What Is a Function?

Explore ideas and representations

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QUICK REVIEW

A function assigns exactly one output to each input in its domain. In $\{(1,4),(2,4)\}$, both inputs may share 4; this is a function. In $\{(1,4),(1,6)\}$, input 1 has two outputs, so it fails. Read a table by its input column, not by whether outputs repeat.

Worked example

Example for form 1: test this assignment. $\{(1,3),(2,3),(3,5)\}$

1. Group the pairs by input: $1 \mapsto 3$, $2 \mapsto 3$, $3 \mapsto 5$.

2. Input 1 gives only 3, and every other listed input also has exactly one output. Repeated outputs are allowed, so this relation is a function on its listed domain.

Answer: A function.

Practice Problems

Show your thinking.

1. Decide whether this relation is a function. $\{(0,2),(1,3),(2,4)\}$

2. Classify this relation with a repeated input.
$\{(1,5),(1,7),(3,9)\}$

3. Do equal outputs prevent this from being a function?
$\{(-2,4),(0,4),(2,4)\}$

4. Is this relation with negative inputs a function?
$\{(-3,1),(-1,0),(-3,2)\}$

5. Test the relation; an identical pair is repeated.
$\{(2,6),(2,6),(4,8)\}$

6. Classify these input-output assignments. $\{(0,0),(0,1),(1,1)\}$

7. Is each input assigned exactly one output here?
$\{(-1,1),(0,0),(1,1)\}$

8. Test this relation containing opposite outputs.
$\{(4,-2),(5,2),(4,2)\}$

9. Use the table to decide whether y is a function of x.

x	y
-1	3
0	3
1	5
2	5

10. For $y = 2x - 3$, find the outputs at $x = 0$ and $x = 4$. Explain why the rule is a function.

Answer Key

1. A function.
2. Not a function.
3. A function.
4. Not a function.
5. A function.
6. Not a function.
7. A function.
8. Not a function.
9. A function.
10. $-3, 5$; a function.

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Group the pairs by input: $0 \mapsto 2$, $1 \mapsto 3$, $2 \mapsto 4$.

2. Input 0 gives only 2, and every other listed input also has exactly one output. Repeated outputs are allowed, so this relation is a function on its listed domain.

Problem 2

1. For input 1, the listed pairs give outputs 5 and 7; these are different because $5 \neq 7$.

2. The same input 1 therefore has two outputs. This violates the one-output rule, so this relation is not a function.

Problem 3

1. Group the pairs by input: $-2 \mapsto 4$, $0 \mapsto 4$, $2 \mapsto 4$.

2. Input -2 gives only 4, and every other listed input also has exactly one output. Repeated outputs are allowed, so this relation is a function on its listed domain.

Problem 4

1. For input -3, the listed pairs give outputs 1 and 2; these are different because $1 \neq 2$.

2. The same input -3 therefore has two outputs. This violates the one-output rule, so this relation is not a function.

Problem 5

1. Group the pairs by input: $2 \mapsto 6$, $4 \mapsto 8$.

2. Input 2 gives only 6, and every other listed input also has exactly one output. Repeated outputs are allowed, so this relation is a function on its listed domain.

Problem 6

1. For input 0, the listed pairs give outputs 0 and 1; these are different because $0 \neq 1$.

2. The same input 0 therefore has two outputs. This violates the one-output rule, so this relation is not a function.

Problem 7

1. Group the pairs by input: $-1 \mapsto 1$, $0 \mapsto 0$, $1 \mapsto 1$.

2. Input -1 gives only 1, and every other listed input also has exactly one output. Repeated outputs are allowed, so this relation is a function on its listed domain.

Problem 8

1. For input 4, the listed pairs give outputs -2 and 2; these are different because $-2 \neq 2$.

2. The same input 4 therefore has two outputs. This violates the one-output rule, so this relation is not a function.

Problem 9

1. The inputs $-1, 0, 1, 2$ occur once each; their outputs are $3, 3, 5, 5$, respectively.

2. Although 3 and 5 repeat as outputs, no input has two outputs. Therefore y is a function of x.

Problem 10

1. At $x = 0$, $y = 2(0) - 3 = -3$. At $x = 4$, $y = 2(4) - 3 = 8 - 3 = 5$.

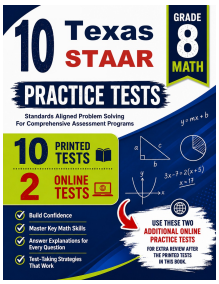
2. Each input produces one number through multiplication and subtraction. Thus this rule assigns exactly one output to every real input.

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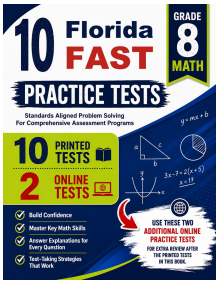
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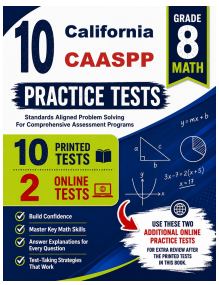
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