  | 0 | 2 | 5  |
| Output y | 1 | 5 | 11 |

Table B:

Table (columns correspond):

|          |   |   |    |
|----------|---|---|----|
| Input x  | 0 | 2 | 5  |
| Output y | 1 | 5 | 10 |

For each table, do the displayed points lie on one straight line?

For A, the rates are  $(5 - 1)/(2 - 0) = 2$  and  $(11 - 5)/(5 - 2) = 2$ . All displayed points lie on  $y = 2x + 1$ . For B, the rates are  $4/2 = 2$  and  $5/3$ , which differ; no single straight line contains the displayed points. Comparing only output differences would ignore unequal input intervals. A finite table alone does not establish a unique rule for inputs that are not listed.

## REUSABLE REASONING GUIDE

# Represent, justify, interpret

Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Givens and input/output meaning****Representation and calculation****Justification or check****Conclusion, domain and units**

## WARM-UP

# Teaching script

## Core: 001 • T1: Identify linear functions from tables using rates of change.

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 input and output represent? What evidence supports your claim?”

### Core task

Table (columns correspond):

|          |   |   |   |
|----------|---|---|---|
| Input x  | 0 | 1 | 3 |
| Output y | 2 | 4 | 8 |

Determine whether the displayed data can belong to a linear function. Show both interval rates. If yes, give a matching equation; if no, explain why no single linear equation works.

### Teacher solution and discussion

First interval:  $(4 - 2)/(1 - 0) = 2$ . Second interval:  $(8 - 4)/(3 - 1) = 2$ . They agree. A matching equation is  $y = 2.0x + 2.0$ ; substitution checks every listed pair. The data alone do not determine a unique rule outside the listed inputs.

### Evidence and response

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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: Identify linear functions from tables using rates of change.

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

Table (columns correspond):

|          |   |   |   |
|----------|---|---|---|
| Input x  | 0 | 1 | 2 |
| Output y | 1 | 2 | 5 |

Determine whether the displayed data can belong to a linear function. Show both interval rates. If yes, give a matching equation; if no, explain why no single linear equation works.

### Teacher solution and discussion

First interval:  $(2 - (1))/(1 - (0)) = 1$ . Second interval:  $(5 - (2))/(2 - (1)) = 3$ . They differ, so no single constant rate and no single line fit all three pairs. The data alone do not determine a unique rule outside the listed inputs.

### Evidence and response

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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 • T1: Identify linear functions from tables using rates of change.

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

Table (columns correspond):

|          |   |   |    |
|----------|---|---|----|
| Input x  | 0 | 2 | 4  |
| Output y | 7 | 3 | -1 |

Determine whether the displayed data can belong to a linear function. Show both interval rates. If yes, give a matching equation; if no, explain why no single linear equation works.

### Teacher solution and discussion

First interval:  $(3 - (7))/(2 - (0)) = -2$ . Second interval:  $(-1 - (3))/(4 - (2)) = -2$ . They agree. A matching equation is  $y = -2.0x + 7.0$ ; substitution checks every listed pair. The data alone do not determine a unique rule outside the listed inputs.

### Evidence and response

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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 linear functions from equations.**

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**

$y = |x| + 2$  for all real  $x$ . Make a table for  $x = -2, -1, 0, 1, 2$ . Explain whether this is a linear function; justify using the equation and the table.

**Teacher solution and discussion**

Table:

Table (columns correspond):

|            |    |    |   |   |   |
|------------|----|----|---|---|---|
| Input $x$  | -2 | -1 | 0 | 1 | 2 |
| Output $y$ | 4  | 3  | 2 | 3 | 4 |

With input steps of 1, output changes are  $[-1, -1, 1, 1]$ . The changes are not constant, which disproves linearity. The squared or absolute-value term also gives a changing rate on the real domain.

**Evidence and response**

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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 • T2: Identify linear functions from equations.**

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**

$y = 5x - 2x - 1$  for all real  $x$ . Make a table for  $x = -2, -1, 0, 1, 2$ . Explain whether this is a linear function; justify using the equation and the table.

**Teacher solution and discussion**

Table:

Table (columns correspond):

|            |    |    |    |   |   |
|------------|----|----|----|---|---|
| Input $x$  | -2 | -1 | 0  | 1 | 2 |
| Output $y$ | -7 | -4 | -1 | 2 | 5 |

With input steps of 1, output changes are [3, 3, 3, 3]. The expression simplifies to  $y = 3x - 1$ , so the rate is always 3; this is linear.

**Evidence and response**

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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: Identify linear functions from graphs.

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 labels, then use a fresh item to check transfer without the prior cue.

### Core task

The graph joins the shown points with straight segments. Decide whether the entire displayed function is linear. Calculate the rate on each side of  $x = 0$ . Then describe one change to the middle point that would reverse your classification, keeping the endpoints fixed.

### Teacher solution and discussion

Left rate 1; right rate  $-1/2$ . Unequal rates make this nonlinear. Keep endpoints and move the middle point to  $(0, -1)$ . This is the midpoint of the endpoint heights, giving equal rates and one straight line.

