

Algebra 1 · Functions, Domain, Range and Function Notation · Lesson

Common Core F-IF.A.1, F-IF.A.2, F-IF.B.5 · mathovore.fr

A function is a rule that gives each input exactly one output. The domain is the set of allowed inputs and the range is the set of outputs. Function notation such as $f(3) = 10$ names the output for the input 3, and a vertical line test checks graphs.

Algebra 1 Common Core: F-IF.A.1 · F-IF.A.2 · F-IF.B.5

Key facts:

- Every input of a function has exactly one output; two inputs may share an output.
- A graph is a function if no vertical line crosses it twice.
- $f(a) = b$ means the output is b when the input is a .
- Domain is the set of inputs; range is the set of outputs.
- Discrete data has separate values; continuous data fills an interval.

What is a function?

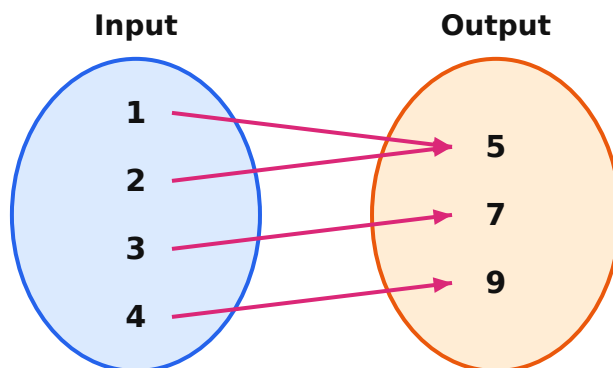
A **function** is a rule that assigns to each input exactly one output. If you feed the same input into a function twice, you always get the same output. Different inputs are allowed to share an output.

Vocabulary

Domain: the set of all allowed inputs (usually the x -values).

Range: the set of all outputs that actually occur (usually the y -values).

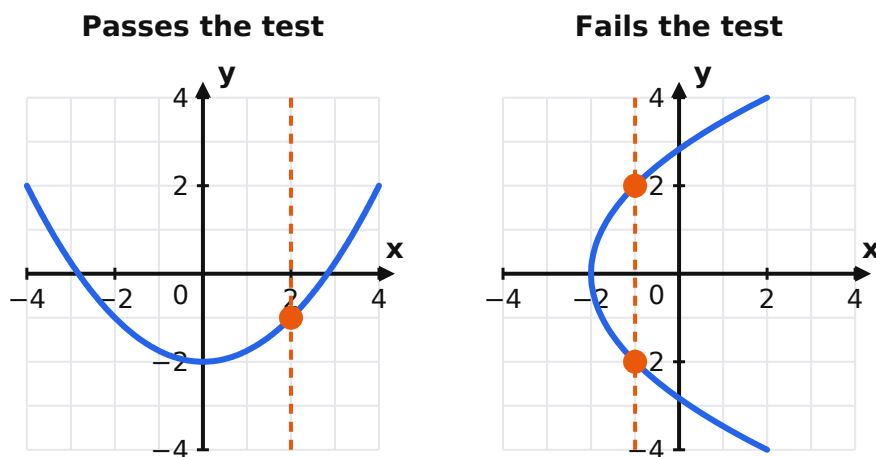
Function notation: $f(x)$ is read “ f of x ” and means the output of f for the input x . It is not f times x .



Inputs 1 and 2 share the output 5, but each input has only one arrow, so this is a function.

How does the vertical line test work?

A graph shows a function when no vertical line crosses it more than once. A vertical line stands for one input value, so two crossings would mean one input has two outputs.

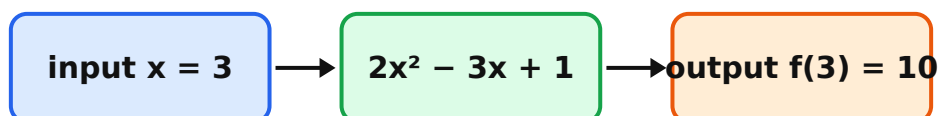


Left: one crossing, so a function. Right: two crossings, so not a function.

How do you evaluate $f(x)$?

1. Replace every x with the input, written in parentheses.
2. Follow the order of operations: exponents, then multiplication, then addition and subtraction.
3. Write the result as $f(\text{input}) = \text{output}$.

Worked example. Let $f(x) = 2x^2 - 3x + 1$. Then $f(3) = 2(3)^2 - 3(3) + 1 = 18 - 9 + 1 = 10$. With a negative input, $f(-2) = 2(-2)^2 - 3(-2) + 1 = 8 + 6 + 1 = 15$.



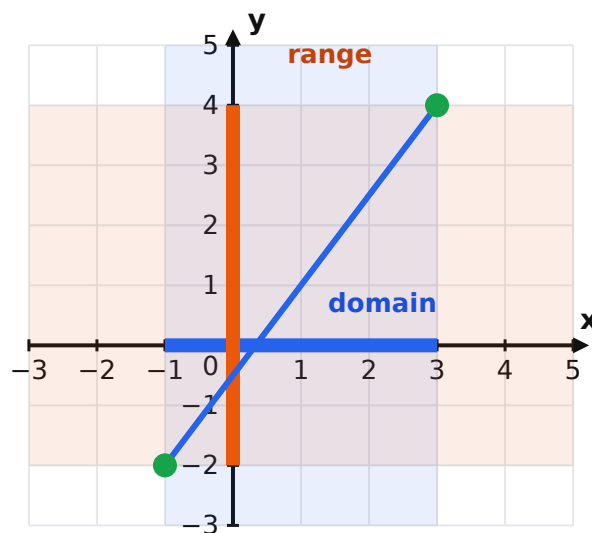
The machine for $f(x) = 2x^2 - 3x + 1$: feed in 3 and get out 10.

What does $f(a) = b$ mean in a story?

The input a and output b each carry units. Suppose $P(n) = 2n - 15$ is the profit in dollars from selling n muffins at a bake sale. Then $P(20) = 25$ says: selling 20 muffins gives a profit of \$25. The input is the number of muffins and the output is the profit.

How do you find the domain and range?

Look at which inputs make sense, then at the outputs they produce. On a graph, the domain is the span of the graph from left to right, and the range is the span from bottom to top.



Domain: the x -values from -1 to 3 . Range: the y -values from -2 to 4 .

Type	Meaning	Example
Discrete	Only separate values, such as whole numbers	Number of tickets sold
Continuous	Every value in an interval	Time in minutes, volume in gallons

Functions, Domain, Range and Function Notation: frequently asked questions

What is the difference between a relation and a function?

A relation is any set of input-output pairs. A function is a relation in which each input has exactly one output. So every function is a relation, but not every relation is a function.

Can two different inputs have the same output?

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

What does the notation $f(x)$ mean?

It means the output of the function f when the input is x . It is a name for the output, not a multiplication. To evaluate $f(5)$, replace x with 5 in the rule.

How do you find the range from a graph?

Find the lowest and highest y -values the graph reaches. If the graph continues forever downward or upward, the range has no lower or upper limit. Check whether endpoints are open or closed.

When is the domain discrete?

The domain is discrete when only separate values make sense, such as whole numbers of tickets or students. The graph is a set of unconnected points, not a line or curve.