

Grade 8 · Introduction to Functions · Lesson

Common Core 8.F.A.1, 8.F.A.2, 8.F.A.3 · mathovore.fr

A function is a rule that gives exactly one output for each input. You can show a function with a table, a mapping, a graph or an equation. A linear function, written $y = mx + b$, has a constant rate of change and a straight-line graph, while a nonlinear function such as $A = s^2$ does not.

Grade 8 Common Core: 8.F.A.1 · 8.F.A.2 · 8.F.A.3

Key facts:

- Standards 8.F.A.1, 8.F.A.2 and 8.F.A.3: define, compare and classify functions.
- A relation is a function when every input has exactly one output.
- Different inputs may share an output, but one input may never have two outputs.
- A linear function $y = mx + b$ has rate of change m and initial value b .
- The area of a square, $A = s^2$, is a nonlinear function.

What is a function?

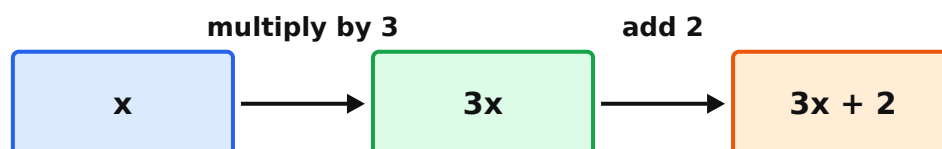
A **function** is a rule that assigns exactly one output to each input. The input is usually x and the output is y . For the rule $y = 3x + 2$, the input 4 gives the output 14 and no other number.

Vocabulary

Input and output: the number you put in and the number the rule returns.

Linear function: a function whose graph is a straight line, written $y = mx + b$.

Nonlinear function: a function whose graph is not a straight line.

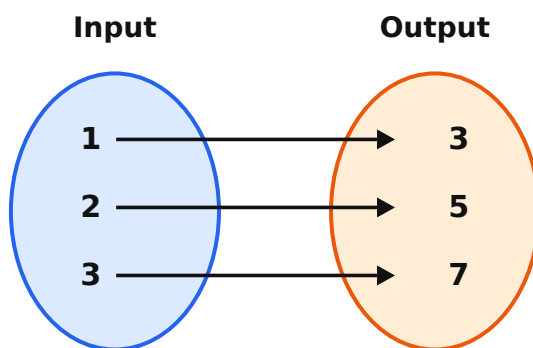


A function machine for $y = 3x + 2$.

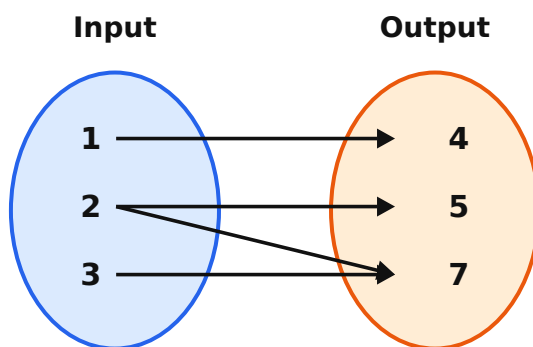
How can you tell whether a relation is a function?

Check every input. If any input has two different outputs, the relation is not a function. Two different inputs may share the same output.

In a mapping diagram, each input has exactly one arrow. In a table, an input never repeats with different outputs. On a graph, no vertical line crosses the graph twice.



A function: each input has one arrow.



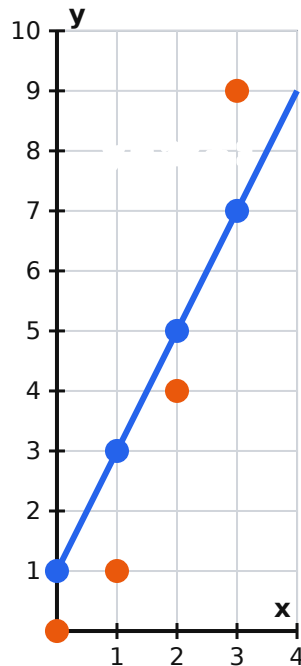
Not a function: the input 2 has two arrows.

How do you write a function as an equation?

Look for the pattern between inputs and outputs. If the outputs change by the same amount for each step in the input, the function is linear. For the table with outputs 3, 5, 7 for inputs 1, 2, 3, each step adds 2, so $y = 2x + 1$. In $y = mx + b$, m is the rate of change and b is the output when the input is 0.

What is the difference between linear and nonlinear functions?

A linear function has a constant rate of change. The area of a square, $A = s^2$, is nonlinear: sides 1, 2, 3, 4 give areas 1, 4, 9, 16, and the jumps 3, 5, 7 keep growing. Its graph curves instead of forming a line.



Blue points lie on a line; orange points for $A = s^2$ do not.

How do you compare two functions?

Find the rate of change and the starting value for each one, even when the functions are shown in different ways. Function A is $y = 2x + 1$ and function B is in the table. Function B goes up by 4 each step, so its rate is 4 and its starting value is 1. Function A has rate 2 and starting value 1, so B grows faster.

x	y
0	1
1	5
2	9
3	13

Function B: the outputs rise by 4 each time.

Introduction to Functions: frequently asked questions

What is a function in simple terms?

A function is a rule that takes an input and gives exactly one output. The rule $y = 2x + 1$ turns 3 into 7 every time.

Can two inputs have the same output in a function?

Yes. In $y=5$, every input gives 5, and it is still a function. What is not allowed is one input with two different outputs.

How can I tell from a graph whether it is a function?

Imagine vertical lines moving across the graph. If any vertical line touches the graph in two or more points, one input has several outputs, so it is not a function.

How do I know a function is linear from a table?

Check that equal steps in x give equal changes in y . The outputs 2, 5, 8, 11 grow by 3 each time, so the function is linear.

How do I compare a function in a table with one in an equation?

Find the rate of change and initial value of each. For a table, divide the change in y by the change in x . For $y=mx+b$, read m and b directly.