What Is a Function?

Apply the skill to decisions and designs

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QUICK REVIEW

In a real model, define the input precisely. One student may have one assigned locker, while a locker number need not identify one student if lockers are shared. A function can have restricted inputs such as whole-number days. For $C = 3n + 2$, each allowed n still determines exactly one cost C.

Worked example

Example for form 3: test this assignment. $\{(3, 5), (4, 5), (5, 7)\}$

1. Group the pairs by input: $3 \mapsto 5$, $4 \mapsto 5$, $5 \mapsto 7$.

2. Input 3 gives only 5, 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. A badge scan maps badge number to assigned student ID. Is this assignment a function? $\{(11, 101), (12, 102), (13, 102)\}$

2. A machine logs input code and output bin. Does this log describe a function? $\{(1, 4), (2, 5), (1, 6)\}$

3. One locker is shared. Does locker number determine student number in these records? $\{(20, 1), (20, 2), (21, 3)\}$

4. Does student number determine locker number in these records? $\{(1, 20), (2, 20), (3, 21)\}$

5. A printing rule is $C = 4n + 1$ dollars for whole-number orders $n \geq 0$. Find C for $n = 3$ and name the input.

6. A sensor reports 18 at hour 2 and 21 at hour 2 on different days. Can hour alone determine its reading?

7. Design a function on inputs $0, 1, 2$ using only outputs 5 and 7, with both outputs used.

8. A delivery fee is $F = 2d + 6$. What output goes with distance $d = 5$? Could the same rule also assign 19 to $d = 5$?

9. Correct a robot log by removing just one inconsistent record. $\{(2, 10), (3, 15), (2, 12)\}$

10. Create a nonfunction using two records of package weight 4 kg and fees 6 and 9 dollars.

Answer Key

1. A function.
2. Not a function.
3. Not a function.
4. A function.
5. $C = 13$ dollars; input n.
6. No; include the day.
7. One answer: $(0, 5), (1, 7), (2, 5)$.
8. 16; no.
9. Remove $(2, 12)$ (one valid choice).
10. $(4, 6), (4, 9)$

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. Group the pairs by input: $11 \mapsto 101$, $12 \mapsto 102$, $13 \mapsto 102$.

2. Input 11 gives only 101, 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 4 and 6; these are different because $4 \neq 6$.

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. For input 20, the listed pairs give outputs 1 and 2; these are different because $1 \neq 2$.

2. The same input 20 therefore has two outputs. This violates the one-output rule, so this relation is not a function.

Problem 4

1. Group the pairs by input: $1 \mapsto 20$, $2 \mapsto 20$, $3 \mapsto 21$.

2. Input 1 gives only 20, 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 5

1. Substitute the order size $n = 3$: $C = 4(3) + 1 = 12 + 1 = 13$. Thus three items cost 13 dollars.

2. The input is the number of items, n, and the output is cost, C. Each permitted order size has a unique cost.

Problem 6

1. The recorded pairs are $(2, 18)$ and $(2, 21)$, so the same hour has outputs $18 \neq 21$.

2. Hour alone is insufficient. Use an input such as (day, hour) to distinguish the two measurements before testing the revised model.

Problem 7

1. Assign $0 \mapsto 5$ and $1 \mapsto 7$ to use both allowed outputs. Assign the remaining input $2 \mapsto 5$.

2. The resulting pairs give each of $0, 1, 2$ one output. Reusing 5 is allowed; other valid assignments also work.

Problem 8

1. At $d = 5$, the stated rule gives $F = 2(5) + 6 = 10 + 6 = 16$.

2. Assigning 19 as well would give the same input 5 two outputs, 16 and 19. That would contradict this function rule.

Problem 9

1. Only input 2 conflicts: it is paired with 10 and 12. Keep the pair $(2, 10)$.

2. Delete $(2, 12)$. Each remaining input has one output; deleting the other conflicting pair would also work.

Problem 10

1. Use weight as input: pair 4 with fee 6 to get $(4, 6)$, then pair 4 with fee 9 to get $(4, 9)$.

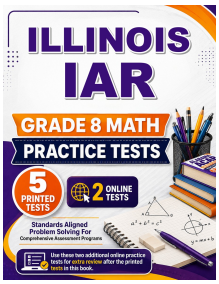
2. Since $6 \neq 9$, one weight has two different fees. These records are not a function of weight alone.

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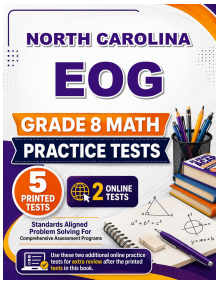
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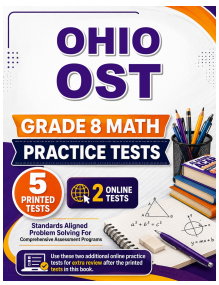
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