LESSON MAKER PRO

One Input, One Output

Decide when a relation is a function

HIGH SCHOOL · FA.F.13

FA.F.13 "Compare and contrast a function and a relation. Use appropriate strategies to assess whether a given situation represents a function or a relation (e.g., the vertical line test)."

NAME _____ DATE _____

THE FUNCTION TEST

A relation pairs inputs with outputs. A function is a relation in which each input has exactly one output. Different inputs may share an output, but on a graph, a vertical line crossing the relation more than once shows it is not a function.

WORKED EXAMPLE

Does the table show y as a function of x?

x	y
11	21
12	22
11	23

1. Find the rows with the same input: x = 11.
2. That input is paired with both 21 and 23.
3. One input has two different outputs, so the relation is not a function.

Answer: No, y is not a function of x.

PRACTICE 6 problems

1 Is y a function of x? Explain whether the repeated output matters.

x	y
-2	4
0	1
2	4

ANSWER _____

_____

2 Is y a function of x for the relation {(1, 2), (3, 4), (1, 5)}? Name an input that proves your answer.

ANSWER _____

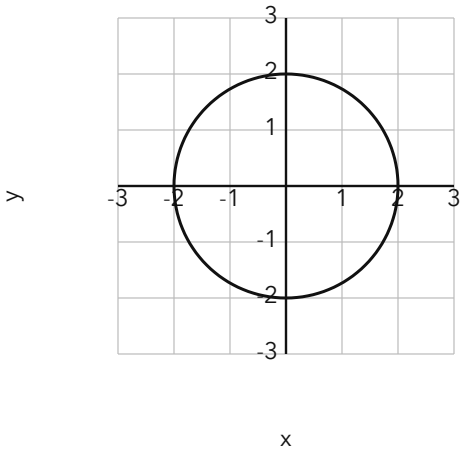
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3 Does $x = y^2 - 1$ define y as a function of x? Give two outputs for x = 0.

ANSWER _____

_____

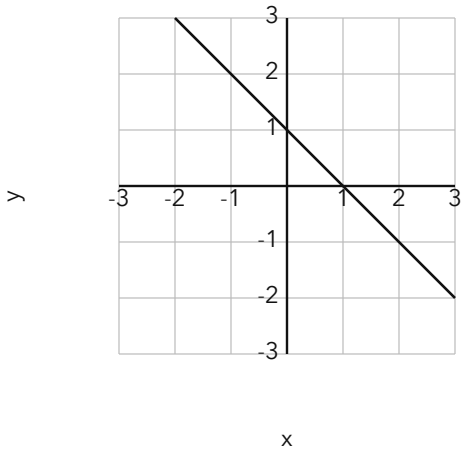
4 Does the graphed relation show y as a function of x? Explain using the vertical line test.



ANSWER _____

_____

5 Does the graphed relation show y as a function of x?



ANSWER _____

6 Is y a function of x? Explain whether the repeated input matters.

x	y
-3	5
-3	5
2	0

ANSWER _____

_____

APPLY IT Show your work

1 A gaming club charges a $4 sign-up fee plus $7 per month. Is total cost a function of the number of months? What is the total cost for 3 months?

WORK SPACE

ANSWER _____

2 A music app records the number of songs in each order and the order's total price. Use the table. Is total price a function of the number of songs? Explain.

MUSIC ORDERS

Songs	Total price ($)
2	4
3	6
2	5

ANSWER _____

CHALLENGE One step up

Consider the relation $y^2 = x + 4$. First, decide whether y is a function of x. Then suppose only pairs with $y \geq 0$ are allowed. Does this restricted relation define y as a function of x? Explain both answers using $x = 0$.

WORK SPACE AND ANSWER

ANSWER KEY

One Input, One Output

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Is y a function of x? Explain whether the repeated output matters.	**Yes. The inputs are all different, so the repeated output of 4 does not matter.**
2	Is y a function of x for the relation {(1, 2), (3, 4), (1, 5)}? Name an input that proves your answer.	**No. The input 1 has two outputs, 2 and 5.**
3	Does $x = y^2 - 1$ define y as a function of x? Give two outputs for x = 0.	**No. When x = 0, y can be 1 or -1.**
4	Does the graphed relation show y as a function of x? Explain using the vertical line test.	**No. The vertical line x = 0 crosses the circle twice.**
5	Does the graphed relation show y as a function of x?	**Yes.**
6	Is y a function of x? Explain whether the repeated input matters.	**Yes. The repeated input -3 has the same output, 5, both times.**

PART 2 · APPLY IT

1. **Yes. The total cost for 3 months is $25.** Each number of months gives one total cost. For 3 months, the cost is 4 + 7(3) = 25 dollars.
2. **No. Two orders with 2 songs have different total prices, $4 and $5.** Compare the rows with 2 songs. The same input has two different outputs, so total price is not a function of the number of songs.

CHALLENGE

The original relation is not a function: when x = 0, y can be 2 or -2. With y ≥ 0, only y = 2 is allowed for x = 0. More generally, each allowed x has only its nonnegative square-root output, so the restricted relation is a function.

Accept any valid input with two different outputs as proof that a relation is not a function. For the challenge, students should address both the original and restricted relations.