

GRADE 8 COMPLETE MATH UNIT

Introduction to Functions

Definition, Evaluation & Comparison

ALIGNED TO CCSS

8.F.A.1 • 8.F.A.2 • 8.F.A.3 • 8.F.B.4 • 8.F.B.5

- 4 topic progressions • 9 worked examples
- 40 + 30 + 25 + 15 problem sets with full solutions
- Cumulative review, unit quiz, and comprehensive test
- Student guided notes with function-machine visuals

UM Printables • Premium Teaching Resources

Pacing Guide & Standards Map

Suggested 12-day sequence for a full functions unit • CCSS 8.F.A.1 – 8.F.B.5

This unit is organized into four topic progressions, each with guided student notes, fully worked examples, a problem set, and a complete answer key. The pacing below assumes 45-minute class periods and includes time for warm-ups, partner work, and formative checks. Teachers using block schedules may collapse adjacent days; teachers needing more practice time may extend Days 4, 7, 10, and 12.

Day	Topic	Classroom Focus	CCSS
1	What Is a Function?	Definition, domain/range, mapping diagrams, tables	8.F.A.1
2	What Is a Function? (cont.)	Vertical Line Test; 40-problem drill begins	8.F.A.1
3	Representing Functions	Graphing ordered pairs, reading outputs, building tables	8.F.A.1, 8.F.B.4
4	Representing Functions (cont.)	15-problem representation-building set	8.F.A.1, 8.F.B.4
5	Evaluating Functions	Function notation $f(x)$, substitution, arithmetic	8.F.A.1, 8.F.A.2
6	Evaluating Functions (cont.)	30-problem evaluation set with full solutions	8.F.A.1, 8.F.A.2
7	Linear vs. Non-Linear	$y = mx + b$, $y = x^2$, $y = x $, $y = 1/x$; rate-of-change test	8.F.A.3
8	Linear vs. Non-Linear (cont.)	25-problem classification activity	8.F.A.3
9	Cumulative Review	Mixed 20-problem review across all four topics	8.F.A.1 – 8.F.B.5
10	Unit Quiz	10-problem formative quiz (MC + short answer)	8.F.A.1 – 8.F.B.5
11	Comprehensive Unit Test	18-problem summative test, Parts A–E	8.F.A.1 – 8.F.B.5
12	Test Debrief & Re-teach	Review worked solutions; targeted small-group reteach	8.F.A.1 – 8.F.B.5

Learning Objectives

By the end of this unit, students will be able to:

- **Define** a function as a rule that assigns each input exactly one output, and identify functions from mappings, tables, equations, and graphs.
- **Represent** functions using mapping diagrams, ordered-pair tables, graphs on the coordinate plane, and algebraic equations in two variables.

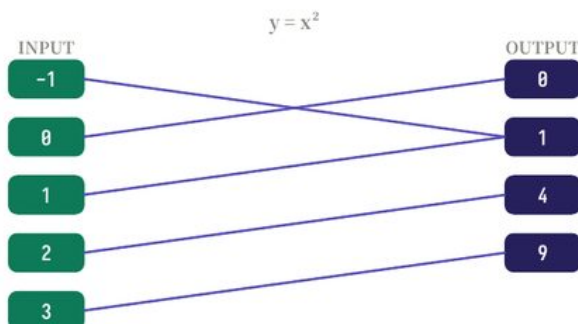


Figure 1.2 · Even though outputs 1 is reached twice (from $x = -1$ and $x = 1$), each input still has only one arrow leaving it. This is a function.

Watch Out!

Two different inputs CAN map to the same output and the relation is still a function. The rule only forbids **one input** → **two outputs**. Re-read the definition slowly: each input exactly one output.

1.3 The Vertical Line Test (VLT)

When a relation is given as a graph on the coordinate plane, the **Vertical Line Test** tells us whether it is a function. The rule is simple: **if any vertical line drawn anywhere on the graph intersects the curve more than once, the graph is NOT a function**. Why does this work? A vertical line at $x = a$ represents a single input value a . If that line hits the graph twice, then input a is paired with two different y -values, violating the 'one input, one output' rule. If every vertical line hits the graph at most once, every input has at most one output — exactly what a function requires.

