

Grade 8 - Understanding Functions - Lesson

Common Core 8.F.A.1, 8.F.A.2, 8.F.A.3 · maths-pdf.fr/en/

A function is a rule that assigns exactly one output to each input. You can show a function with a table, a graph, an equation such as $f(x) = 2x + 1$, or words. A function is linear if it has a constant rate of change and its graph is a straight line; otherwise it is nonlinear.

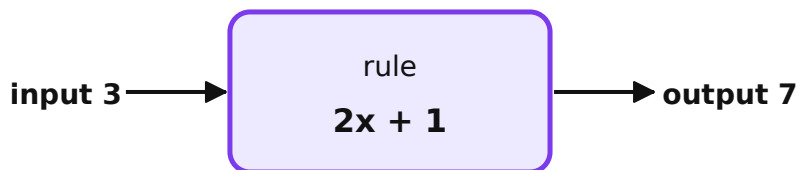
Grade 8 · Common Core State Standards: **8.F.A.1, 8.F.A.2, 8.F.A.3**

Key facts

- Every input has exactly one output in a function.
- Function notation: $f(x) = 2x + 1$ means $f(3) = 7$.
- Vertical line test: a graph is a function only if no vertical line touches it twice.
- Linear functions have a constant rate of change and graph as straight lines.
- Compare functions using rate of change and initial value, whatever their representation.

What is a function?

A function is a rule that assigns to each input exactly one output. The input is the x -value and the output is the y -value. A function machine is a helpful picture: put in a number, the rule works, and one number comes out.



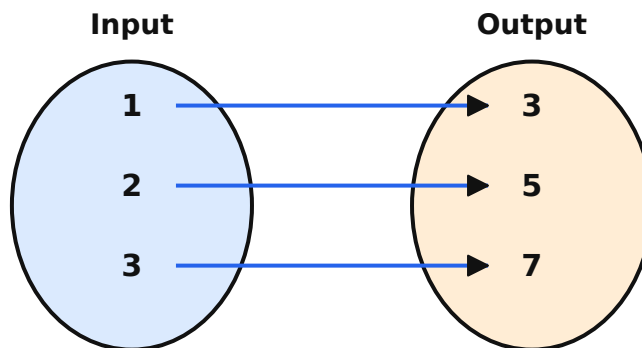
A function machine gives exactly one output for each input.

Function

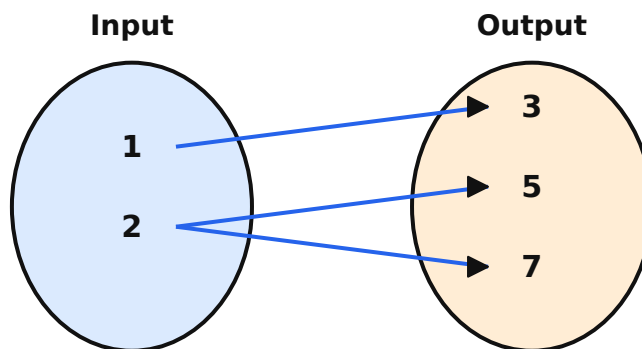
A relation is a **function** if every input has exactly one output. We write $y = f(x)$, read "f of x". If $f(x) = 2x + 1$, then $f(3) = 2 \cdot 3 + 1 = 7$.

How can you tell if a relation is a function?

Check that no input is repeated with a different output. In the first diagram each input has one arrow, so it is a function. In the second, the input 2 has two arrows (to 5 and to 7), so it is not.



A function: each input has one arrow.

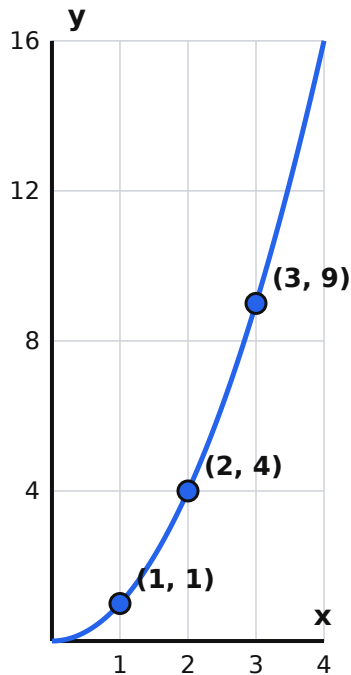


Not a function: the input 2 has two outputs.

On a graph, use the vertical line test: if any vertical line touches the graph more than once, the graph is not a function.

How do you tell linear functions from nonlinear ones?

A linear function has a constant rate of change, so its graph is a straight line and it fits $y = mx + b$. A table is linear if equal steps in x give equal steps in y . The function $y = x^2$ is nonlinear: for $x = 1, 2, 3$ the outputs 1, 4, 9 increase by 3, then by 5.



The graph of $y = x^2$ is a curve.

How do you compare two functions?

Compare them by their rates of change and starting values, even if one is a graph and the other an equation. Suppose function A is $y = 3x + 1$ and function B has a table with (0,2), (1,5), (2,8). Both have rate 3, but B starts at 2 while A starts at 1, so B always gives 1 more.

1. Find the rate of change (slope) of each function.
2. Find the starting value (the output when $x = 0$).
3. Compare the rates and the starting values.

Questions about understanding functions

Can two different inputs have the same output?

Yes. In $f(x) = x^2$, both $f(2)$ and $f(-2)$ equal 4. What is not allowed is one input with two outputs.

What does $f(x)$ mean?

It is the output of function f when the input is x . It does not mean f times x .

How do I know a table is linear?

Check that the change in y divided by the change in x is the same between every pair of rows.

What is the domain and range?

The domain is the set of all inputs and the range is the set of all outputs. For (1, 3), (2, 5), (3, 7) the domain is 1, 2, 3 and the range is 3, 5, 7.

Is $y = 5$ a function?

Yes, every input has the same single output 5. Its graph is a horizontal line, and it is linear with slope 0.