

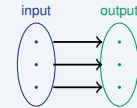
# Relations and Functions

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 18

## Quick Review and Helpful Hints

A *relation* is any set of ordered pairs. A *function* is a special relation where every input ( $x$ ) has *exactly one* output ( $y$ ). To check: make sure no  $x$ -value is paired with two different  $y$ -values. On a graph, use the *vertical line test* – a vertical line may touch the graph only once.

▶ **Example:** Is  $\{(1, 2), (2, 4), (3, 6)\}$  a function? **Work:** Each input 1, 2, 3 appears just once, so each has only one output.  
 ★ **Answer:** Yes



Each input → exactly one output.

### ◆ Practice Problems

Tell whether each relation is a function (Yes/No).

- |  |   |
|--|---|
| <p>1. <math>\{(1, 2), (2, 3), (3, 4)\}</math> _____</p> <p>2. <math>\{(1, 2), (1, 3), (2, 4)\}</math> _____</p> <p>3. <math>\{(0, 5), (1, 5), (2, 5)\}</math> _____</p> <p>4. <math>\{(4, 1), (4, 2), (5, 3)\}</math> _____</p> <p>5. <math>\{(-1, 0), (0, 1), (1, 2)\}</math> _____</p> <p>6. <math>\{(2, 2), (3, 3), (2, 4)\}</math> _____</p> <p>7. <math>\{(7, 1), (8, 1), (9, 1)\}</math> _____</p> | <p>8. <math>\{(1, 1), (2, 2), (3, 3), (1, 4)\}</math> _____</p> <p>9. Inputs 1, 2, 3, 4 each with one <math>y</math> _____</p> <p>10. A vertical line hits the graph twice _____</p> <p>11. <math>\{(5, 10), (6, 12), (7, 14)\}</math> _____</p> <p>12. <math>\{(0, 0), (0, 1)\}</math> _____</p> <p>13. <math>\{(-2, 3), (-1, 3), (0, 3)\}</math> _____</p> <p>14. <math>\{(1, 5), (2, 6), (3, 7), (2, 8)\}</math> _____</p> |
|--|---|

### ◆ Word Problems

15. A machine gives each input exactly one output. Is it a function? \_\_\_\_\_
16. Is the relation "person → their birth month" a function? \_\_\_\_\_
17. Is " $x$  → its square roots" a function (for example  $4 \rightarrow 2$  and  $-2$ )? \_\_\_\_\_
18. Is  $\{(1, 2), (2, 4), (3, 6), (4, 8)\}$  a function? \_\_\_\_\_



## Answer Keys

- |                                 |                                  |                                  |
|---------------------------------|----------------------------------|----------------------------------|
| 1. <input type="checkbox"/> Yes | 7. <input type="checkbox"/> Yes  | 13. <input type="checkbox"/> Yes |
| 2. <input type="checkbox"/> No  | 8. <input type="checkbox"/> No   | 14. <input type="checkbox"/> No  |
| 3. <input type="checkbox"/> Yes | 9. <input type="checkbox"/> Yes  | 15. <input type="checkbox"/> Yes |
| 4. <input type="checkbox"/> No  | 10. <input type="checkbox"/> No  | 16. <input type="checkbox"/> Yes |
| 5. <input type="checkbox"/> Yes | 11. <input type="checkbox"/> Yes | 17. <input type="checkbox"/> No  |
| 6. <input type="checkbox"/> No  | 12. <input type="checkbox"/> No  | 18. <input type="checkbox"/> Yes |

### Step-by-Step Explanations

**1.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Each  $x$  (1, 2, 3) appears once: yes. So the final answer is Yes.

**2.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x = 1$  pairs with both 2 and 3: no. So the final answer is No.

**3.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Repeated  $y$ -values are fine; each  $x$  is unique: yes. So the final answer is Yes.

**4.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x = 4$  pairs with both 1 and 2: no. So the final answer is No.

**5.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Every  $x$  is different: yes. So the final answer is Yes.

**6.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x = 2$  pairs with 2 and 4: no. So the final answer is No.

**7.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Each  $x$  is unique (same  $y$  is okay): yes. So the final answer is Yes.

**8.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x = 1$  appears with 1 and 4: no. So the final answer is No.

**9.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is No input is repeated: yes. So the final answer is Yes.

**10.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is It fails the vertical line test: no. So the final answer is No.

**11.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Each  $x$  is unique: yes. So the final answer is Yes.

**12.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x = 0$  has two outputs: no. So the final answer is No.

**13.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is All  $x$ -values differ: yes. So the final answer is Yes.

**14.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is  $x = 2$  pairs with 6 and 8: no. So the final answer is No.

**15.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is One output per input: yes. So the final answer is Yes.

**16.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Each person has one birth month: yes. So the final answer is Yes.

**17.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is 4 has two roots (2 and  $-2$ ): no. So the final answer is No.

**18.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Every  $x$  is unique: yes. So the final answer is Yes.



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