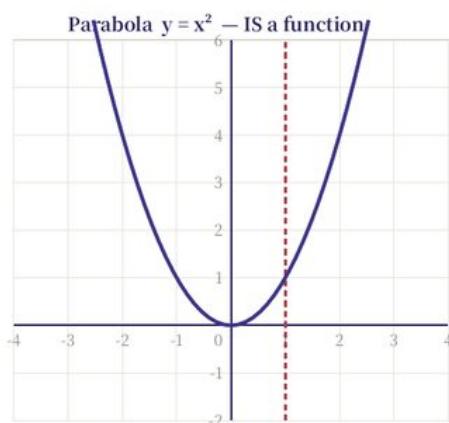


Figure 1.3a · The dashed vertical line at $x = 1$ hits the parabola exactly once. Every vertical line hits this graph at most once. VLT passes.

Topic 1 · Worked Examples

Applying the function test to mappings, tables, equations, and graphs · CCSS 8.F.A.1

EXAMPLE 1. Testing a Mapping Diagram

Question. Is the following relation a function? $\{(-2, 5), (0, 3), (1, 4), (3, 4), (-2, 1)\}$

Step 1 — List every input. The inputs (x-values) are $-2, 0, 1, 3, -2$. Notice that -2 appears twice.

Step 2 — Check the rule for each input. For input -2 we see two pairings: $(-2, 5)$ and $(-2, 1)$. The same input is matched to two different outputs (5 and 1).

Step 3 — Apply the definition. A function requires that each input has exactly one output. Because input -2 has two outputs, the relation fails the test.

Conclusion. The relation is **NOT a function**. The single offending input is $x = -2$.

EXAMPLE 2. Testing a Table of Values

Question. Determine whether the table below represents a function.

x	-1	0	1	2	1
y	2	0	2	4	-3

Step 1 — Read down the x-row. Inputs are $-1, 0, 1, 2, 1$. Input 1 appears in two columns: column 3 ($y = 2$) and column 5 ($y = -3$).

Step 2 — Compare outputs for the repeated input. When $x = 1$ in column 3, $y = 2$. When $x = 1$ in column 5, $y = -3$. These two outputs disagree, so $x = 1$ is paired with two different y-values.

Step 3 — Decide. The 'one input, one output' rule is broken.

Conclusion. The table does **NOT** represent a function. (Note: even a single repeated x with conflicting y is enough to disqualify the entire relation.)

EXAMPLE 3. Testing a Graph (Vertical Line Test)

Question. Use the Vertical Line Test to decide whether the graph of $y^2 = x$ is a function.

Step 1 — Solve for y. $y^2 = x$ gives $y = \pm \sqrt{x}$. For any $x > 0$ there are two y-values: one positive, one negative. This already tells us the test will fail.

Step 2 — Visualize a vertical line. Imagine a vertical line at $x = 1$. The graph contains both $(1, 1)$ and $(1, -1)$, so the vertical line crosses the curve at two points.

Drill: 40-Problem Function Identification

Mappings • Tables • Equations • Graphs • [CCSS 8.F.A.1](#)

Directions. For each item, decide whether the relation is a function. Write YES or NO and give a one-sentence reason. Use the answer key on the following pages to check your reasoning.

Set A • Mapping Diagrams (1–10)

1. $\{(1, 2), (2, 4), (3, 6), (4, 8)\}$
2. $\{(0, 5), (1, 5), (2, 5), (0, 6)\}$
3. $\{(-2, 3), (-1, 1), (0, -1), (1, 1), (2, 3)\}$
4. $\{(1, 10), (2, 20), (3, 30), (3, 40)\}$
5. $\{(5, 1), (6, 2), (7, 3), (8, 4), (9, 5)\}$
6. $\{(0, 0), (1, 1), (1, -1), (4, 2)\}$
7. $\{(2, 5), (4, 5), (6, 5), (8, 5)\}$
8. $\{(-1, 4), (0, 4), (1, 4), (-1, 7)\}$
9. $\{(10, 100), (20, 200), (30, 300), (40, 400)\}$
10. $\{(1, 3), (2, 6), (3, 9), (4, 12), (2, 5)\}$

Set B • Tables of Values (11–20)