### Evidence and response

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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 • T3: Identify linear functions from graphs.

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 graph joins the shown points with straight segments. Decide whether the entire displayed function is linear. Calculate the rate on each side of  $x = 0$ . Then describe one change to the middle point that would reverse your classification, keeping the endpoints fixed.

## Teacher solution and discussion

Left rate 0; right rate -1. Unequal rates make this nonlinear. Keep endpoints and move the middle point to  $(0, 1)$ . This is the midpoint of the endpoint heights, giving equal rates and one straight line.

## Evidence and response

Look for a claim tied to specific inputs, outputs, changes or graph features. If a learner only names an answer, ask which values or parts of the graph support it. If axes are reversed, reteach input/output order with one pair, 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

**Table (columns correspond):**

|                 |          |          |          |
|-----------------|----------|----------|----------|
| <b>Input x</b>  | <b>0</b> | <b>1</b> | <b>3</b> |
| <b>Output y</b> | <b>1</b> | <b>3</b> | <b>7</b> |

**On the listed input domain, which rate description is correct?**

- A. Constant rate 2.
- B. Constant rate -1.
- C. Rates vary: 2, then 5.
- D. Rates vary: -1, then 0.

Reasoning: \_\_\_\_\_

M02 | Warm-up | T1

**Table (columns correspond):**

|                 |           |          |           |
|-----------------|-----------|----------|-----------|
| <b>Input x</b>  | <b>-2</b> | <b>0</b> | <b>2</b>  |
| <b>Output y</b> | <b>4</b>  | <b>0</b> | <b>-4</b> |

**On the listed input domain, which rate description is correct?**

- A. Rates vary: -2, then -4.
- B. Rates vary: 0, then -3.
- C. Constant rate -2.
- D. Constant rate 0.

Reasoning: \_\_\_\_\_

WARM-UP

001 • Show your reasoning

T1: Identify linear functions from tables using rates of change.

Table (columns correspond):

|          |   |   |   |
|----------|---|---|---|
| Input x  | 0 | 1 | 3 |
| Output y | 2 | 4 | 8 |

Determine whether the displayed data can belong to a linear function. Show both interval rates. If yes, give a matching equation; if no, explain why no single linear equation works.

Representation / calculation

Explanation / check

WARM-UP

002 • Show your reasoning

T1: Identify linear functions from tables using rates of change.

Table (columns correspond):

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

Determine whether the displayed data can belong to a linear function. Show both interval rates. If yes, give a matching equation; if no, explain why no single linear equation works.

Representation / calculation

Explanation / check

## WORKED TEACHER KEYS

**M01****M01 • T1: Identify linear functions from tables using rates of change.****Answer: A. Constant rate 2.**

The successive rates are  $(3 - (1))/(1 - (0)) = 2$  and  $(7 - (3))/(3 - (1)) = 2$ . They are equal, so the displayed points lie on one line.

**Check each alternative**

A. The successive rates are  $(3 - (1))/(1 - (0)) = 2$  and  $(7 - (3))/(3 - (1)) = 2$ . They are equal, so the displayed points lie on one line.

B. The actual consecutive rates are 2 and 2; this description misstates their values or whether they are equal.

C. The actual consecutive rates are 2 and 2; this description misstates their values or whether they are equal.

D. The actual consecutive rates are 2 and 2; this description misstates their values or whether they are equal.

**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

**M02****M02 • T1: Identify linear functions from tables using rates of change.****Answer: C. Constant rate -2.**

The successive rates are  $(0 - (4))/(0 - (-2)) = -2$  and  $(-4 - (0))/(2 - (0)) = -2$ . They are equal, so the displayed points lie on one line.

**Check each alternative**

A. The actual consecutive rates are -2 and -2; this description misstates their values or whether they are equal.

B. The actual consecutive rates are -2 and -2; this description misstates their values or whether they are equal.

C. The successive rates are  $(0 - (4))/(0 - (-2)) = -2$  and  $(-4 - (0))/(2 - (0)) = -2$ . They are equal, so the displayed points lie on one line.

D. The actual consecutive rates are -2 and -2; this description misstates their values or whether they are equal.

**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

**001 / 002****001 • T1: Identify linear functions from tables using rates of change.**

First interval:  $(4 - (2))/(1 - (0)) = 2$ . Second interval:  $(8 - (4))/(3 - (1)) = 2$ . They agree. A matching equation is  $y = 2.0x + 2.0$ ; substitution checks every listed pair. The data alone do not determine a unique rule outside the listed inputs.

**002 • T1: Identify linear functions from tables using rates of change.**

First interval:  $(1 - (5))/(0 - (-2)) = -2$ . Second interval:  $(-3 - (1))/(2 - (0)) = -2$ . They agree. A matching equation is  $y = -2.0x + 1.0$ ; substitution checks every listed pair. The data alone do not determine a unique rule outside the listed inputs.