11. $x: 1, 2, 3, 4 \mid y: 5, 10, 15, 20$
12. $x: 0, 1, 2, 3 \mid y: 4, 4, 4, 4$
13. $x: -1, 0, 1, 2 \mid y: 1, 0, 1, 4$
14. $x: 2, 2, 5, 7 \mid y: 3, 8, 10, 14$
15. $x: 0, 1, 4, 9 \mid y: 0, 1, 2, 3$
16. $x: 5, 5, 5, 6 \mid y: 1, 2, 3, 4$
17. $x: 1, 2, 3, 4 \mid y: 2, 4, 8, 16$
18. $x: 0, 1, 2, 3 \mid y: -2, -1, 0, 1$
19. $x: 3, 3, 4, 5 \mid y: 9, 8, 16, 25$
20. $x: 10, 20, 30, 40 \mid y: 1, 2, 3, 4$

Set C • Equations (21–30)

Drill 40 • Answer Key

Full explanations for every problem • CCSS 8.F.A.1

Each answer shows whether the relation is a function (YES) or not (NO), followed by a one-sentence reason citing the definition.

Set A • Mappings (1–10)

1. YES — each input appears exactly once.	2. NO — input 0 maps to both 5 and 6.
3. YES — inputs are unique (outputs may repeat).	4. NO — input 3 maps to both 30 and 40.
5. YES — inputs 5, 6, 7, 8, 9 each appear once.	6. NO — input 1 maps to both 1 and -1.
7. YES — all inputs map to one output (5); allowed.	8. NO — input -1 maps to both 4 and 7.
9. YES — inputs 10, 20, 30, 40 each appear once.	10. NO — input 2 maps to both 6 and 5.

Set B • Tables (11–20)

11. YES — x-values 1, 2, 3, 4 are unique.	12. YES — every input maps to 4 (constant function).
13. YES — x-values -1, 0, 1, 2 are unique.	14. NO — input 2 appears with outputs 3 and 8.
15. YES — x-values 0, 1, 4, 9 are unique (this is $y = \sqrt{x}$).	16. NO — input 5 maps to 1, 2, and 3.
17. YES — x-values 1, 2, 3, 4 are unique.	18. YES — x-values 0, 1, 2, 3 are unique.
19. NO — input 3 maps to both 9 and 8.	20. YES — x-values 10, 20, 30, 40 are unique.

Set C • Equations (21–30)

21. YES — $y = 3x - 7$: each x gives one y .	22. YES — $y = x^2 + 2$: each x gives one y .
23. NO — $x = y^2$ means $y = \pm \sqrt{x}$ (two outputs).	24. YES — $y = x $: each x gives one y .
25. YES — $y = 5$: every input produces 5 (constant).	26. NO — circle fails VLT (hits twice).
27. YES — $y = 1/x$: each nonzero x gives one y .	28. NO — $y = \pm \sqrt{x}$ explicitly gives two outputs.
29. YES — $y = 2x$: each x gives one y .	30. NO — $x = 4$ is a vertical line; VLT fails.

Set D • Graphs (31–40)

31. YES — line with positive slope passes VLT.	32. YES — parabola opens upward; VLT passes.
33. NO — circle fails VLT (hits twice).	34. NO — sideways parabola fails VLT.
35. YES — V-shape ($y = x $) passes VLT.	36. YES — horizontal line passes VLT.
37. NO — vertical line fails VLT (one x , many y).	38. YES — hyperbola $y = 1/x$ passes VLT.
39. NO — 'X' graph fails VLT (hits both diagonals).	40. YES — by definition, any graph passing VLT is a function.

FULL RESOURCE INCLUDES

WHAT'S INSIDE.

A complete, ready-to-teach Grade 8 functions unit.

1

What Is a Function?

8.F.A.1 · 40-PROBLEM DRILL

Function machine visuals, vertical line test, mapping diagrams & worked examples.

2

Representing Functions

8.F.A.2 · 15-PROBLEM SET

Equations, tables, graphs & verbal descriptions — multiple representations.

3

Evaluating Functions

8.F.A.3 · 30-PROBLEM DRILL

Function notation $f(x)$, substitution, linear & quadratic evaluation with steps.

4

Linear vs. Non-Linear

8.F.A.3 · 25-PROBLEM ACTIVITY

Constant-rate-of-change test with full justifications & graphical analysis.



9-DAY PACING GUIDE



COLOR-CODED EXAMPLES



VOCABULARY GLOSSARY



CUMULATIVE REVIEW

41

PAGES

158

PROBLEMS

4

TOPICS

3

ASSESSMENTS

100%

ANSWER KEYS

Get the full unit today.

NOTES · EXAMPLES · DRILLS · QUIZ · TEST · KEYS

